Faculty of Forestry, Zagreb University
ECTS course catalogue

Introductory about Faculty of Forestry

Forestry teaching in Croatia begins at the in Križevci in 1860 and the Forestry Academy established in 1898 in Zagreb. It was the fourth higher education institution of the University of Zagreb. Wood technologists have been educated since 1948. The Faculty of Forestry is an internationally recognized institution in the training of highly qualified personnel for the needs of forestry, wood processing and furniture production. The Faculty is a place of continuous education and growth of intellectuals of a wide range of knowledge who are recognizable in their work not only in the profession but also in the social life of Croatia. The Faculty has incorporated into its activities all its past and its predecessors knowledge.

Forestry is the science, business and art of forest management and conservation, and the associated land, for the lasting benefit of the economy, society and the environment. It understands the balanced management of forest resources for optimal yield of forest products, wildlife, conservation of abundant reserves of clean water, attractive and recreational environment in both natural and urban environments, and the provision of diverse services and products e.g. in tourism, sports, etc.

Wood technology is a science and a profession, and is defined as the integrated application of natural and technical sciences to create products from a renewable natural resource - wood. The specificity of this scientific field and profession is that it deals with the development and design of new products based on wood and wood materials, as well as specific process and production technologies for their processing and processing appropriate to the requirements of biomaterials. In addition, the field of wood technology is increasingly important because of the use of biomass as an eco-energy.

Forestry, wood processing and furniture production offer economic, developmental and social benefits and opportunities. They are a significant source of employment and economic progress in our country and in the world, but with a careful balancing act with the multifunctional role of the forest. Sustainability and multifunctionality of forests must be geared to the function of sustainable development and an eco-efficient industry based on wood processing.

The Faculty of Forestry in Zagreb is the only higher education institution of its kind in the Republic of Croatia. In science and research, the Faculty is registered within the biotechnical scientific field, scientific fields of forestry and wood technology.

The Faculty's scientific-teaching and professional activity is carried out in departments and institutes. The Faculty consists of two departments - Forestry and Wood Technology.

The following departments are part of the Forestry Department:

- Department of Ecology and Forestry
- Department of Forest Measurement and Management
- Department of Forest Genetics, Dendrology and Botany
- Department of Forestry Techniques and Technologies
- Department for Forest Protection and Hunting
- Department for Educational and Experimental Forest Facilities

The following are within the Wood Technology Department
institutes:
- Department of Wood Science
- Department of Materials Technology
- Institute for Production Organization
- Department of Process Engineering
- Department of Furniture and Wood Products

Laboratories and teaching-experimental forest facilities are organized within the Institute for the purposes of teaching, research and practical work of students:
- Ecology-pedology laboratory
- Forest Seed and Nursery Laboratory
- Dendrochronology Laboratory
- Forest Resources Measurement Laboratory
- Laboratory for Remote Sensing and GIS
- Molecular Biological Laboratory
- Laboratory for technical and technological measurements in forestry
- Forest Biomass Laboratory
- Tree Pathology Laboratory
- Zoology Laboratory in Forestry
- Teaching and experimental forest facility Lipovljani
- Teaching and testing forest facility Velika
- Zalesina Forest Training Facility
- Teaching and experimental forest facility Rab
- Teaching and experimental forest facility Zagreb with forest garden
- Laboratory for anatomical properties and wood Protection
- Laboratory for physical and mechanical properties of wood
- Laboratory for wood panels
- Laboratory for hydrothermal treatment of wood and wood materials
- Chemistry laboratory
- Industrial systems laboratory
- Wood mechanical processing Laboratory
- Laboratory for measuring noise and vibration
- Laboratory for testing furniture and furniture components
- Laboratory for testing wood products in construction
- Laboratory for computer modelling and development of products

Teaching is provided through lectures, exercises, practicums, field exercises, seminar papers and fieldwork.

At the Faculty of Forestry, from 2005/2006 three undergraduate universities and one professional study are carried out:

1. Undergraduate study in Forestry (Chapter A)
2. Undergraduate study Urban Forestry, Nature and Environmental Protection (Chapter D)
3. Undergraduate study Wood Technology (Chapter F)
4. Undergraduate Professional Study Wood Technology (Chapter I)

Undergraduate studies last six semesters (3 years, 180 ECTS credits).

Upon completion of undergraduate studies, a student is issued a diploma determining the completion of studies and gaining the title according to the study program:

- Forestry Bachelor
- Bachelor of Urban Forestry, Nature and Environmental Protection
- Wood Technology Bachelor
- Professional Bachelor of Wood Technology.

Graduate programs have been developed and approved, and their implementation has begun in 2008/2009:

1. Master study of Forestry

Direction Growing and Management of Hunting Forests (Chapter B)
Forestry Techniques, Technologies and Management (Chapter C)

2. Master study Urban Forestry, Nature and Environmental Protection (Chapter E)

3. Master study Wood Technology Processes (Chapter G)

4. Master Study of Wood Product Design (Chapter H)

Graduate studies last four semesters (2 years, 120 ECTS credits).

Upon graduation and defence of the thesis, the student is issued a diploma confirming the completion of studies and gaining an academic title according to the study program:

- Master of Forestry - cultivation and management of forests with hunting management
- Master of Forestry - Techniques, Technologies and Management in Forestry
- Master of Urban Forestry, Nature and Environmental Protection
- Master of Wood Technology - Wood Technology Processes
- Master of Wood Technology - Design of wood products.

The Faculty of Forestry organizes and conducts postgraduate studies which train students for scientific research work and the on an academic degree of doctor of science in the field of biotechnical sciences, as well as professional specialist in work and training in forestry and wood technology.

Undergraduate university study

A. FORESTRY

INTRODUCTION

Forestry is the profession, science and art of managing and protecting forest ecosystems for the long-term benefit of society, the environment, and economy. Undergraduate students are trained in the management of forest ecosystems from a biological-ecological, technological and economic aspect. The study is based on fundamental knowledge in the field of forestry with directing students to professional work in all aspects of forestry organizationsand forest enterprises, but also focusing on further education in graduate studies. Students gain the necessary knowledge and skills to solve complex tasks in forestry and for coping with the constant technological change, innovation and knowledge. Undergraduate study in forestry is designed so that students are led in a logical sequence from the basic biological and technical disciplines, through disciplines in which they are introduced to the components of forest ecosystems and to the techniques of forest management, to those that embrace the knowledge of forest and forest land management. Through fieldwork students acquire necessary practical experience they are acquainted with the practical application of aquired knowledge. Students acquire conditions for performing more complex jobs in forestry and for continuation of education in graduate studies by individual making of bachelor thesis. Defending the bachelor thesis is requirement for study conclusion. University Baccalaureus engineer of forestry with the knowledge gained by the completion of this study are completely qualified for a job as a forest warden and as a professional assistant in all tasks of the forestry profession.

PROGRAMME DETAILS

List of compulsory and elective courses

I. YEAR					
Course code	Course name	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
1. semester					
	Compulsory courses				
ŠP1001	CHEMISTRY WITH BIOCHEMISTRY	3	1	0	7
ŠP1002	MATHEMATICS	3	3	0	7
ŠP1003	PETROLOGY WITH GEOLOGY	2	1	0	5
ŠP1004	ZOOLOGY IN FORESTRY	2	1	1	6
ŠP1005	SOCIOLOGY IN FORESTRY	1	1	0	5
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE				
Total		**11**	**7**	**1**	**30**
2. semester					
	Compulsory courses				
ŠP2001	PHYSICAL AND HEALTH EDUCATION	3	3	4	8
ŠP2002	FORESTRY BOTANY	2	2	0	5
ŠP2003	BIOMETRICS	2	2	3	8
ŠP2004	SOIL SCIENCE	2	3	6	6
ŠP2005	GROUND SURVEYING WITH FUNDAMENTALS OF CARTOGRAPHY	1	1	0	3
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE				
Total		**10**	**11**	**13**	**30**

II. YEAR					
Course code	Course name	Course name	Lectures (hours)	Exercises (hours)	Field work (days)
3. semester					
	Compulsory courses				
ŠP3001	FOREST MENSURATION	3	2	2	7
ŠP3002	REMOTE SENSING AND GIS IN FORESTRY	2	2	2	5
ŠP3003	BASES OF HUNTING MANAGEMENT	2	2	2	6
ŠP3004	PHYSIOLOGY OF FOREST TREES	2	1	0	4
ŠP3005	FOREST GENETICS	2	1	0	4
ŠP3006	BASICS OF FOREST ECONOMICS	2	1	0	4
	Elective courses				
	PHYSICAL AND HEALTH EDUCAT.				
Total		**13**	**9**	**6**	**30**

4. semester					
	Compulsory courses				
ŠP4001	ESTABLISHMENT OF FORESTS	3	2	3	6
ŠP4002	FORESTRY PHYTOCENOLOGY	2	2	3	6
ŠP4003	FOREST ECOLOGY	2	2	3	6
ŠP4004	FOREST ENTOMOLOGY	2	2	3	6
ŠP4005	DENDROLOGY	3	2	3	6
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
Total		**12**	**10**	**15**	**30**

III. YEAR					
Course code	Course name	Course name	Lectures (hours)	Exercises (hours)	Field work (days)
5. semester					
	Compulsory courses				
ŠP5001	SILVICULTURE I	3	2	5	7
ŠP5002	BASIC FOUNDATIONS OF FOREST REGULATION AND PLANNING	2	2	2	7
ŠP5003	LOGGING I	2	2	4	7
ŠP5004	THE BASIC OF FOREST MECHANIZATION	2	2	2	5
ŠP5005	NATURE AND ENVIRONMENTAL PROTECTION	2	1	0	4
Total		**11**	**9**	**13**	**30**
6. semester					
	Compulsory courses				
ŠP6001	FOREST ROADS	2	2	4	5
ŠP6002	ORGANIZATION BASICS IN FORESTRY	2	2	3	5
ŠP6003	WORK SAFETY IN FORESTRY	2	1	1	3
ŠP6004	FOREST PHYTOPATHOLOGY	2	2	2	5
ŠP6005	FUNDAMENTALS OF FOREST PROTECTION	2	0	0	3
	Elective courses				
ŠP6005	MANNERS OF GAME HUNTING	1	0	0	1
ŠP5005	ORNAMENTAL DENDROLOGY	1	0	0	1
	SLOBODNI IZBORNI PREDMET	1	0	0	1
	BACHELOR THESIS				6
Total		**13**	**7**	**10**	**30**
Optionally elective courses					
PU6006	BASICS KNOWING OF FUNGI	1	0	0	1
ŠP 6008	MANAGEMENT OF FOREST GENETIC RESOURCES	1	0	0	1
ŠDU2002	FIRES OF OPEN SPACE	1	0	0	1
PU6009	EXOTIC WOODY PLANTS	1	0	0	1

Learning outcomes of the study program

Undergraduate study Forestry

A - general engineering competence

A1. apply aproach to experimental observing and mathematical modelling, mathematically solving research and practical problems, statistically process, present and analyse data and conclude individually based on analysed data

A2. use relevance in maintaining, area and possibilities of basic technical components

A3 apply skills in solving practical side of buisness, either by control measuring, calculations or testing verification

B - focused engineering competence

B1. identify tree species based on morphological characteristics, identify parts and tree shapes and apply theoretical and practical knowledge of commercially indigenous and foreign tree species and shrubs

B2. recognise and determine the most important types of xylophages bacteria, insects and funghi on trees species and detect wood defects incurred due to their activity

B3 acquire basic principles of protection of forests from abiotic and biotic factors, especially fires and apply basic procedures and means in protection of forests

B4. participate in the realization of forest management programs

B5 perform works on inventorying forests

B6. perform professional field works on establishing, caring for, and renewing forest stands

B7. perform professional field works in the melioration and management of forest areas in the Mediterranean region

B8. collaborate in preparation of ecological studies and spatial plans

B9. apply knowledge about the forest machines, techniques and standard technologies used in forestry and above all in timber harvesting from natural forests, forest cultures and plantations

B10. apply knowledge about techniques and technology of building forest roads

C - organizational engineering competence

C1. plan and organise time study, work rationalisation, conduct works of organization of production in forestry

C2. organise and conduct sale of timber assortments and timber products

C3. organise and conduct work safety in forestry

C4. conduct professional works on implementation of wildlife management programs and perform organisation od hunting areas

C5 plan and calculate production, calculate basic indicators of successful buisness, compose basic financial reports, recognise and analyse types of costs

D - developing engineering competence

D1. continue perfection on university graduate studies on Forestry section on Faculty of Forestry

Connection of the courses learning outcomes with the study program learning outcomes

Course code	General engineering competence			Focused engineering competence										Organizational engineering competence					Developing engineering competence
	A1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	C5	D1
ŠP1001	+																		
ŠP1002	+																		
ŠP1003	+					+				+	+								
ŠP1004						+					+								
ŠP1005				+		+		+											
PHE																			+
FL																			
ŠP2001				+															
ŠP2002	+																		
ŠP2003			+				+				+								+
ŠP2004	+							+			+								+
ŠP2005				+															
ŠP3001	+							+						+					+
ŠP3002			+					+			+								+
ŠP3003	+																+		+
ŠP3004				+					+	+									
ŠP3005									+										
ŠP3006	+	+	+															+	
ŠP4001	+								+	+		+							+
ŠP4002	+			+			+				+								+
ŠP4003				+		+	+	+	+		+								
ŠP4004					+														
ŠP4005				+															
ŠP5001									+										
ŠP5002							+	+											+
ŠP5003												+							
ŠP5004			+									+							
ŠP5005											+								+
ŠP6001													+						
ŠP6002														+					
ŠP6003																+			
ŠP6004					+	+			+										
ŠP6005						+			+										
ŠP6006	+														+				
ŠP5006								+											
ŠP6006					+														
ŠP6007						+				+									
ŠP6008							+		+		+								
PU6009								+			+								

Chemistry with Biochemistry

ŠP1001

ECTS 7

English language R1

E-learning R1

Teaching hours 60
Lectures 45
Exercises 15
Field work 0

Lecturer
Vibor Roje, Ph.D., Asst. Prof.

Associate teacher for exercises
Vibor Roje, Ph.D., Asst. Prof.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Chemical thermodynamics: enthalpy, exothermic and endothermic reactions, Hess's law, spontaneous processes, thermodynamic laws, entropy, Gibbs energy, energy exchange in living organisms,
Chemical kinetics: chemical reaction rate, reaction rate effects, catalysts and enzymes,
Chemical Balance: The Law of Chemical Balance,
Acid-base equilibrium, water dissociation, pH, pH in living organisms, buffers, biologically significant buffers, chemical elements in Nature,
Atmosphere, hydrosphere, lithosphere, soil, biogenic elements, soil, influence of pH and acid rain, reception of biogenic elements, significance of individual biogenic elements,
Organic compounds: in general, classification of organic compounds, aliphatic and aromatic hydrocarbons, alcohols, phenols, ethers, polyols,
Chirality, stereochemistry,
Aldehydes, ketones, reaction reactions of aldehydes and ketones, keto-enole tautomerism, carboxylic acids and their derivatives, esters, acidic agents,
Galic acid, tannin, humus, humic acid, humin, lipids, lipid, fat, oil, fatty acid, fatty acid hydrolysis, phospholipids, waxes, terpenes,
Heterocyclic compounds, sulphur compounds,
Carbohydrates, carbohydrate distribution, monosaccharide, α- and β- form, mutarotation, monosaccharide reactions, disaccharides, celobiozes, sucrose, invert sugar, polysaccharides, starch, cellulose,
Amino acids, stereochemistry, dissociation, peptide bonding, peptides, proteinisation, enzyme activity and activity, enzyme division, coenzymes,
Nucleosides, nucleotides, nucleic acids, DNA and RNA structure, replication, mutagenic defects,

Energy of biochemical reactions, ADP and ATP, photosynthesis, light and dark reactions, Calvin cycle, polysaccharide synthesis, cellulose synthesis and lignin, Aerobic and anaerobic respiration, pyrolysis acid degradation, Krebs-Martius cycle, breathing chain, anaerobic breathing

Type of course:

Chemistry with Biochemistry (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To make connections between names, chemical formulas and basic properties of simple inorganic and organic substances.	Exercises, homework, partial exams, written exams, oral exam	A1
To describe the groups of natural organic compounds and to recognize the natural organic compound on the basis of its structure or structure segment representation.	Exercises, homework, partial exams, written exams, oral exam	A1
To describe the basic characteristics of biological membranes, to list the basic groups of enzymes, to describe the basic properties of metabolic processes, to describe the basic characteristics of photosynthetic processes.	Exercises, homework, partial exams, written exams, oral exam	A1

General competences:

Scientific thinking, establishing causal relationships between phenomena.
Acquiring chemical symbolism.
Solving simple numeric problems.

Type of instruction:

Lectures

Exercises

As a part of the exercises, the chemical and stoichiometric problems that follow the lecture will be solved. The exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teacher's obligations:

To hold the lectures and exercises. To create the teaching materials. Creating and holding of the exams and assessment of the students' knowledge. Partial exams, regular written and oral exams and consultations.

Student's obligations:

Regular attendance and active participation in lectures and exercises. Setting up partial exams or exams in regular exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1.5
Exercises (E)	-	-	-	15	0	0.5
1st partial exam (physical chemistry)	33.3 %	60-70%	Sufficient (2)	0	60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2nd partial exam (organic chemistry)	33.3 %	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
3rd partial exam (natural organic chemistry, biochemistry)	33.3 %	60-70%	Sufficient (2)	0	60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**			**60**	**150**	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	90	3
TOTAL	**100 %**			**60**	**150**	**7**

*** The students who do not pass the partial exams during the semester are admitted to the exam in a regular or extraordinary exam period. In such a case, the examination consists of a written and oral part, and both parties participate equally in the final assessment.**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is regularly checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
1st partial exam	Partial exam refers to the material processed in the first five lessons. It consists of so-called theoretical and computational tasks.	6th week	Students who pass the 1st partial exam can access the 2nd partial exam.
2nd partial exam	The partial exam refers to the material processed from the 6th to the 10th teaching term.	11th week	Students who pass the 2nd partial exam can access the 3rd partial exam.
3rd partial exam	The partial exam refers to the material processed from the 11th to the 14th teaching term.	15th week	Students who pass the 3rd partial exam are eligible for a final grade of Chemistry with Biochemistry.
Written exam	Written exams are attended by students who have a duly attended and certified semester but have not passed the three partial exams.	Exam terms	-
Oral exam	Students who passed a written exam are invited to the oral exam. The results of the written and oral exams equally participates in the final evaluation of Chemistry with Biochemistry.		-

Obligatory literature

1. On the weab-site http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=99 under the subject *Kemija s biokemijom* (ŠP 1001), there are links to the .ppt files of the teaching material (in Croatian)
2. M. Sikirica, B. Korpar-Čolig, Chemistry with Exercises 1, Školska knjiga, Zagreb, 1991, and latter editions (in Croatian)
3. M. Sikirica, B. Korpar-Čolig, Chemistry with Exercises 2, Školska knjiga, Zagreb, 1992, and latter editions (in Croatian)
4. M. Sikirica, B. Korpar-Čolig, Organic Chemistry, Školska knjiga, Zagreb, 1996, and latter editions (in Croatian)

Recommended literature

1. M. Sikirica, Stehiometrija, Školska knjiga, Zagreb
2. V. Rapić, Nomenklatura organskih spojeva, Školska knjiga, Zagreb, 1991. i kasnija izdanja
3. L. Streyer, Biokemija, Školska knjiga, Zagreb, 1991.
4. C.E. Mortimer, Chemistry, 6th edition, Wadsworth Publ. Co, Belmont, CA, 1986

Mathematics

ŠP1002

ECTS 7

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Azra Tafro, PhD

Associate teacher for exercises
Azra Tafro, PhD

Grading
Sufficient (2) 50%
Good (3) 60%
Very good (4) 75%
Excellent (5) 90%

Course content:

Number sets. Real numbers.
Infimum and supremum of a set.
Inequalities
Functions. Continuity of a function. Limit of a function.
Derivative. Derivations of elementary functions. Differential calculus. Function analysis using differential calculus.
Functions of two variables.
Definite integral. Areas. Indefinite integral. Some integration methods. Applications of integral calculus (areas, volumes, moments, centroid).
Differential equations.
Vectors in a two- and three-dimensional space. Vector operations.
Matrices and matrix calculus.

Type of course:

Mathematics (compulsory, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpretation of basic notions and facts of sets and functions when solving mathematical problems (graphs of elementary functions, sequence limits, domain of a function, properties of functions, composition of functions, inverse functions, function limits, function continuity).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Applications of derivatives (tangents, elementary and compound function derivatives, derivative rules, function growth and decay, extremes of functions, graphs).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of two variable functions (partial derivatives, extremes).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of indefinite integrals (concept of primitive function and indefinite integral, integrating, basic properties of indefinite integrals, integration methods).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Analysis of definite integrals (basic concepts, Newton-Leibnitz formula, calculating areas of plane figures using definite integrals, calculating the volume of a solid of revolution, centroid coordinates, double integral, first order differential equations).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of vectors and matrices (vectors in two- and three-dimensional space, operations with vectors, matrices and matrix calculus, determinants).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1

General competences:

Mastering the knowledge and skills needed to follow the coursework of other subjects.
Training to formulate mathematical models and solve practical problems.
Developing abstract and analytical thinking, precision of expression and insight.

Type of instruction:

Lectures

Exercises

Exercises serve as an upgrade and addition to knowledge obtained in the lectures. Exercises are auditory.

Working methods:

Teachers' obligations:

Teaching in class – lectures and exercises. Formulating the exercises and tests, as well as grading them. Organizing partial exams, exams, oral exams and office hours. Producing teaching materials.

Students' obligations:

Regular attendance and active participation in class, both in lectures and exercises. Taking partial exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			45	30	2.5
Exercises (E)	-			43	32	2.5
Partial exam 1 (PE1)	50%	50-59%	Sufficient (2)	1	29	1
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-59%	Sufficient (2)	1	29	1
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**PE1+PE2**		**90**	**120**	**7**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100%	50-59% 60-74% 75-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**FE**				

*** Students who fail to pass the partial exams, but have acquired at least 10% of the total score on those exams, can take the final exam which makes up 100% of the grade. The exam consists of a written and an oral part, and students who achieve at least 50% on the written part can take the oral part of the exam.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Attendance is checked during class. Attendance and participation are necessary for obtaining the lecturer's signature and attending partial exams and exams.	semester (90 hours of direct lectures)	-
Partial exam 1	Students solve problems from the coursework of the first part of the semester. The exam is in written form. A minimum of 10% of the score on the first partial exam is necessary for obtaining the lecturer's signature and taking the second partial exam and further exams.	8th week	Under extraordinary circumstances and with a valid excuse,the student can take the exam at a later date.
Partial exam 2	Students solve problems from the coursework of the second part of the semester. The exam is in written form. A minimum of 10% of the score on the partial exam is necessary for obtaining the lecturer's signature and taking further exams.	15th week	Under extraordinary circumstances and with a valid excuse,the student can take the exam at a later date.
Written exam	The exam includes coursework from the entire semester. Students who obtained the lecturer's signature can take the exam.	Exam terms	
Oral exam	The exam includes coursework from the entire semester. Students who passed the written exam can take the oral exam. The final grade is obtained by combining the results of the written and oral exams.	Exam terms	

Obligatory literature

1. Bradić T. et al: Matematika za tehnološke fakultete, Element, Zagreb, 1998.
2. Javor, P.: Matematička analiza 1, Element, Zagreb, 2003.

Recommended literature

1. Hitrec,V. : Matematika (analiza funkcija), skripta. Šumarski fakultet, Zagreb, 1986.
2. Hitrec,V. : Matematika (funkcije od dvije varijable, integriranje i primjena), skripta, Zagreb, 1991.
3. Šego, B. : Matematika za ekonomiste, Narodne novine d.d., Zagreb, 2005.

Petrology with geology

ŠP1003

ECTS 5

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. PhD Dunja Aljinović
Associate prof. PhD Bojan Matoš

Associate teacher for exercises
Associate prof. PhD Bojan Matoš
Senior assistent, PhD. Duje Smirčić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

In the first part of the course students are getting acquainted with the Earth's interior, lithosphere, minerals and their crystallographic, physical and chemical properties. Mineral structure and systematic minerals is explained.
The concept of rock as mineral association and the genesis of different rock groups (igneous, metamorphic and sedimentary) is explained. Occurrences of different rock groups and their structure and texture are explained. For each group of rocks general classification is explained.
Petrographic part of the course is concluded with processes of rock weathering and erosion in relation to soil formation. The goal is to get the idea of soil formation and pedogenic processes as the introduction for pedologic courses later in the study program.
After the petrological part of the course, basic geological knowledge are being taught for understanding: endogenous and exogenous, physical and chemical processes that influence the geological features, formation of relief, geological structural elements, surface and ground water regimes, formation of morphological features in the karst area, landslides, and geological roll in environmental protection, exploitation of mineral resources and protection of the ground water.

Type of course:

Petrology with geology (compulsory, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Students will be able to describe the Earth's interior and the methods of investigation of the Earth's interior. They will be able to recognize the relation between endogenous and exogenous factors that are operating in the Earth's interior and exterior such as thermal convection in the upper mantle and rise of mountains. Students will be able to explain causes of plate tectonics.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to recognize the types of boundaries between the tectonic plates	Practical part of the exercises, partial exam, final exam	A1
Students will be able to describe elements of mineral crystals and their lattice, and crystal differences between groups of silicate minerals. They will be able to describe different physical properties of minerals and recognize specific physical properties by testing the minerals	Practical part of the exercises, partial exam, final exam	A1
Students will be able to describe the genesis of igneous rocks, differentiate igneous rocks based of their place of formation and structure	Practical part of the exercises, partial exam, final exam	A1
Students will be able to classify igneous rocks based on the mineral and chemical composition. Students will be able to specify the minerals that are occurring in the composition of different igneous rocks.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to adduce the conditions of sedimentary rock formation. They will be able to recognize and explain the basic characteristics of sedimentary rocks (layer, bedding, bed surfaces) and classify the sedimentary rocks in elementary groups. They will be able to name and classify sedimentary rocks.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to define structural and mineral changes in the processes of formation of metamorphic rocks. They will be able to name the metamorphic rocks representing different type of metamorphism. Students will be able to differentiate metamorphic rocks from other rock types.	Practical part of the exercises, partial exam, final exam	A1
Students will understand the methods and basic principles used in stratigraphic classification systems, which describe the relative and absolute ages of geological events, processes and formations.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to understand and use the professional terminology used in stratigraphic classification systems which describe the time sequences of geological events, processes and formations.	Practical part of the exercises, partial exam, final exam	A1
Student will be able to understand and use the information shown on the geological maps, profiles and columns.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to understand and use basic geological principles to determine relative ages of	Practical part of the exercises, partial exam, final exam	A1

the geological sequence.		
Students will be able to recognize and describe the basic features of primary and secondary geological structures in the rocks of the Earth's crust. Students will be able to understand and use the professional terminology used in structural geology for classification and description of primary and secondary geological structures in the rocks of the Earth's crust. Students will be able to recognize, understand and use the information about primary and secondary geological structures gathered from the conducted field measurements as well as those shown on the geological maps and profiles.	Practical part of the exercises, partial exam, final exam	A1, B8
Students will be able to independently construct the geological profile based on the data from the geological map	Practical part of the exercises, partial exam, final exam	A1
Students will be able to understand the impact of surface and groundwater on the mechanical and chemical weathering of minerals and rocks, formation of relief and morphological shapes in plain, mountain and karst areas.	Practical part of the exercises, partial exam, final exam	B7
Students will be able to understand the natural hydrodynamic processes in the hydrological cycle and understand/use professional terminology used in hydrology and hydrogeology when describing the hydrological cycle, mode of water drainage on the surface as well as underground. Students will be able to understand and use the professional terminology used in hydrogeology for classification of groundwater in rocks with intergranular and fractural porosity, in classification of wellsprings, aquifers and their protection.	Practical part of the exercises, partial exam, final exam	B7
Students will be able to understand the mechanisms of earthquake occurrences, intensity, distribution and frequency in geodynamical different areas of the Earth's crust.	Practical part of the exercises, partial exam, final exam	A1
Students will be able to understand the reasons and factors influencing slope stability and understand and use the professional terminology used in engineering geology for classification of landslides and rockslides and soils.	Practical part of the exercises, partial exam, final exam	B3, B7, B8

General competences:

the program of the course offers the basic knowledge from mineralogy, petrology and geology to forestry students and allows the students to gather the knowledge form
(1) basic classifications of minerals and rocks
(2) rock forming processes
(3) formation of relief and soils
(4) understanding and using the geological map
(5) understanding of hydrogeological characteristics of surface and ground water flows
(6) Role of geology in the environmental protection and planned, sustainable development.

Type of instruction:

Lectures

Exercises

Exercises are organised in a practical way, where students are getting acquainted with mineral and rock samples and basic principles of their determination and description. Specific methods of rock and mineral determinations are used, and classification of each rock type is learned. Students are learning basic knowledge in geological mapping: map orientation, recognizing geological principle of mapping and principle for construction of the geological profile.

Working methods:

Teachers' obligations:

Lecturing and textual and graphical presenting (ppt) following the main elements/content related to the basics of petrology and geology. Preparation of exercises and partial exams and their grading. Organising partial exams, oral exams and consultations. Preparation of lecture material.

Students' obligations:

Regular attendance and active participation on lectures and exercises. Construction and delivery of the program/geological profile in the agreed time. Attending the partial exams, and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	30%	-		30	15	1,5
Partial exam 1 – Earth's interior, minerals, physical properties of minerals and igneous rocks (genesis, classification)	20%	50-62%	Sufficient (2)	1	30	1
		63-75%	Good (3)			
		76-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 – Sedimentary and metamorphic rocks	20%	50-62%	Sufficient (2)	1	30	1
		63-75%	Good (3)			
		76-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 3 – Geology, geological	20%	60-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			

structures, hydrology and hydrogeology		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Construction of the geological profile	10%			4	15	0,5
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		37	120	5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	60	2
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercise	Attendance of the course is conducted in the beginning of the lectures. Students can be excused from 20% of the total lecture hours.	semester (45 hours of direct lecturer)	-
Attendance of exercise	Exercises are conducted in groups. Each exercise term s practical where students are acquainted first the minerals and rocks, and afterwards with geological structures and a geological map. During the construction of the program (geological profile) students are following the steps and at the end of each term an examination is carried out. In the last term of the exercises students are delivering the correctly constructed program and are getting the signature as a part of the obligation for getting the grade.		In case of any need compensation is planned according to the plan of the course.
Partial exam 1	All students can approach the partial exam. It has 25 points and is graded according to the percentages.	6. week	
Partial exam 2	All students can approach the partial exam. It has 13 points and is graded according to the percentages.	9. week	
Partial exam 2	All students can approach the partial exam. It has 60 points and is graded according to the percentages.	14. week	There is a possibility of a correction of one of the partial exams.
Written exam	Students who did not get the grade through partial exams are approaching the written exam. The exam is composed of the whole course material and has a total of 100 points, 60 of which are for a positive grade.	Exam terms	-
Oral exam	Only students that are participating in the commissioned exam are being tested via oral exam.		-

Obligatory literature

1. Tišljar, Josip: Petrologija s osnovama mineralogije, Zagreb, Rudarsko-geološko-naftni fakultet, 1999.
2. Vrkljan, Maja: Uvod u mineralogiju i petrologiju. Zagreb, Rudarsko-geološko-naftni fakultet, 2012.
3. Pavelić, Davor: Opća geologija. Zagreb, Rudarsko-geološko-naftni fakultet, 2014

Recommended literature

1. Plummer, C.C., McGeary, D., Carlson, D.H. (1999): Physical geology. 8th Edition, WBC – McGrar-Hill Publisher, Boston-Toronto.
2. Vrkljan, M. (2001): Mineralogija i petrologija – osnove i primjena. 1-2017, Udžbenici Sveučilišta u Zagrebu, izd. RGN fakultet, Zagreb.
3. Pavelić, Davor: Opća geologija. Zagreb, Rudarsko-geološko-naftni fakultet, 2014

Zoology in forestry

ŠP1004

ECTS 6

English language R1

E-learning R1

Teaching hours 52.5
Lectures 30
Exercises 15
Field work 7.5

Lecturer
Prof. Josip Margaletić, PhD

Associate teacher for exercises
Asst.prof. Marko Vucelja, PhD
Linda Bjedov, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students become acquainted with the basic characteristics of the animal kingdom. They become acquainted with the basics of taxonomy and the division of animals into phyla and the morphological, physiological, ecological and etological differences among these. An overview of the lower taxa of the phyla, concentrating in particular on the relevant organisms which inhabit protected areas (national parks, nature parks, horticultural objects), their biology, ecological role and possible harmfulness in forestry and hunting management. The course emphasizes the importance of animals in the processes of cycling matter and energy and the maintenance of stability and diversity of life in various biotopes.

Type of course:

Zoology in forestry (obligatory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret animal promorphology (importance and meaning of zoology, differences between plants and animals, the division of zoology, the size and form of animals, the plan of animal bodies (promorphology), the position of animals in space and time	Written and oral exam	B3, B8

(ecological, geographic, geological), trophic chains.		
Describe the Systematics of the Animalia Kingdom (animal phylogeny, heredity and evolution, animal taxonomy, Kingdom Monera, Kingdom Protoctist, Animalia Animalia, Speciation, Insulation Mechanisms, biological community and ecosystems).	Written and oral exam	B3, B8
Interpret the integumentary, skeletal, muscular and nervous system in animals.	Written and oral exam	B3, B8
Interpret the sensory, digestive and respiratory systems in animals.	Written and oral exam	B3, B8
Interpret the excretory, hormonal, excretory and reproductive system of organs in animals (forms of sexual and non-sexual reproduction, gender determinations, generation changes, heterogenesis).	Written and oral exam	B3, B8
Describe the behavior of animals (osmoregulation of animals on land, bioluminescence, migration, raising of offspring).	Written and oral exam	B3, B8

General competences:

The course is based on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures
Exercise
Fieldwork

Working methods:

Teachers' obligations:
Holding lessons – lectures, exercise and fieldwork. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, exercise and fieldwork. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lecture	-	-	-	30	-	1
Exercise	-	-	-	15	30	1,5
Fieldwork	-	-	-	7,5	7,5	0,5

Exam (PE)	100%	60-70%	Sufficient (2)	-	90	3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			52,5	127,5	6

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		90	3
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (30 hours of direct lecturer)	-
Attendance of exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer	-
Attendance of fieldwork	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (7,5 hours of direct lecturer	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exame.	Exam terms	-
Oral exame	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	-

Obligatory literature

1. Matoničkin, I., 1981: Beskralješnjaci, Biologija viših avertebrata, Školska knjiga, Zagreb.
2. Oštrec, Lj., 1998: Zoologija, štetne i korisne životinje u poljoprivredi. Zrinski d.d., Čakovec, 232 str.
3. Matoničkin, I., Erben, R., 2002: Opća zoologija, Školska knjiga, Zagreb, 381 str.

Recommended literature

1. Schwenke, W., 1981: Letfaden der Forstoologie und des Forstchutzes gegeb Tiere. Pareys Studientexte 32, Verlag Paul Parey, Hamburg und Berlin, 188 pp.
2. Young, J. Z., 1995: The life of vertebrates, 3rd edn., Oxford University Press Inc., New York, 645 pp.
3. Randal, D., Burggren, W., French, K., 1998: Eckert animal physiology. Mechanisms and adaptations; W. H. Freeman and Company, New York, 825 pp.

Sociology in Forestry

ŠP1005

ECTS 5

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Anđelina Svirčić Gotovac, Assistant Professor

Associate teacher for exercises
Anđelina Svirčić Gotovac, Assistant Professor

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 81%
Excellent (5) 91%

Course content:

Present sociology as a social science in the context of contemporary phenomena and basic social concepts (norms, institutions, patterns of behavior, social state, tradition, democratization of society, etc.).
An analysis of basic sociological theories in the context of the modernization and urbanization of society (from the beginning of the 19th century to the present postmodern phase).
Clarify the position of Croatia in today's transitional context, as well as the cause and effect of links between global, national and local processes (retraditionalization and demographic processes).
Interpret the postmodern and information context and how information technology enables a new division and evaluation of work (international and interregional).
Analyze the phenomenon of globalization and global (glocal) development in a neoliberal context (in urban and rural development).
Introduce them to the socio-ecological paradigm, the bioethical paradigm and the ecological injustice (between the North and the South).
Present the concept of sustainable development (the importance and role of international agreements aimed at resolving the ecological crisis (eg Kyoto Protocol and the Paris Agreement) and environmental footprint and environmental sustainability index.
Analyze the elements of ecological crime (ways and types that have led to anthropogenic impacts on the environment to the destruction of natural resources, and the role of multinational companies in the global political and economic crisis.

Highlights the importance of forestry and 'greening' for a sustainable space and lifestyle.

Type of course:

Sociology in Forestry (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish basic social concepts (norms, institutions, patterns of behavior, social state, tradition, democratization of society, etc.).	Seminar papers and presentations, colloquia, written and oral exams	B1
Analyze basic sociological theories in the context of modernization and urbanization of society (from the beginning of the 19th century to the present postmodern phase). Understand the phenomenon of globalization and global development in a neoliberal context.	Seminar papers and presentations, colloquia, written and oral exams	B3
Understand the concept of sustainable development (Kyoto Protocol and the Paris Agreement). Analyze the state of the ecological crisis and environmental footprint in terms of sustainability of the environment and sustainable life.	Seminar papers and presentations, colloquia, written and oral exams	B5

General competences:

The distinction between basic sociological definitions in the socio-spatial context of contemporary phenomena and social changes.
To clarify the position of Croatia in today's transitional context, as well as the cause and effect of links between global, national and local processes (retraditionalization, negative demographic trends, depopulation, ruralization).
Understand the concept of sustainable development (the role of international agreements aimed at resolving the ecological crisis, eg the Kyoto Protocol and the Paris Agreement).
Determine the state of the ecological crisis in the context of sustainable growth and sustainable living in a global context. Distribute examples of positive EU models.

Tipe of instruction:

Lectures and seminars

As part of the seminar exercises, there are several examples and topics from the contemporary context of Europe and the world. Seminars are an upgrade to knowledge adopted in lectures.

Working methods:

Teacher's obligations:

Maintaining original classes - lectures, seminars. Designing topics for seminars and workshops and assembling knowledge tests and evaluating them. Holding of colloquia, written and oral exams and consultations. Creation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures and seminars, preparation and presentation of seminar work. Take a colloquium or a written and oral exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students work load outside the direct teaching	ECTS
Lectures (L)	20%			30		1
Exercises (E)	20%	50-60%	Sufficient (2)	15		
		61-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	60%	60-70%	Sufficient (2)	15	30	
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy20+Exy20+PExy60)/100**		45	45	3

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-60%	Sufficient (2)			
		61-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of students is checked and recorded. The student can be legally absent with up to 15% of the hours of direct instruction.	semester (45 hours of direct lecturer)	-

Partial exam	Students can pass the exam through two colloquiums (each bearing 50% of the material exhibited). A colloquium is evaluated and takes part in the final grade of the course.	15. week	-
Written exam	The exam can be attended by students who have a seminar conducted. Students who passed both colloquia do not write a written exam. Students who did not pass both colloquia must write a written exam consisting of 10 essay questions. The written exam is evaluated and is involved in the final grade of the course.	Exam terms	-
Oral exame	Students who pass a written exam ask questions from different parts of the program content. The final grade from the subject is obtained according to the formula **Vx20+K2x20+PIx60/100**	Exam terms	-

Obligatory literature

1. On the website http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the subject Sociology in Forestry under LECTURE there are links to all lectures made during the semester. The lecturer from the course is Anđelina Svirčić Gotovac.
2. Ulrich Beck (2011). Worldwide risk society. Looking for lost security. Novi Sad, Akademska knjiga.
3. Ivan Cifrić (2000). Bioethics and ecology. Matica hrvatska Zaprešić. Zaprešić.
4. Dražen Šimleša (2010.) Eco-footprint. How development evolved sustainability. TIM press, Zagreb.
5. Anđelina Svirčić Gotovac (2018). (Not) the possibility of sustainable development for small and medium-sized cities in the Croatian spatial system. U: *Koga (p)održava održivi razvoj? Prinosi promišljanju održivosti ruralnih područja u Hrvatskoj*, (Ur.) Bušljeta Tonković, A.; Holjevac, Ž.; Brlić, I.; Šimunić, N., Institut društvenih znanosti Ivo Pilar, Biblioteka Zbornici, 95-107.

Recommended literature

1. Ivan Cifrić (2003). Environment and sustainable development - environmental vulnerability and landscape aesthetics, HSD, Zagreb.
2. David Harvey (2013). Short History of Neoliberalism., HSD, Zagreb.
3. Naomi Klein (2000). No logo. Flamingo. Great Britain.

Physical and health education

-

ECTS points 0

English R1

hours of classes 60
Lectures 0
Exercises 60
Field work 0

Leader of exercises
Sen. Lec. Davor Pavlović

Evaluation
Continuous monitoring of presence and participation in exercises and the acquisition of motor skills of kinesiology.

Course contents:

The Physical and health programs at the Faculty of Forestry of the University of Zagreb are carried out as:

- Basic programs,
- Special programs,
- Programs for students with special needs
- Elective programs for students of senior years.

Teaching is carried out by choice of students of a particular teaching unit and content that is a part of one of the above programs. The aim of this course is the acquisition of theoretical and practical kinesiological knowledge with the purpose of training students for independent physical exercise. At the same time, students are informed about the importance of health education in order to preserve and improve health, the harmfulness of various forms of addiction to health, in particular the impact on intellectual efforts and physical exercise.
Students acquire knowledge about the importance of quality nutrition and the most interesting results of previous research carried out on the student population in the health segment (prevention, diseases, diet, diagnostics, stress, physical activity as a relaxation agent ....).

Type of course:
Physical and Health Culture (compulsory elective course, 1st semester, year 1)
Physical and Health Culture (compulsory elective course, 2nd semester, year 1)
Physical and Health Culture (compulsory elective course, 3rd semester, year 2)
Physical and Health Culture (compulsory elective course, 4th semester, year 2)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the structure of the physical exercise class.	exercises, correction and evaluation exercises	D1
Explaination of the impact of physical exercise on health.	exercises, correction and evaluation exercises	D1
Choose fitness exercises designed to strengthen individual muscle groups.	exercises, correction and demonstration	D1
Demonstrate specific exercises with regard to kinesiologic activity.	exercises, structural analysis, assistance, correction and evaluation exercises	D1
Organize constructive free time	Exercises and evaluation exercises	D1
Assess personal diet and physical exercise habits.	exercise, diet diary correction and evaluation exercises	D1
Demonstrate general preparatory exercises and stretching exercises.	exercises, description, demonstration, correction	D1
Understanding kinesiology programs and their target orientation.	vježbe, korekcija i vrednovanje vježbi	D1
Control emotions and strengthen self-control.	Exercises, correction	D1

General competences:

Social-civic competences- Understanding of social behavior and codex from a different environment, creating new social contacts and friendships
Organizational competences in teamwork - networking and creating contacts, contributes to group relationships and efficiency
Methodical - didactic kompetencije- Management of time in the learning process, the ability to use new knowledge in practice

Type of instruction:

Field work
Practical exercises in different sports facilities depending on the choice of activity

Lectures
Health care for students

Exercises
Practical exercises from basic, special or elective programs in different working conditions, with the option to apply different trainers and aids

Working methods:

Teacher's obligations:

Teaching - exercise and consultation with students, professional training of teachers, organization and preparation of sports teams and organization of faculty sports competitions. Creating teaching materials.

Student's obligations:

Regular attendance and active participation in exercises.

Reccomended literature:

1. Bos, K. (2004.) Walking to health, Mozaik knjiga
2. Colwin, C., M. (1998). Swimming for the 21st Century, Gopal d.o.o.
3. Cook, B., C. (1996) Strength Basics. Your Guide to Resistance Training for Health and Optimal Performance, Human Kinetics
4. Ćurković, S. (2010). Kinesiological Activities and Risk Behavior of Students, Dissertation. Faculty of Kinesiology, University of Zagreb
5. Janković, V. i Marelić, N. (1995). Volleyball, Faculty of Physical Culture in Zagreb
6. Neljak, B. i Caput-Jogunica, R. (2012) Kinesiology Methodology in Higher Education, Faculty of Kinesiology, University of Zagreb
7. Pavlović, D.(2010.) Script for Students of the Faculty of Forestry of the University of Zagreb
8. Sertić, H. (2005.) The Basics of Martial Arts, Faculty of Kinesiology, University of Zagreb
1. 9.Šatalić, Z.(2016.) Sports nutrition, Znanje d.o.o, Textbooks of the University of Zagreb
9. Šnajder, V. (1995) From start to finish, Školske novine, Zagreb
10. Proceedings International Scientific Conference on Kinesiological Recreation and Quality of Life, ur. M. Andrijašević (2008) Faculty of Kinesiology, University of Zagreb

Forestry botany

ŠP2001

ECTS 8

English language R1
E-learning R1

Teaching hours 122
Lectures 45
Exercises 45
Field work 32

Lecturer
Prof. dr. sc. Jozo Franjić
Prof. dr. sc. Željko Škvorc

Associate teacher for exercises
Doc dr. sc. Daniel Krstonošić
Doc. dr. sc. Krunoslav Sever
Doc. dr. sc. Martina Temunović

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction – history and division of botany. Plant anatomy, use of a microscope. Basic characteristics and structure of a plant cell. Types of tissue that form plant tissue and their characteristics. Anatomical structure of vegetative plant organs, basic classification of leaves, shedding of leaves, structure of monocotyledon and dicotyledon-gymnosperm stem. Anatomical structure of wood, anatomical structure of bark, anatomical structure of the root. Phylogenetical development of stele.
Historical development of plant classification, methods of phylogenetical classification, classification units (taxons), taxonomy and nomenclature of plants. Systematic division of the wildlife world and basic characteristics of specific groups – Virota, Procaryota, Bacteriobiota, Eucaryota, Vegetabilia. General characteristics of plants, reproduction of plants.
Basic characteristics of fungi and their role in the ecosystem. Morphologic and anatomical structure of fungi. Fungi reproduction and nutrition.
Systematic classification of real fungi and basic characteristics of specific groups: Archimycotina, Siphonomycotina - Oomycetes, Zygomycetes. Septomycotina: Ascomycetes - Protoascomycetidae, Plectomycetidae, Discomycetidae, Basidiomycetes - Phragmobasidiomycetidae, Holobasidio-mycetidae.
Systematic classification of plants and basic characteristics of individual groups: Rhyniophyta, Bryophyta – mosses, Lycopodiophyta – club-mosses, Equsetophyta - horsetails, Polypodiophyta - ferns.
Systematic classification and basic characteristics of specific groups of gymnospermae. Ontogenetical development of conifers.

Angiospermae, morphologic structure of angiospermae, structure of vegetative organs – root, stem, leaf. Structure of reproductive organs – flower, seed, fruit. Ontogenetical development of angiospermae. Systematic classification of angiospermae and basic characteristics of specific families.

Type of course:

Forestry botany (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To present the plant cell structure and function and plant function and plant histology (cytology, cytoplasm, plastids, mitochondria, cell wall, pits, cell nucleus, chromosomes, DNA, mitosis, meiosis, primary, secondary meristems, phellogen, vascular cambium, permanent or final cells, dermal and vascular tissue).	Practicum, Preliminary exam	B1
To interpret the anatomy of vegetative plant organs (leaf, stem structure, tree structure of Gymno- and Angiosperms, bark anatomy, root anatomy, phylogeny of stele).	Practicum, Preliminary exam	B1
To present plants systematics and systematic life division (systematic units (taxa), artificial and phylogenetic systems, plant evolution, speciation, hybridization, plant propagation, general characteristics and division of Cormophyta).	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Pteridophyta.	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Gymnosperms.	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Angiosperms (vegetative and reroductive plant organs, function, basic forms, plant organs transformations)	Practicum, Preliminary exam	B1
To show the most important families and genera of the forest plants (diversity, taxonomic status, distribution, significance).	Preliminary exam	B1

General competences:

Students are introducted to basic botanical terms which are the base for senior-year courses.
Furthermore, they are introduced to a great diversity of the world of plants, fungi and microorganisms, as well as to basic characteristics of particular groups of classification.
All of that develops their understanding of the functioning and r ole of particular parts of different ecosystems they will work in after their graduation.

Type of instruction:

Lectures

Exercises

As part of laboratory exercises, practical exercises in plant anatomy using microscopes are carried out. In addition, laboratory as well as field exercises in morphology and determination of plants are carried out. Exercises serve as an upgrade to the knowledge adopted in lectures.

Field work

Field work is carried out in order to introduce students to the plants characteristic for individual ecosystems and to make herbarium collections for the purpose of learning and passing the exam. During field work, practical work on plant collection, herbarium technique and plant identification is carried out. Field teaching is performed in groups and is carried out in the most significant forest plant communities present in the Republic of Croatia.

Working methods:

Teacher's obligations:
Performing original teaching - lectures, exercises, field works. Compiling and evaluating of knowledge tests. Exemination and evaluate Herbar collections. Providing preliminary exams, oral exams and consultations. Production of teaching materials

Student's obligations:
Regular attendance and active participation in lectures, exercises and field works. Making herbarium collection. Passing preliminary exams and exam.

Methods of grading

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	10%	Partly messy and incomprehensible, with major corrections	Sufficient (2)	45	0	1,5
		Orderly, legible, with major corrections	Good (3)			
		Orderly, legible, with minor corrections	Very good (4)			
		Orderly, legible, correct	Excellent (5)			
Field work (FW)	-	-	-	32	-	1

Herbarium (H)	10%	Partly messy, some plants were poorly herbarized, with major corrections, minimum number of plants	Sufficient (2)	-	15	0,5
		Orderly, plants properly herbarized, with major corrections, minimum number of plants	Good (3)			
		Orderly, plants properly herbarized, with minor corrections, more than minimum number of plants	Very good (4)			
		Orderly, plants properly herbarized, correct, significantly more than minimum number of plants	Excellent (5)			
Partial exam - plant identification (PE1)	10%	60-70%	Sufficient (2)	-	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - plant anatomy (PE2)	20%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - plant systematics (PE3)	20%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Partial exam - final (PE4)	30%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E*10+H*10+PE1*10+PE2*20+PE 3*20+PE4*30)/100**		122	120	8

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures+exercies +field works	The attendance of students is checked and recorded at the lectures. The student can justifiably be absent with a maximum of 20% of lectures and 10% of the exercises. Field work must be done in 100% amount. Exercises are attended in groups. On the web site students can see the template of the folder and worksheet which they are required to prepare and have on the exercises. Students are required to have the lab equipment listed on the web pages, which is also presented at the first lessons. Before the first exercise, students are required to study the template script about microscopy that can be downloaded from the web site. Prior to field work, students are required to study the instructions about collecting and herbarizing plants that can be downloaded from the web site which is also presented at the lectures.. For field work, they must prepare a field folder with papers for collecting plants.	semester (122 hours of direct lectures)	Exceptionally, in the case of a justified reason, the student compensates the absence of the individual exercise
Makeing exercises	Evaluated are accuracy, regularity and active participation in the exercises.	in accordance to the agreed deadline	
Making herbarium collection	Students are obliged to make herbarium collection according to the instructions presented during lectures and field work and that are also listed on the web site. The template for the field folder and herbarium labels should be downloaded from the web site. The accuracy, the orderliness and the quality of the herbarium are evaluated. Herbarium should contain at least 150 plants systematically sorted by families. The herbarium collection should be reviewed and positively evaluated prior to takeing the final exam	in accordance to the agreed deadline	
Partial exam in plant recognition (PE1)	Students have to recognize plant species from photographs. The accuracy of the recognition and pronunciation of the Latin names of plants is evaluated.	in accordance to the agreed deadline and exam schedule	
Partial exam in plant anatomy (PE2)	Partial exam can be accessed by students who have passed the pre-exam in recognition of plants (PE1). The partial exam consists of a written and oral part. The written part consists of 10 questions to which the students answer textually or by anatomical drawings of	After 10th week in accordance to the agreed deadline and exam schedule	

	individual plant parts.		
Partial exam in plant systematics (PE3)	Partial exam can be accessed by students who have passed the pre-exam in plant anatomy (PE2). The partial exam consists of a written and oral part. The written part consists of 15 questions.	in accordance to the agreed deadline and exam schedule	
Partial exam – final (PE4)	Final exam can be accessed by students who have passed all the previous partial exams and have positively evaluated exercises and herbarium collection. The partial exam consists of a written and oral part. The written part consists of 15 questions. If during the academic year the students do not pass the final exam, in the new academic year, they must re-submit the partial exams (PE1-PE3) before takeing the final exam. The final grade of the subject is obtained according to the formula: **V*10 + H*10+K1*10+K2*20+K3*20+ZK*30/100**	in accordance to the agreed deadline and exam schedule	

Obligatory literature

1. Franjić, J., Ž. Škvorc, 2010: Šumsko drveće i grmlje Hrvatske. Šumarski fakultet Sveučilišta u Zagrebu, 432. str.
2. Franjić, J., Ž. Škvorc, 2014: Šumsko zeljasto bilje Hrvatske. Šumarski fakultet Sveučilišta u Zagrebu, 626. str.
3. Vidaković, M., J. Franjić, 2004: Golosjemenjače. Sveučilište u Zagrebu-Šumarski fakultet. Zagreb.
4. Franjić, J., 1998: Praktikum iz anatomije bilja (interna skripta), 1-22. Zagreb.
5. Franjić, I., Škvorc, Ž., Trinajstić, I., 2008: Anatomija bilja (interna skripta), 1-63. Zagreb.
6. Trinajstić, I., 1976: Sistematika bilja (opći dio, bakterije i gljive), (interna skripta), 1-43. Zagreb.
7. Trinajstić, I., 1976: Sistematika bilja (Embriobyonta), (interna skripta), 1-117. Zagreb.

Recommended literature

1. Nikolić, T., 2017: Morfologija biljaka. Alfa d.d., Zagreb
2. Nikolić, T., 2013: Sistematska botanika - raznolikost i evolucija biljnog svijeta. Alfa d.d., Zagreb
3. Nikolić, T., 2013: Praktikum sistematske botanike - raznolikost i evolucija biljnog svijeta. Alfa d.d., Zagreb.
4. Šugar, I., 1990: Botanički leksikon. Globus Zagreb.
5. Nikolić, T., 1996: Herbarijski priručnik, Školska knjiga. Zagreb.
6. Domac, R. 1994: Flora Hrvatske. Priručnik za određivanje bilja. Školska knjiga, Zagreb.
7. Nikolić, T. (ur.) 2019: Flora Croatica Database (URL http://hirc.botanic.hr/fcd). Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu.

Biometrics

ŠP2002

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0

Lecturer
Professor Anamarija Jazbec, PhD
Assistant professor Mislav Vedriš, PhD

Associate teacher for exercises
Assistant professor Mislav Vedriš, PhD
Assistant professor Ernest Goršić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basic biometric terms (observations, data, population). Types of variables. Graphical tools.
Descriptive statistics. Frequency table.
Measures of central tendency. Measures of position.
Measures of variation, asymmetry and skewness.
Normal distribution.
Binomial distribution. Normal approximation to a binomial distribution.
Sampling methods. Central limit theorem. Estimators. Standard error.
Confidence interval. Interval estimation of the mean and proportion. T-distribution.
Hypothesis testing and inference. Testing expected value. Testing proportion.
Testing variances. F distribution. Testing means from two samples.
Testing proportions from two samples. Paired t-test.
$\chi 2$ distribution. Chi-square test.
Correlation

Type of course:

Biometrics (compulsory course, 2nd semester, 1st year, undergraduate study Forestry)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain types of variables: numeric (continuous and discrete) and categorical (dichotomous, ordinal i nominal); graphical presentation and frequency tables, classification of graphs according to data types: bar chart, histogram, frequency polygon, line chart, pie chart, scatterplot, stem-and-leaf plot, Box-Whisker plot; relative frequencies, cumulative absolute and cumulative relative frequencies, calculation and analysis	2 partial exams, Written and oral final exam	A1
Describe measures of central tendency and measures of position (arithmetic mean, geometric mean, harmonic mean, quadratic mean, minimum, maximum, median, lower and upper quartile, mode)	2 partial exams, Written and oral final exam	A1
Explain measures of variation (data range, interquartile range, standard deviation, variance, coefficient of variation)	2 partial exams, Written and oral final exam	A1
Interpret theoretical distributions or models of population distributions (normal Gaussian distribution, Student's t-distribution, binomial distribution, chi-square distribution, F-distribution, definition of density function and distribution function, calculating probability (area) under the density function for normal and t-distribution, calculating probability for binomial distribution, normal approximation to the binomial distribution)	2 partial exams, Written and oral final exam	A1
Explain point estimates of arithmetic mean, variance and proportion (central limit theorem, sampling distribution, standard error) Distinguish population parameters from their sample estimates; estimate population arithmetic mean (expected value), variance and proportion based on the sample	2 partial exams, Written and oral final exam	A1
Present hypothesis testing of arithmetic mean and proportion (rules and procedure of testing, type I (α) and type II (β) errors, power of the test (1- β), testing (assumed constant) arithmetic mean and proportion of population	2 partial exams, Written and oral final exam	A1
Present interval estimates of expected value and proportion, testing of proportion, variances (F-test) and arithmetic mean (Student t-test) from two independent samples and testing difference of arithmetic means from two dependent samples (paired t-test)	2 partial exams, Written and oral final exam	A1
Present analysis of observed and expected frequencies for categorical variable using chi-square test	2 partial exams, Written and oral final exam	A1
Describe correlation analysis and calculate linear correlation coefficient for two continuous variables	2 partial exams, Written and oral final exam	A1

General competences:

Collect and organize data, statistically analyse, present and interpret analysed data.
Discuss and make conclusions based on analysed data

Type of instruction:

Lectures

Exercises

Exercises complement subject exposed in lectures. During exercises, students work out numerical examples by computer and hand calculation as a preparation for the written exam. Each student gets additional individual assignments for work at home that are reviewed by associate teacher.

Working methods:

Teachers' obligations:

Direct teaching – lectures and exercises. Designing and reviewing the student assignments. Composing and evaluating written exams. Carrying out oral exams and consultations. Designing and composing of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preapering, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures (L)	-			30	15	1,5
Exercises (E)				30	45	2,5
2 Partial exams (PE)	100%	65-74	Sufficient (2)	4	26	1
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
Final exam (FE)	100%	60-70	Sufficient (2)	3	-	-
		71-80	Good (3)			
		81-90	Very good (4)			
		91-100	Excellent (5)			

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance is checked for all students during the semester. Each student is allowed to be absent up to 4 hours of lectures and 4 hours of exercises.	End of semester	-
Partial exam	Two partial exams are carried out, each with 5 assignments and resulting maximum 100 (2*50) points. Minimum 65 points (20 points per exam) can substitute the final exam.	During semester	-
Written exam	Students that meet attendance criteria can access to the written exam. Written part consists of 5 assignments making maximum total 100 points.	Exam terms	-
Oral exam	Students that pass written part can access the oral exam.	Exam terms	-

Obligatory literature

1. Biometrika course on e-learning system Merlin: https://moodle.srce.hr/2018-2019/course/view.php?id=36293
2. Jazbec, A., 2009: Osnove statistike, Šumarski fakultet, Zagreb

Recommended literature

1. Pranjić, A., 1986: Šumarska biometrika,. Šumarski fakultet, Zagreb, 204 pp.
2. Sokal, RR., Rohlf, FJ., 1995: Biometry. Freeman and Company. New York. 880 pp.
3. Prodan, M., 1961: Forstliche Biometrie., BLV München, 432 pp.
4. Kozak, A., Kozak, R., Staudhammer, C., Watts, S., 2008: Introductory probability and statistics: Applications for forestry and natural sciences. CABI International, 408 pp.

Soil Science

ŠP2003

ECTS 8

English language R1
E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof. dr. sc. Nikola Pernar
Prof. dr. sc. Darko Bakšić
Doc. dr. sc. Ivan Perković

Associate teacher for exercises
Prof. dr. sc. Darko Bakšić
Prof. dr. sc. Nikola Pernar
Doc. dr. sc. Ivan Perković

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

The curriculum of Soil Science is realized through lectures, practical part and field courses.
The curriculum of lectures can be divided into 5 parts, or 9 methodological units (including the exercises and field courses) for which the learning outcomes are expressed.
The first, introductory part gets students acquainted with the subject and aims of soil science, development of soil science and specific soil qualities of various ecosystems.
The second part elaborates the genesis of soil in nature. Generally speaking, the second part elaborates pedogenetic processes. Moreover, this part is about the sources of soil mineral compound – weathering of rocks and minerals and characteristics of products of weathering. Organisms as the source of organic soil matter and its decay, and products of decay – transformations and cycling of matter in soil-plant system are elaborated separately.
The third part elaborates soil characteristics as anisotropic and polydisperse natural body: physical characteristics; sorption characteristics; physical aspects of water in the soil; heat characteristics of soil and chemical aspect of water in the soil – soil solution.
The fourth part, after students have acquired basic, general knowledge of soil, elaborates the migration processes in the soil, specific soil-forming processes, soil-forming factors, and soil evolution and profile morphology.
The fifth part elaborates soil classification and provides the overview of the characteristics of main taxonomic units.

Type of course:

Pedology (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compare the role of soil and pedosphere. Identify the global significance of soil. Interpreted the specificity of forest soil.	partial examination, laboratory exercises, full examination	D1
Group primary soil minerals and compare their properties. Group the most usually rocks and compare their properties that are most important to soil properties. Explain to weathering of minerals and rocks. Explain the properties of rocks and minerals.	partial examination, laboratory exercises, full examination	D1
Enumerate and classify the most important soil organisms. Describe the accumulation of organic residues - quantity and quality. Describe the method of degradation of organic residues and the formation of humus. Describe composition and properties of humus. Analyze a soil humus acidity and character of humus	partial examination, laboratory exercises, full examination	A3, B4, B8, D1
Describe biological circulating of matter and role of soil. Identify specific cycles of some biogenic elements. Explain the principles of soil sorption. Explain the composition and role of the colloidal complex of soil. Analyze the sorption characteristics of soil.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1
Explain the solid soil phase composition. Enumerate and distinguish the properties of mechanical particles of soil. Particle size distribution and soil structure Enumerate and distinguish the properties of shapes and elements of the soil structure. Soil porosity and soil densities. Enumerate and explain the soil consistency indicators.	partial examination, laboratory exercises, full examination	A3, B4, B8
Natural dynamic water in soil. Describe water forms in soil. Analyze the soil water constants. Explain quantity and quality of soil air. Analyze soil air capacity. Explain thermal properties of soil. Explain chemical properties of soil solution. Analyze and interpret soil reaction. Explain the significance and nature of the redox potential of the soil.	partial examination, laboratory exercises, full examination	A3, B4, B8

Describe the dynamics of biogenic elements in the soil solution.		
Soil-forming factors. Identify the nature of some soil-forming factors in Croatia. Enumerate and explain some soil-forming processes. Identify the role of sol-forming factors and processes on a specific soil profile.	partial examination, laboratory exercises, full examination	B4, B8
Soil horizons. Explain the properties of some soil horizons. Soil classification system. Enumerate the sections, classes and types of soil. Explain the basic characteristics of the most important soils at the class level and type of soil. Classify soil according to taxonomic affiliation.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1
Plan, ways and purpose of soil sampling. Representative soil samples. Describe the types of soil samples. Describe sampling and mark of soil samples. Enumerate and describe field observations of soil parameters.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1

General competences:

Interpretation of pedogenic relations in some area.
Soil sampling, cooperation in the implementation of laboratory analyzes and interpretation of analysis results.
Interpretation of pedophysiographic features in forming economic measures.
Understanding the physiographic properties with the application in optimizing soil fertility.

Tipe of instruction

Lectures

The lectures are realized in blocks-hours in one of the major classroom. They are based on PP presentations and correspond to a material in the text-book.

Exercises

Exercises are the upgrading of knowledge adopted in lectures and there are platforms for understanding individual chapters. During laboratory exercises students perform 18 practical exercises on which they prepare a report on the exercises. Exercises are performed in the Ecological-Pedologycal laboratory in small groups (8 students in group).

Field courses

Field courses is maintain close to the Faculty (Maksimir or Dotršćina) with goal to present the relationship between soil-forming factors, understanding of the general soil morphology, present soil sampling (soil profile, sounding, composite and individual samples) and description of morphological properties of the soil.

The second part of field work is maintain in the mountainous area (Medvednica or Samoborsko gorje) and in the lowland area (near Zagreb), where students present different relationships of soil-forming factors, different physiographic features and different soil type, specialty in terms of using his roles.

Working methods:

Teachers' obligations:

Teaching - lectures, exercises, field courses.
Designing topics for seminar task, compiling knowledge tests and evaluating them.
Observations of written and oral exams and consultations.
Creating teaching materials.

Students' obligations:

Regular attendance and active participation on lectures, exercises and field courses; preparation of exercises report and preparation and presentation of seminar work (possibly).
Partial and/or full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	30	2
Laboratory Exercises (LE)	10 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	30	2
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time; commitment to exercises	Very good (4)			
		Clean, easy, accurate and timely; an emphasis on exercises	Excellent (5)			
Field courses (FC)				24	6	1

Exam (E)	90 %	50-60 %	Sufficient (2)	4	86	3
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(LEx10+Ex90)/100**		88	152	8

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lectures (L)	On the lectures is checked the students presence.The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	Semester (30 hours of direct teaching)	-
Laboratory Exercises (LE)	Exercises are attended by groups. 18 practical exercises are performed. At the beginning of the exercise, students receive a report template. The accuracy, regularity and the engagement in the exercises are evaluated.	According syllabus and agreement with the students	In the case of a justified reason, the student draws up absence from the particular exercise term
Field courses (FC)	Field work is performed in groups during the second half of the semester, and the terms are published at the beginning of the semester.	Second half of the semester.	-
Partial exam (PE)	Students can take the exam in two parts (partial). The first part takes place after ~ 60% of theoretical teaching, and the term is agreed with the students .The exam consists of a written and oral part (the written part of the exam must be passed for oral instruction), and it is about 60% of the subjects provided by the theoretical program. Partial exams can be accessed by students who have no more than one absence from the lectures. Those students who take the first partial exam will also take the second part of the exam on some of the regular test terms by the end of the current academic year. The arithmetic mean of the two grades represents the grade of the exam that) gives the final grade.	Agreement with the students in second half of the semester.	-
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade.	Published test deadlines.	-

Obligatory literature

1. Pernar, N., 2017: Tlo; nastanak, značajke, gospodarenje. Šumarski fakultet, Zagreb, XVIII + 799 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Scheffer, F. & P. Schachtschabel, 2010: Lehrbuch der Bodenkunde. 16. Auflage, neu bearbeitet und erweitert von Blume et al. Spektrum Akademische Verlag Heidelberg, Berlin, 578 p. (neubearbeitet von H. P. Blume, G. W. Brümmer, H. Fleige, R. Horn, E. Kandeler, I. Kögel-Knabner, R. Kretzschmar, K. Stahr & B.-M. Wilke).
2. Blume, H. P., G. W. Brümmer, H. Fleige, R. Horn, E. Kandeler, I. Kögel-Knabner, R. Kretzschmar, K. Stahr & B.-M. Wilke, 2016: Scheffer/Schachtschabel Soil Science.Springer, 629 p.

Ground surveying with fundamentals of cartography

ŠP2004

ECTS 6

English language R1

E-learning R1

Teaching hours 120
Lectures 30
Exercises 45
Field work 45

Lecturer
Prof.dr.sc. Renata Pernar

Associate teacher for exercises
Doc.dr.sc. Mario Ančić
Dr. sc. Jelena Kolić

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The curriculum of the subjects of Ground surveying with fundamentals of cartography is realized through lectures, exercises and field teaching. The subject is conceived so that during lectures and laboratory work, as well as by means of practical reports (programs), students are dealing with themes regarding ground surveying during summer term. The teaching includes: fundamentals of elevation and orthogonal projection; measuring units, norms, errors during measuring; methods for surveying of points, lengths, angles, surfaces, height differences; measuring devices and accessories; methods for displaying of individual objects and phenomena in maps; methods of mapping - graphical, numerical; map interpretation, using of maps, measuring on maps, orientation by means of a map.

Type of course:

Ground surveying with fundamentals of cartography (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes and evaluation methods	Learning outcomes and evaluation methods	Learning outcomes and evaluation methods
Explain cartography and its tasks. Extract objects of display and object names (toponyms) on different cartographic views (TK 50000, 25000, 5000). Describe and explain the difference between topographical and thematic maps.	Performing exercises, midterm exam, comprehensive exam	D1
Specify a measurement definition, used measuring units, specify standards, and explain measurement errors. Explain the difference between direct and indirect measurements. Determine scale. Construct linear and transverse scale. Calculate allowed deviations and measurements.	Performing exercises, midterm exam, comprehensive exam	A1, D1
Adopt the basics of orthogonal and quoted projections. Explain the quoted projection of the topographic plane and its application. Calculate the largest slope line and constant slope line. Explain and make a cross section of the topographic plane with the vertical plane and direction. Create a terrain profile.	Performing exercises, midterm exam, comprehensive exam	A1, B5, B8, D1
Explain and share map projections. Explain the coordinate systems. Specify the types of coordinates. Calculate coordinates on different topographic maps ((TK 50000, 25000, 5000). Measure the size on topographic maps 1: 50.000 and 1: 5.000 (angle, length, altitude difference, gradient, ..).	Performing exercises, midterm exam, comprehensive exam	A1, D1
Describe cadastre and its organization Describe the land registry and its organization State and explain the difference between the old and the new cadastre. Explain and describe the indirect method of determining the surface on cadastral maps. Calculate area with the different methods (dot grid, grid squares grid and analytical calculation of area).	Performing exercises, midterm exam, comprehensive exam	A1, B5, B8, D1
Explain triangulation, polygonometry. Calculate the direct and indirect geodetic task. Describe the methods of direct and indirect length measurements. Determine azimuths, distances, height differences, and inclinations between the points. Mapping certain points in the default scale.	Performing exercises, field work midterm exam, comprehensive exam	A1, B5, B8, D1
Collect data, calculate and explain measurements with the compass. Describe and perform the recording of the details by a polar and orthogonal method. Calculate the altitude difference, explain and enumerate type of leveling.	Performing exercises, field work midterm exam, comprehensive exam	A1, B5, B8, D1
Describe the global positioning system and its parts Indicate GPS application in forestry. Explain GPS measurement errors. Apply GPS to determine spot positioning in terrain.	Field work, comprehensive exam	A1, B5, B8, D1

General competences:

The task of the subject is to make student acquainted with the need for ground surveying and cartography in forestry. Apart from that, students must be acquainted with the fundamentals of cartography and ground surveying, so as to prepare them for studying and practical use of mapping and terrain surveying methods during their further studies and in practice.

Type of instruction:

Lectures

Lectures are performed in the form of a block of classes with computer presentations, and simpler measurements are practically performed, while more complex methods and modern instruments are presented in demonstration exercises.

Exercises

Exercises are the upgrading of knowledge adopted in lectures. Exercises are performed in groups according to a schedule that adjusts to the number of students.

Field work

Lecture is held near to the Faculty (Maksimir) and includes:

1. Setting and measuring polygon trains.
2. Setting and measuring detailed leveling, line and surface leveling, measurement and calculation.
3. Orientation on the terrain, finding objects on the basis of reading maps, finding objects using a compass, finding objects using GPS.
4. Measuring lengths on flat and rough terrain, determining the incline of the terrain.
5. Setting and measuring using the compass. Setting of the broken line by means of a compass, repairs of setting.

Working methods:

Teachers' obligations:

Teaching - lectures, exercises, field work.

Designing seminar topics (compensation for justified absences from lectures and exercises). Assembling tests and evaluating them. Maintaining the midterms exam, Written and Oral Exams and Consultations. Creating teaching materials.

Students' obligations:

In the course with regular attendance of lectures, exercises and field work student will produce 10 individual programs (tasks), and 3 projects tasks on field work. Exam through two midterm exam or written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	10%			45	3,75	1,625
Field work (FW)	10%			45	3,75	1,625
Partial exam (PE) or Comprehensive exam (CE)	80%	60-70%	Sufficient (2)		52,5	1,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10+FWx10+CEx80)/100**		120	60	6

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises (E)	Exercises are attended in groups. 10 practical exercises are performed. At the beginning of each exercise, students are received templates with tasks. The accuracy, precision, regularity, and engagement on the exercises are evaluated.	In accordance with the syllabus and agreed terms directly with the students.	The student work off for absence from the individual exercise term
Field work (FW)	Field teaching is performed in groups in the second half of the semester, and the terms are published at the beginning of the semester. Attendance on field teaching is a prerequisite for approach to exam.	May	-
Partial exam	Students can take the exam through two partial exam. The first partial exam is held after 50% of theoretical teaching and exercises. The term is arranged with students. Students who have a committed and correct 5 individual programs can access partial exam. Students who have passed the first partial exam, are eligible for the second partial exam, provided the submitted and accurate remain 5 programs, and 3 programs on a field teaching. The second partial exam is held at the end of the semester and before the start of deadlines exams. Each partial exam is in the form of a written exam, consisting of 5 logically set tasks, which are solved	Agreement with students (April - June)	-

	calculations and graphically. Both passed a partial exam (arithmetic mean of two grades) are recognized for the students for the final grade.		
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures, exercises and field teaching are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures, exercises and field teaching). Students in the written exam solve 5 tasks (calculation and graphically). A written exam is a condition for access to an oral exam, where a final grade is obtained.	Published examination deadlines	-

Obligatory literature

1. Kušan (ed.) (1994): Nove tehnike izmjere i kartografije, Šumarski fakultet Zagreb, 75 str.
2. Niče, V.: Deskriptivna geometrija (odabrana poglavlja), Školska knjiga Zagreb (bilo koje izdanje)
3. Lovrić, P. (1988): Opća kartografija, SNL Zagreb, 291 str.
4. Neidhardt, N. i Tomašegović, Z.: Geodezija u šumarstvu, Zagreb, 266 str.
5. Pernar, R.: Prezentacije s predavanja
6. Šumarska enciklopedija: Geodezija, Geodetski instrumenti, Zagreb
7. Pribičević, B. i D. Medak (2003): Geodezija u građevinarstvu (odabrana poglavlja), V.B.Z., Zagreb, 223 str.

Recommended literature

1. Brinker and Minnick, R. (1995): The surveying handbook (second edition), New York, 840 str.
2. Macarol, S.: Praktična geodezija, (bilo koje izdanje) Zagreb)
3. Ziegler, T. (1989): Vom Grenzstein zur Landkarte, Stuttgart, 167 str.

Wood anatomy

ŠP2005

ECTS 3

English language R1

E-learning R2

Teaching hours 45
Lecturers 30
Exercises 15

Lecturers
Prof.dr.sc. Jelena Trajković
Izv.prof.dr sc. Bogoslav Šefc

Associate teacher for exercises
Prof.dr.sc. Jelena Trajković
Izv. prof. dr. sc. Bogoslav Šefc
Dr.sc. Iva Ištok

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction: The aims of wood anatomy. The origin of wood in plant kingdom. Commercial utilisation. Methods in wood anatomy
Macroscopic wood characteristics. Main sections and directions in wood. Texture, grain, growth rings, wood pores, sapwood and hardwood
Wood formation in tree, cambium. Structure of vascular plants. Cambium. Ontogenesis of wood tissue.
Secondary phloem and rhytidome. Periderm, structure, origin, position, duration. Bark, inner, outer, rhytidome, cork.
Wood cell walls: Layers, submicroscopic structure, pits and other sculptures of the wood cell walls
Wood elements. Morphology of wood cells, their dimensions and function.
Histology of conifer wood and dicotyledon wood.
Wood identification. Dichotomous and polytomous keys for microscopic and macroscopic identification of commercial wood species
Variations in wood structure. Wood variations within the tree on different positions: within growth ring, between growth rings, along the radius of transversal section, tree height, between roots, trunk and branch. Causes of wood structure variability within species and within tree. History, position and properties of juvenile and adult wood in trees. Growth ring width: the percentage of late wood in growth ring.
Irregularities of wood structure. Reaction wood, compression failures, brittle heart, spiral grain, knots, false and incontinuous rings.

Influence of wood structure on technical properties of wood and its use. Wood anatomy and moisture content. Moisture content and technical properties of wood. Wood shrinkage and swelling. Wood anatomy and wood density. Wood density and technical properties of wood.

Type of course:

Wood anatomy (mandatory subject, 2. semestar, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe and recognize (sketch) position and role of wood cells, wood tissues and phloem cells and tissues in living tree (botanical conection)	Exercises in practicum, colloquium and exam	B1
Describe and recognize the role of wood anatomy in fundamental wood properties (technical conection)	Exercises in practicum, colloquium and exam	B1
Determine (recognize) domestic commercial types of wood using determination key(s)	Exercises in practicum, colloquium and exam	B1

General competences:

Professional recognition and distinction of individual parts of wood in a tree.
Application of knowledge of wood anatomy to basic wood properties.
Determining the types of wood of commercial autochthonous tree species.
Use of wood identification keys.

Type of instruction:

Lectures

Exercises

Seven practical exercises of the microscopic and macroscopic recognition of wood are performed as part of laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers. Providing colloquia, oral exams and consultations. Creating teaching and testing materials.

Students obligations:

Regular attendance and active participation in lectures and exercises. A justified absence of up to 20% of lectures and 10% of exercises is allowed (Article 30 of the Ordinance on Undergraduate and Graduate Studies at the Faculty of Forestry of the University of Zagreb). Taking colloquia and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Predavanja	-	-	-	30	15	1,5
Exercises (E)	10%	Mostly inaccurate, with major corrections	Sufficient (2)	15		0,5
		Mostly accurate, with corrections	Good (3)			
		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Macroscopic Wood Identification Colloquium (C)	15%	Constant help of the examiner	Sufficient (2)	1	15	0,5
		Partial help of the examiner	Good (3)			
		minor help of the examiner	Very good (4)			
		without any help of the examiner	Excellent (5)			
Exam (E_x)	75%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	1	13	0,5
UKUPNO	**100%**	**(Ex10 + Cx15 + E_xx75)/100**		47	43	90

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and recorded.	Semester	-
Exercises (E)	Exercises are attended by groups. There are 7 practical exercises of microscopic and macroscopic recognition of wood. The accuracy, tidiness and regularity of performance are evaluated.	Semester (15 hours of exercises)	Exceptionally, in the case of a justified reason
Macroscopic Wood Identification Colloquia (C)	It consists of determination of 10 types of coniferous and dicotyledonous woods with the aid of magnifiers. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Colloquia can be taken three times in one academic year

Exam (P)	The exam can be attended by students whose exercises and colloquia were evaluated positively. The written exam is evaluated and participates in the final grade of the subject. The final grade of the course is obtained according to the formula **Ex10 + Cx15 + E_xx75)/100**	Exam terms	-

Obligatory literature

1. http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 pod predmet Strukturna svojstva drva, pod PREDAVANJA nalaze se poveznice: Predavanja iz predmeta strukturna svojstva drva (skripta, autori: Jelena Trajković i Bogoslav Šefc, pdf dokument oko 3 MB) i Atlas slika uz predavanja (Ilustracije uz predavanja, sabrali: Jelena Trajković i Bogoslav Šefc, pdf dokument oko 39 MB)
2. Z. Špoljarić 1978: Anatomija drva, Šumarski fakultet, Zagreb
3. Anatomija drva e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=37196

Recommended literature

1. Panshin, A. J.; Zeew, C. de, 1980: Textbook of wood technology, McGraw-Hill, Inc. 722 str.
2. Schweingruber, F.H., 1990: Anatomy of European woods, Paul Haupt Berne and Stuttgart Publishers, 800 str.
3. Špoljarić, Z.; Petrić, B.; Šćukanec, V., 1969: Višejezični rječnik stručnih izraza u anatomiji drva, Poslovno udruženje šumskoprivrednih organizacija, Zagreb, 85 str.
4. Šumarska enciklopedija, HLZ Miroslav Krleža, Zagreb
5. Osnove nauke o drvu, Šumarski fakultet Sveučilišta u Zagrebu, 1985. (Drvo, Anatomija drva)

Forest mensuration

ŠP3001

ECTS 7

English language R1

E-learning R1

Teaching hours 91
Lectures 45
Exercises 30
Field work 16

Lecturer
Professor Mario Božić, PhD

Associate teacher for exercises
Assistant professor Ernest Goršić, PhD
Assistant professor Mislav Vedriš, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction. Measures and measurement systems. Measurement errors (precision, accuracy, bias, significant digits). Presentation of data. Tree measurement. Diameter, breast height diameter, perimeter. Crown measurement. Measuring heights, hypsometers: Blume-Leiss, Haga, Bitterlich Relascope (standard, CP), Vertex, Laser. Estimating cross section area of a stem. Bitterlich basal area. Tree volume. Sectional method. Volume of fuelwood and wood for chemical processing. Determination of standing tree volume. Tree form coefficients. Bitterlich method. Height accumulation method. Grosenbaugh 3P method. Tree volume tables (construction and application). Bark volume. Weight of tree and its parts. Tree growth and increment (height, diameter, basal area, volume, bark, form factor). Increment rate. Total analysis. Dendrochronology. Relationships of tree parameters in a forest stand. Growth and yield tables. Single entry volume tables.

Type of course:

Forest mensuration (compulsory course, 3rd semester, 2nd year of undergraduate study Forestry)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
List measured variables, precision and accuracy in measurement, and means of data presentation.	Inspection and evaluation of assignments, partial and final exams	B5, C1
Interpret measurement of tree diameter, perimeter and height (instruments, errors).	Field exercises, partial and final exams	B5, C1
Explain data collection on sample plot, stand and management unit (sample and sample size, types and sizes of sample plots, measurement on sample plots.	Field exercises, Inspection and evaluation of assignments, partial and final exams	A1, B5, C1, D1
Interpret a diameter distribution in even-aged and selection stands (change of diameter distribution due to harvest, importance of diameter distribution by tree species and diameter classes).	Inspection and evaluation of assignments, partial and final exams	A1, B5, C1, D1
Describe construction of height curves (height curve of even-aged and selection stands, shift of height curve in even-aged stands, methods of curve construction).	Inspection and evaluation of assignments, partial and final exams	A1, B5, C1
Interpret determination and calculation of volume (volume of felled and standing trees, sectional method, single-entry and double-entry volume tables, applicability of single-, double- and triple-entry volume tables for single trees and forest stands).	Inspection and evaluation of assignments, partial and final exams	B5, C1
Describe design of a sample and data collection methods for diameter increment.	Partial and final exams	B5, C1, D1

General competences:

Skills of data collection on tree and stand level.
Knowledge in calculation and determination of single tree basal area and volume, and forest stand structural characteristics

Type of instruction:

Lectures

Exercises

Exercises consist of six field measurement exercises held in forest near faculty (Maksimir park). Eight terms are carried out in computer classroom when data collected in field exercises are processed and calculated using Excel software.

Working methods:

Teachers' obligations:

Direct teaching – lectures, exercises and field work. Designing and reviewing the student assignments. Composing and evaluating written exams. Carrying out partial, written and oral exams and consultations. Designing and composing of teaching materials

Students' obligations:

Regular attendance and active participation in lectures, exercises and field work. Working out assignments and seminars in given period. Taking partial exams and final exam.

Methods of grading

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures (L)		-	-	45		1,5
Exercises (E)	20%	Significant corrections, on time	Sufficient (2)	30	30	2
		Medium corrections, on time	Good (3)			
		Minor corrections, on time	Very good (4)			
		No correction, on time	Excellent (5)			
Field work (FW)	-	-	-	16	-	0,5
Partial exam 1 (PE1)	40%	60-70%	Sufficient (2)		44	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	40%	60-70%	Sufficient (2)		44	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20+PE1x40 + PE2x40)/100**		91	118	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		88	3
TOTAL	**100%**	**(FEx80+Ex20)/100**				
***Students that do not pass partial exams during the semester take the final exam – final grade consists of 80% from final exam and 20% from exercises**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance is checked for all students during the semester. Each student is allowed to be absent up to 20% of lectures and 10% of exercises.	semester (75 hours of direct lecturer)	-
Field work	Attendance is checked and active participation is evaluated for all students. Field work is completely compulsory	Semester (16 hours of direct teaching)	In special cases of justified absence, students can compensate field work by seminar paper and partial exam on field work issues
Exercise assignments (E)	Students are instructed (preparatory materials, templates) to make individual assignments on the matter that is covered by lectures and exercises. Accuracy, tidiness and timeliness are evaluated.	According to schedule	
Partial exam	Delivered and correct assignments dealing with subject matter are requirement for each partial exam. Each partial exam consists of 20 assignments, with minimum threshold 60%. Access to second partial exam is enabled to those who pass the first one, and have correct all assignments and seminar on field work. Students who pass both partial exams are exempt from final exam, and points from exercise assignments are added to make the final grade.	Middle and the end of a semester	
Written exam (WE)	Exam consists of 20 assignments, consisting of subject matter from lectures, exercises and field work. Minimum threshold is 60%.	Exam terms	
Oral exam (OE)	Requirement for oral exam is successfully fulfilled written exam at the same exam term. Theoretical knowledge and subject covered during teaching are tested. Final grade is calculated as follows: **(WEx40+OEx50+Ex10)/100**		

Obligatory literature

1. Božić, M., Goršić, E., Vedriš, M.: Forest mensuration, Teaching materials from lectures ansd exercises
2. Pranjić, A., Lukić, N., 1997.: Izmjera šuma. Šumarski fakultet Sveučilišta u Zagrebu, 410 pp., Zagreb.

Recommended literature

1. Bitterlich, W., 1984: The Relascope Idea. CAB, pp.242, London
2. Loetsch, F., Zöhrer, F., Haller, K.E., 1973: Forest Inventory. pp.467, BLV München.
3. Šmelko, Š. & kolektiv, 2003: Meranie lesa a dreva. LVH SR, pp.239, Zvolen.
4. Zöhrer, F., 1980: Forstinventur, pp.202, Pareys, Hamburg
5. West, P.W., 2004: Tree and Forest Masurement. Springer V, pp.167, Berlin.

Remote sensing and GIS in forestry

ŠP3002

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 30
Field work15

Lecturer
Prof.dr.sc. Renata Pernar
Izv. prof. dr. sc. Ante Seletković

Associate teacher for exercises
Doc.dr.sc. Mario Ančić
Dr. sc. Jelena Kolić

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The curriculum of the subjects of Remote sensing and GIS in forestry is realized through lectures, exercises and field teaching. The lectures include the following thematic wholes: Fundamentals of remote sensing. Types of photographs, sensors and satellites. Possibilities for application of aerial and satellite images in forestry. Fundamentals of geographic information systems (GIS). Vector and raster GIS. Data forms and types in GIS. Data entry. Database organization regarding environment. Intergration of databases with geometrical data, data analyses in GIS, and application of GIS in forestry.

Type of course:

Remote sensing and GIS in forestry (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of remote sensing Describe the historical development of remote sensing. Compare digital and analog photography. Explain ways of stereoscopic observation.	Performing exercises in a practicum, midterm exam, comprehensive exam	D1
Identify the basic principles of remote sensing and their physical and technological basics. Explain and describe parts of the electromagnetic spectrum. List reflection and emission properties of natural objects. Describe the spectral characteristics of objects on Earth surface.	comprehensive exam	A3, B5, B8, D1
Indicate and explain the recording systems within remote sensing. List the types and characteristics of photography Describe procedures of aerial survey. Explain what type of errors occur in aerial surveying. Describe and demonstrate the preparation of images for measuring and orientation procedure of the aerial photographs. Perform visual, measurement and digital photo interpretation on aerial photographs. Specify the application of aerial photographs for forestry purposes.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B8, D1
Specify the types of satellites and their classification according to purpose and orbit. Explain ways of interpretation of satellite images. Carry out a visual interpretation of satellite imagery. Show and explain the procedure of digital interpretation of satellite image (supervised and unsupervised classification). Specify the application of satellite images in forestry.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B8, D1
Pronounce the definition of the geographic information system (GIS). Specify a historical overview of GIS development. Explain the GIS organization.	comprehensive exam	D1
Show the establishment of a database in GIS. Apply different forms of data for displaying objects. Carry out linking of the attribute database with geometric data.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B8, D1
Explain the difference and the basic features of raster and vector GIS. Compare and describe the analysis of vector and raster data. Create thematic maps based on the interpretation of the images. Explain the application of RS and GIS in forestry.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B8, D1

General competences:

Students will acquire knowledge on latest achievements in the field of application of remote sensing in our country and in the world, theoretical fundamentals of remote sensing, types of systems photographing and methods of photographing, as well as possibilities for the application of aerial and satellite images in forestry. They will also get to know fundamental assumptions and methods for establishment of geographic information systems in forestry, as the aid for data saving, processing and analysis, as well as their maintenance and integration with other disciplines.

Type of instruction:

Lectures

Lectures are performed in form of the block lessons with computer presentations. Within the course, along with regular attendance of lectures, exercises and field work, students during the semester creates individual programs (tasks), and two project tasks from field work.

Exercises

Exercises are the upgrading of knowledge adopted in lectures. The first part of the exercises is related to lectures from the field of remote sensing, and the second part on the geographic information systems. Therefore, the exercises are performed in the practicum and computer classroom, in groups according to the schedule. A group adjusts to the number of students.

Field work

Lecture is held near to the Faculty (Maksimir - Dotrščina), and it includes verification of the results photo interpretation images of the terrain with aim of land use determination.

Working methods:

Teachers' obligations:

Teaching – lectures, exercises and field work.
preparing seminar topics (compensation for justified absences from lectures and exercises). Providing midterm exam s, oral exams and consultations. Creating teaching materials.

Students' obligations:

Within the course, with the regular attendance of lectures, exercises and field work, students create individual assignments and two project tasks from field work during the semester.
Taking an exam is through the 2 midterm exam and oral exam. Regular attendance and active participation on lectures and exercises, preparation of seminar work.

Methods of grading

<table>
<tr><th>Evaluation elements</th><th>Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures (L)</td><td>-</td><td>-</td><td>-</td><td>30</td><td>0</td><td>1</td></tr>
<tr><td>Exercises (E)</td><td>-</td><td colspan="2"></td><td>30</td><td>7,5</td><td>1,25</td></tr>
<tr><td>Field work (FW)</td><td>-</td><td></td><td></td><td>15</td><td>7,5</td><td>0,75</td></tr>
<tr><td rowspan="3">Midterm exam (ME)</td><td rowspan="3">25%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="3"></td><td rowspan="3">22,5</td><td rowspan="3">0,75</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
</table>

		91-100%	Excellent (5)			
Comprehensive exam (CE)	75%	60-70%	Sufficient (2)	3	34,5	1,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PEx25 + CEx75)/100**		**75**	**72**	**5**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises (E)	Exercises are attended in groups. Each student is doing individual tasks. The first part of the exercise is related to remote sensing (exercises in practicum), and the second part on the geographic information systems (exercises on computers in computer classroom). The accuracy, precision, regularity, and engagement on the exercises are evaluated. 2 absences from exercises are allowed with the additional preparation of the seminar work.	In accordance with the syllabus and agreed terms directly with the students.	The student work off for absence from the individual exercise term
Field work (FW)	Field teaching is performed in groups at the end of the semester, and the dates are published at the beginning of the semester. Attending of field teaching is a prerequisite for passing exams.	January	-
Partial exam	A compulsory two midterm exams is laid within the course. The first midterm exam is held after 50% of theoretical teaching and exercises. The term is arranged with students. The midterm exam can be accessed by students who have submitted accurate individual tasks. Those students who hold the first midtermexam will get the right to go to the second exam, with the condition of submitted and accurate remaining tasks, and the programs from the field teaching. The second midterm exam is held at the end of the semester and before the start of deadlines exams. Two passed a midterm exam is a condition for students to get a signature and go to the exam. The midterm exam is repeated during the academic year, according to the published schedule of exams.	Eight days before each test deadline, according to the published schedule.	-
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures, exercises and field teaching and passed two midterm exams are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures, exercises and field teaching). A passed midterm examination is a requirement for an oral exam, and grade of two midterm examinations is part of the final grade.	Published examination deadlines	-

Obligatory literature

1. Oluić, M. (2001): Snimanje i istraživanje Zemlje iz svemira: sateliti, senzori, primjena. HAZU, Zagreb, 580 str.
2. Tutić, D.; Vučetić, N.; Lapaine, M. (2002): Uvod u GIS, Geodetski fakultet, Zagreb, 39 str.
3. Pernar, R.: Prezentacije s predavanja
4. Brukner, M. (1994): GIZIS – osnove. INA-INFO, Zagreb, 204 str.

Recommended literature

1. Lillesand T.M., Kiefer R.W. and J. W. Chipman (2004): Remote sensing and image interpretation, Wiley & Sons, 763 str.
2. Campbell J. B. (1996): Introduction to Remote Sensing , 2nd ed., Guilford, 622 str.
3. Donassy, V., Oluić, M., Tomašegović, Z. (1983): DI u geoznanostima, Zagreb, 333 str.

Bases of hunting management

ŠP3003

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2

Lecturer
Prof.dr.sc. Marijan Grubešić
Prof.dr sc. Krešimir Krapinec
Doc. dr. sc. Kristijan Tomljanović

Associate teacher for exercises
Prof.dr sc. Krešimir Krapinec
Doc. dr. sc. Kristijan Tomljanović

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Historical overview of hunting management. Hunting management as sporting, recreational and economic activity Exploring of game species starts with the classification of game on a scientific, legal and hunting basis. Then each single game species is addressed morphologically and biologically in detail. Manners of game rearing, such as natural breeding, breeding in an enclosed area and ombined breeding. Under game illnesses and protection an overview of infectious, uninfectious, parasitic and diseases of artificial breeding is given. Arrangement of hunting grounds, basic hunting ground factors, preparing of hunting ground cadastre, establishment of hunting-productive areas for economically important game species, evaluation of hunting grounds for large and ground game, establishment of hunting ground capacities in terms of game and establishment of numerical game strength. Technical arrangement of hunting grounds refers to the familiarization with hunting management and hunting-technical structures. Hunting of game, manner of hunting, rules of behavior during the hunt and hunting usage Hunting weapons, rifles and shotguns, their parts, manner of functioning, correct handling and maintenance of weapons. Rifle and shotgun ammunition, hunting ballistics Hunting kinology, historical development of dogs, classification of hunting dogs, working characteristics and methods for upbringing and training of dogs. Domestic and international regulations. The hunting management basis as the document on the basis of which the hunting ground is managed. Exercises take place in lecture-hall, cabinet and laboratory. Teaching in the field: Organization and Implementation of Hunting and Arrangement of Hunting Ground and Game Counting.

Type of course:

Bases of hunting management (compulsory, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the role and importance of hunting management through history, legal regulations in hunting (hunting and hunting development, the role of hunting management)	practice exercises, final exam	A1, C4, D1
Explain hunting zoology (game species, morphological and biological characteristics, protected animal species, bugs and horns, determining age and sex, assessing hunting trophies).	practice exercises, final exam	A1, C4, D1
Interpret game disease (symptoms, pests, hygiene hunting ground, and treatment of patients game mortality).	practice exercises, final exam	A1, C4, D1
Describe the hunting ground (division and arrangement of the hunting ground, hunting productive area, bonitating hunting ground for large and small game)	practice exercises, final exam	A1, C4, D1
Interpret catching wild animals, hunting weapons and ammunition (the proper operation and maintenance of weapons, ammunition, hunting ballistics).	practice exercises, final exam	A1, C4, D1
Explain hunting kinology (division of hunting dogs, working characteristics and methods of dog education and training).	practice exercises, final exam	A1, C4, D1

General competences:

Students will get to know hunting as a complex area, comprising biological, technical and economic part. Through teaching, exercises and teaching in the field students will be prepared for the duties, which will be implemented in practice in terms of game breeding, protection and hunting.

Tipe of instruction:

Lectures

In the lectures students are introduced to the theoretical part through a review of the historical development of hunting, game biology and ecology, game diseases, breeding techniques, hunting legislation, hunting knife, hunting weapons and charge.

Exercises

As part of the lesson, fifteen exercises are carried out, which are upgraded to the knowledge adopted in the lectures.

Field work

1. Visit to the Hunting Museum of the Croatian Hunting Association.
2. Shooting of flying targets on a hunting and sporting arena

Working methods:

Teachers obligations:

Maintaining original teaching - lectures, exercises and field teaching. Maintenance of written, oral exams and consultations. Preparation and preparation of teaching materials.

Students obligations:

Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,0
Exercises (E)	-	-	-	30	0	1,0
Field work	-	-	-	16	0	0,5
Partial exam (PE)	100%	60-70%	Sufficient (2)	-	104	3,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+E+FW+PE)/100**		76	104	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	76	106	6
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct	-

		lecturer)	
exercies	Exercises are attended by groups. As part of the exercise, 15 practical exercises from the aforementioned thematic units are performed. At the beginning of the first exercise, students receive task templates, and. Exercises are a condition for accessing the exam.	according to the agreed term	-
Written exam	Exam can be attended by students who have completed and committed exercises. The students in the pre-printed printed exam answer the questions asked. Passage in writing is necessary for passing on the oral exam.	Exam terms	-
Oral exame	The requirement for the entrance to the oral exam is at least 60% of the points collected on the written part of the exam. The final grade is obtained according to the formula **(FEx100)/100**	Exam terms	-

Obligatory literature

1. Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str.
2. Andrašić, D., 1982: Objekti tehničkog uređenja lovišta i uzgajališta divljači, Zagreb,106 pp.
3. Andrašić, D., 1973: Uređivanje lovišta. Lovna privreda IV dio, Zagreb.
4. Group of authors: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str.
5. Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str.
6. Tucak, Z., Florijančić, T., Grubešić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K., 2002: Lovstvo. Drugo prošireno izdanje. Uđbenik, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet Osijek, 405 str.

Recommended literature

1. Pascal Durantel, P. 2007 : Enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 607 str.
2. Pascal Durantel, P. 2007: Praktična enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 285 str.
3. Whitehed, G. K. (1993): The Whitehead Encyclopedia of Deer. Swan Hill Press, Shrewsbury, UK, 597 str.
4. Blüchel, K.G.: Die Jagd, 652 str.

Physiology of forest trees

ŠP3004

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. dr. sc. Željko Škvorc
Prof. dr. sc. Jozo Franjić
Doc. dr. sc. Krunoslav Sever

Associate teacher for exercises
Doc. dr. sc. Krunoslav Sever
Prof. dr. sc. Željko Škvorc

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction. Importance of plant physiology. Forest plants. Introduction to cell metabolism. Chemical composition of a plant body. Enzymes. Water and plant cells. Absorption, circulation and secretion of water in the plant.
Mineral plant nutrients - absorption and availability of minerals, role of mineral nutrients, mycorrhiza. Assimilation of mineral substances. Transfer of dissolved substances. Chemo-autotrophy, photo-autotrophy, structure of the photosynthesis apparatus, photosynthetic reactions, impact of environmental elements on photosynthesis, heterothropic nutrition. Cell breeding - aerobic, anaerobic. Breeding of a whole plant. Regulation of metabolism within the cell.
Growth, differentiation, maturation, falling off of organs. Plant hormones, auxins, gibberelins, cytokinins, abscisins and other physiologically active substances. Temperature impact on growth and development of wooden plants, dormancy of the buds, dormancy of the seeds, dormancy of the embryos. Impact of light upon growth and development of wooden plants, phytochromes, photomorphogenesis, flowering control. Physiology of fertilization, processes from fertilization to fruit maturity, seed germination. Fruit yielding of forest trees. Surface protection of the plant and protective substances.
Physiology of stress, resistance of wooden plants to low and high temperatures, resistance of wooden plants to drought, resistance of wooden plants to pH values of the soil. Lack of oxygen in the soil, pollution of water, soil and air, resistance of wooden plants to diseases.

Physiology of movement, passive movements, movements of organs, free locomotore movements, movements in the cell, physical movements.

Type of course:

Physiology of forest trees (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain the relationship between water and plants (water potential, plant water uptake and conductivity, root pressure, water extraction, transpiration, embolism of the tree conducting system, plant water status).	Exercises, Preliminary exam	B1
To explain plant metabolism and mineral nutrition (the structure and activity of enzymes in plant cells, the physiological role of mineral substances in the plant, the assimilation of mineral substances and the role of mycorrhiza).	Exercises, Preliminary exam	B1
To interpret photosynthesis and breathing (chemoautotrophy, photoautotrophy, the structure of photosynthetic apparatus, photosynthetic reactions, photorespiration, photosynthesis types, influence of environmental factors, aerobic and anaerobic cellular respiration, whole-plant breathing, the regulation of cellular metabolism).	Preliminary exam, knowledge test, final exam	B1
To present physiological processes of plant growth and differentiation in relation to key environmental factors (plant hormones, auxins, gibberellins, cytokinins, abscisic acid, bud, seed and embryo dormancy, phytochromes, photomorphogenesis).	Preliminary exam, knowledge test, final exam	B6, B7
To analyze the physiological processes involved in the fruiting of forest trees (the control of flowering, development of male and female gametophytes, fertilization).	Preliminary exam, knowledge test, final exam	B6
To interpret the physiology of stress (resistance of woody plants to low and high temperatures, droughts, water, soil and air pollution with diseases).	Preliminary exam, knowledge test, final exam	B6, B7
To explain the physiology of motion (passive movements, organ movements, free locomotor movements, motion in the cell, physical movements).	Preliminary exam, knowledge test, final exam	B1

General competences:

Development of basic knowledge necessary for evaluation of research on plant physiology and its integration into the models of plant functioning. Development of abilities of critical insight into plant physiology, as well as development and improvement of skills in experiment design and statistical analysis.

Type of instruction:

Lectures

Exercises

Exercises are performed in the laboratory. Exercises are the upgrading of knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	15	0	0,5
Partial exam - exercises (PEE)	30%	60-70%	Sufficient (2)		15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE1)	35%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Partial exam (PE2)	35%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PEE*30+PE1*35+PE2*35)/100**		45	75	4

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	70%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		60	2
TOTAL	**100%**	**(FE*70+PEE*30)/100**				
*** students who do not pass through the partial exams have to access the final exam that makes 70% of the grade, and the remaining 30% of the grade make the exercise**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lectures + exercises	The attendance of students is checked and recorded at the lectures. Student may not be absent more than 20% of lectures and 10% of exercises. The exercises are attended in groups. Exercises are performed in the laboratory. Students have templates for each exercise	semester (45 hours of direct teaching	Exceptionally, in the case of a justified reason, the student may compensate the absence of an individual exercise.
Partial exam - exercises (PEE)	After the exercises are done, the students are obliged to take the partial exam. The students answer the questions on previously printed exam.	in accordance to the agreed deadline	-
Partial exam (PE1)	The students answer the questions on previously printed exam. Students are not obligatory to access the 1st **p**artial exam. If they do not access the partial exam, they have to take the final exam.	9th week	-
Partial exam (PE2)	The students answer the questions on previously printed exam. Students are not obligatory to access the 2nd partial exam. If they do not access the partial exam, they have to take the final exam. If the students have a positive grade in partial exams according to the formula **PEEx30 + PE1x35 + PE2x35** they are not required to access the final exam.	15th week	-

Final exam (FE)	Students who fail to pass the Partial exam are obligatory to attend the final exam. The final exam consists of a written and oral part. In a written part students answer the questions on previously printed exam. Students who pass a written exam are oraly asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **FEx70 + PEEx30**	in accordance to the exam schedule	-

Obligatory literature

1. Škvorc, Ž., Sever, K., Franjić, J., 2013: Fiziologija šumskoga drveća (interna skripta), 1-97. Zagreb

Recommended literature

1. Pevalek-Kozlina, B. 2002: Fiziologija bilja. Profil interrnational. Zagreb
2. Dubravec, K. .D., Regula, I. 1995: Fiziologija bilja. Školska knjiga. Zagreb.
3. Pallardy S. G. 2008: Physiology of Woody Plants, 3. izd. Elsevier Inc.

Forest Genetics

ŠP3005

ECTS 4

English language R1

E-learning R2

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Professor Davorin Kajba, PhD

Associate teacher for exercises
Professor Davorin Kajba, PhD
Assistant Professor Ida Katičić Bogdan, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Students are introduced to reproduction and heredity, function of cell organelles, karyotyp, morphology and structure of chromosomes. Cell division (mitosis, meiosis), Structure of DNA, loci, Heterozigosity and homozigosity, Dominance and recessivness of genes, Mutations (gene, chromosome, aneuploids, polyploids), Induced mutations, Genes and their changeability, Gene expression, Embryonal differentiation of cells, Cytoplasmatic components of heredity, Basics of molecular structure and function of genes, Gene interactions, Selected methods and techniques of molecular genetics and their application in forestry, Techniques of DNA marker identification, Recombination and variability of traits, Inheritance of qualitative traits, Mendel's rules of inheritance, Explanation of quantitative traits inheritance, Additive and non-additive type of inheritance; examples in forest trees, Heterozys, Quantitative trait loci analysis. Furthermore: Variability parameters of quantitative traits, Types and examples of quantitative traits inheritance in forest trees, The occurrence of heterozys and transgression. Inheritance of sex, species and genus hybrids, Sexual incompatibility in forest trees. Students are also introduced to occurrence of modification, Phenotypical stability, Adaptability and genotypic-environment interaction and with Heritability and Phenotypical stability of clones/sibs in forest trees. Population genetics, Population structure, Change in gene frequency (migration, mutation, selection). Hardy-Weinberg law of population balance, Genetic drift and Experimental data testing in forest trees populations.

Type of course:

Forest Genetics (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Observing the level of organization and gene expression in forest trees (propagation and heredity in forest trees, cell division, heterozygosity and homozygosity, gene expression, molecular basis structure and function of the gene).	Practise exercises, colloquia, knowledge test, final exam	B6
Apply of basic principles of inheritance in forest trees (Mendel's laws, additive and non-additive inheritance in forest trees, heterozygosity, transgression, hybrids, sexual incompatibility in forest trees).	Practise exercises, colloquia, knowledge test, final exam	B6
Analyze of population genetics and mutations in forest trees (changes in gene frequencies (migration, mutation, selection), Hardy-Weinberg's population equilibrium law, genetic drift).	Practise exercises, colloquia, knowledge test, final exam	B6

General competences:

Students acquire theoretical and practical knowledge of the reproduction and inheritance of molecular, quantitative, population and evolutionary genetics with examples of forest trees.

Type of instruction:

Lectures

Exercises

Students learn practically in the exercises and study the variability and inheritance of qualitative and quantitative traits in forest trees.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards	Sufficient (2)	15	15	1
		Extended lectures with less than 10% of acceptable disadvantages of the application of technical standards	Good (3)			
		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards	Excellent (5)			
Making excersies (E)	30%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards	Sufficient (2)		30	2
		Extended lectures with less than 10% of acceptable disadvantages of the application of technical standards	Good (3)			
		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards	Excellent (5)			
Colloquium from	30%	60-70%	Sufficient (2)		13	0,5

application of biochemical and molecular genetic research in forestry (K1)		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Colloquium from the study of the variability of qualitative and quantitative properties (K2)	30%	60-70%	Sufficient (2)	2	13	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Total	**100%**	**(Px10+Vx30 + K1x30+K2x30)/100**		49	71	4

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**(FEx60+PEGx30+Ex5+HWx5)/100**				
*** students who do not pass the course through two partial exams during the semester take the final exam that is 60% of the grade and is the same as the partial exam - angiosperms; the remaining 5% is the grade of the exercises, 5% is the grade of the homework and 30% of the partial exam - gymnosperms**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours. Student activity is recorded.	semester (45 hours of direct lecturer)	-
Making exercises	Exercises are attended by groups. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted in a probationary period (provided that the student does not leave the class more than allowed, that the average grade of all the lessons in the classroom is greater than enough.	15. week	
Colloquium from the method of studying the variability of	The first colloquium can be accessed by students who have a positive evaluation of the 1st Exercise and no less than 20% have abstained from teaching.		

qualitative and quantitative properties in forest trees. (K1)			
Colloquium from the population structure and frequency of genes and genotypes, genetic equilibrium in forest tree populations. (K2	Colleges can be accessed by students who have passed the 1st Colloquium. The two colleges are scored with a total of 70 points, each colloquium with 35 points. A total of 42 of 70 points are required for the passage (60%).Students who get enough points from both hands get a final score on the subject. The final grade is the average score from the exercise and the score by the points.		
Written exam	The written exam consists of six assignments. For the passage it is necessary to have 28 points out of a total of 47 points (60%).	Exam terms	
Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the university textbook) is checked. The final grade is obtained according to the formula		

Obligatory literature

1. Kajba, D., D. Ballian: ŠUMARSKA GENETIKA, Zagreb-Sarajevo, 2007, 283 str.
2. D. Ballian, D. Kajba: OPLEMENJIVANJE ŠUMSKOG DRVEĆA I OČUVANJE NJEGOVE GENETSKE RAZNOLIKOSTI, Sarajevo-Zagreb, 2011 (u tisku)
3. Vidaković, M., A. Krstinić: GENETIKA I OPLEMENJIVANJE ŠUMSKOG DRVEĆA, Liber, Zagreb, 1985, 505 str.
4. Vidaković, M. i sur.: GENETIKA, Šumarska enciklopedija I, JLZ, Zagreb, 1983, str. 614-638.
5. Borojević, K.: GENI I POPULACIJA. Forum. Novi Sad. 1986, 545 str.
6. Krstinić, A. i sur.: OPLEMENJIVANJE ŠUMSKOG DRVEĆA. U: Šume u Hrvatskoj. 1992, str. 109-121.
7. Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, 398 str.
8. Kalafatić, M.: OSNOVE BIOLOŠKE EVOLUCIJE, HPD, 1998, 136 str.

Recommended literature

1. Eriksson, G., I. Ekberg, D. Clapham: AN INTRODUCTION TO FOREST GENETICS. SLU Repro, Uppsala. 2007, 185 str.
2. White, T. L., Adams, W. T., Neale, D. B., 2007: Forest Genetics, CABI Publishing, 682 str.
3. Wright, J. W.: INTRODUCTION TO FOREST GENETICS, Academic Press, New York, 1976, 463 str.
4. Hattemer, Hans H., Bergmann, F., Ziehe, M.: EINFÜHRUNG IN DIE GENETIK, J.D. Sauerländer's Verlag, Frankfurt am Main, 1993, 492 str.
5. Kumar, S., M. Fladung: MOLECULAR GENETICS AND BREEDING OF FOREST TREES, Food Products Press, 436 str.
6. Hartwell, L.H. i sur.: GENETICS. McGraw Hill. 2000, 820 str.

a. Paule, L.: GENETIKA A ŠL'ACHTENIE LESNÝCH DREVÍN, Príroda a.s., Bratislava, 1992, 304 str.

Basics of forest economics

ŠP3006

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
assoc. prof. Stjepan Posavec, PhD

Associate teacher for exercises
Karlo Beljan, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Name, concept, subject and methods of forestry economics.
Characteristics of forestry economics and its place in science.
Forest as a socio-economic category. Forest functions. Specificity of production process in forestry. Biological-technical characteristics and economic features.
The ranking and importance of forestry in Croatia. Natural characteristics of Croatia. Forests in Croatia. Characteristics of the forests in relation to ownership. The relationship between forestry and wood processing industry. Forest products trade. Share of forestry in gross domestic product.
The basics of natural resources economy of, the basis of environmental pollution economic, the essential features of forestry (economic and market determinants).
Natural resources, importance of forest resources and consumers. The basic market laws and their impact on the forest resources price formation. Supply and demand law.
Manufacturing in forestry. Duration, activity and multifunctional character of production in forestry. Specificities of forestry planning process. Land as a resource, forest rent and forest tax.
Meaning of forest as capital. Interest account application.

Type of course:

Basics of forest economics (compulsory, semester 3, year 2)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain economics of natural resources and sustainable development (specificity of production in forestry, biological-technical characteristics and economic characteristics).	exercises, final exam	A1
Interpret forest rent and forest tax.	exercises, final exam	A1
Interpret the determination of forests value (methods of evaluation in forestry, problems of total economic value of natural resources)	exercises, final exam	A1
To explain the meaning of forest as capital (fixed assets and capital in forestry, categories of capital goods in forestry).	exercises, final exam	A1
To analyze marketing in forestry (market laws, formation of forest resource prices, supply and demand laws).	exercises, final exam	A2, C5
Present economic analysis and planning in forestry (business indicators, forestry production, outline investment plan and business plan).	exercises, final exam	A3, C5

General competences:

Problems of forest management and forest resources as part of the economy of renewable natural resources.
The system and process of sustainable forest resources management.
Ideas, concepts and methods used by modern forestry economists.

Type of instruction:

Lectures

Exercises

Working methods:

Teachers' obligations:
Teaching original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge exams and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Students' obligations:
Taking lessons and active participation in all segments (lessons, exercises). Individual preparation and exercise submission. Taking exam

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	-	-	30	0	1
Exercises (E)	10%	-	-	15	0	1
Self-conducting exercises (E)	20%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)		30	1
		Proper, readable, with major corrections and on time	Good (3)			
		Proper, readable, with minor corrections and on time	Very good (4)			
		Proper, readable, accurate and on time	Excellent (5)			
Partial exam (PE)	60%	60-70%	Sufficient (2)		45	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PEx80)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	45		4
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Checking the attendance of students on lectures. Student can miss the lectures justifies no more than 15%	semester (45 hours of direct lecturer)	-
Self-conducting exercises (E)	Exercises are conducted individually. At the beginning of the first exercise, students receive task templates for all	14 days after the	Submission after the deadline means

	exercises, as well as all necessary info. Evaluation consist of accuracy and time frame in which in necessary to hand exercises.	exercise session	getting an additional exercise in agreement with the teacher
Written exam	Students could attend exam with successfully and correct finished exercises. Students on printed written exam work on three calculation tasks. One positive exam has 10 points. Half of the correct exam gain 5 points. Grades for written exam are: 15-sufficient (2) 20- good (3) 25-very good (4) 30-excellent (5)	Exam terms	-
Oral exam	Students with positive written exam are questioned from different part of the course content. Final grade consists achieved percentage together from written and oral exam: Sufficient (2) 60%, Good (3) 71%, Very good (4) 81% Excellent (5) 91%	Exam terms	-

Obligatory literature

1. Figurić, M.: Uvod u ekonomiku šumskih resursa, Šumarski fakultet, Zagreb, 1998.
2. Sabadi, R.: Ekonomika šumarstva, Školska knjiga Zagreb, 1992.

Recommended literature

1. Klemperer, W.D.: Forest resource economics and finance, McGraw-Hill Book Comp., New York, 1996.

Establishment of forests

ŠP4001

ECTS 6

English language R1

E-learning R2

Teaching hours 99
Lectures 45
Exercises 30
Field work 24

Lecturer
prof. dr. sc. Milan Oršanić
doc. dr. sc. Damir Drvodelić

Associate teacher for exercises
doc. dr. sc. Damir Drvodelić
doc. dr. sc. Vinko Paulić

Grading
Sufficient (2) 58%
Good (3) 68%
Very good (4) 76%
Excellent (5) 84%

Course content:

Students are familiar with the basic tasks of forestry, forest nursery as well as raising tree and shrub plantation during the course of the course as well as work on the exercises.
In the field of forest seed, students are introduced to forestry, forest seed types, chemical composition, physiological prerequisites for fertilization, harvesting and handling with seeds, finishing, seed quality testing. In a special part, the seeds of the main forest species, from the point of view of the material, cultivating, collecting, morphological characteristics, preservation etc.
In the field of forest nursery special attention should be paid to the choice of habitats for the establishment of forest nurseries, the methods of plant production (generatively, vegetatively), the ways of planting seedlings (root roots, container seedlings), soil treatment and fertilization (fertilizer types), seed extraction and packing , dispatches, legal regulations and management in nursery. In a special part, the cultivation of the main species of forest trees would be processed.
In the field of afforestation and raising of forest plantations, we would look at the history of afforestation in Croatia and in the world, the reasons for raising the plantations as well as the world trends, the advantages and disadvantages of plantations, the selection of species for afforestation, number of plants and densities, ways of raising, planting time, , care, hedging of branches and patrols, rotation of species, raising of special purpose plantations (biomass, windscreen belts, Christmas trees and so on).

Type of course:

Forest Establishment (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain forestry seeds (forest seeds and species, maturation and collection, cleansing and sorting, dormancy, forest seed quality elements).	Practicum, Preliminary exam, Final exam	A1, B1, D1
Applied forest nursery and breeding methods in nurseries (division of nurseries, choice of habitats for the establishment of forest nurseries, generative and vegetative propagation of plants).	Practicum, Preliminary exam, Final exam	A1, B6, D1
Describe soil treatment (division, basic and additional soil treatment, depth and volume of soil treatment, basis of equipment and tools used in soil treatment).	Practicum, Preliminary exam, Final exam	B9
Presenting Container Planting (Container Sharing, Planted Container Problems, Root System Deformation, Substrate, Breeding Time, Plant Care in Containers).	Practicum, Preliminary exam, Final exam	B6, D1
Analyze the production technology of the main crops of forest seedlings (*Quercus, Fagus, Fraxinus, Alnus, Betula, Populus, Salix, Abies, Pinus, Picea*).	Practicum, Preliminary exam, Final exam	B6
Appropriate afforestation of the main species of forest trees (raising and cultivation of forest cultures of autochthonous species of shreddersand conifers).	Practicum, Preliminary exam, Final exam	B6, B7, B9

General competences:

The aim of the course is to acquaint students with the ways of establishing a forest. Due to the complexity of matter students are introduced to the basics of seedling, nursery and raising of forest cultures and plantations. By listening to this course students are able to create a project for the creation of new forest stands (afforestation).

Forms of teaching:

Lectures

Exercises

As part of the lesson, fifteen exercises are carried out, which are upgraded to the knowledge adopted in the lectures.

Field work

Within the course, field work is done in three days:
1. Truffle seed in the Jastrebarsko forestry institute (seed processing, seed detection, seed treatment, quality assurance, seed storage refrigerator), container filling line, duneman fertilizer, watering system, production of pedunculate seedlings, nursing machinery.
2. Nursery Višnjevac in the Forestry Directorate of Osijek (HŠ d.o.o). The technology of foundry and locust beetle foundry and the raising of poplar plantations. 3. Field exercises from forest cultures and

plantations in Varaždin or Karlovac, getting acquainted with raising techniques, care and cultivation characteristics of various types of conifers of domestic and alohton conifers.

Working methods:

Teacher's obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Student's obligations:

Regular attendance and active participation in lectures, exercises and field sessions. A justified absence with a maximum of 20% of lectures and 10% of exercises is allowed. Creating and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	-	-	-	30	6	1,2
Field work (FW)	-	-	-	24	18	1,4
1. Partial exam (PE1)	50%	60-70%	Sufficient (2)	-	30	1,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2. Partial exam (PE2)	50%	60-70%	Sufficient (2)	-	27	0,9
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(P+V+TN+K1x50+K2x50)/100**		99	81	6

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100 %	58-67% 68-75% 76-83% 84-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	57	1,9
TOTAL	**100%**	**(ZIx100)/100**				
*** Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 100% of the final grade**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (P)	The lectures are checked and the presence of students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours.	semester (45 hours of direct teaching)	-
Exercises (V)	Exercises are checked and students attend. Student may justifiably be absent with a maximum of 10% of direct teaching hours. At the end of the semester, the students submit their exercises based on the instruction given from the beginning of the course on the layout and content of the exercises.	After completing classes	-
Field work (TN)	On-site teaching is checked and the presence of students is recorded and no absences allowed. After completing each field course, the students are obliged to write and submit a report from the field teaching.	According to the field curriculum	-
Partial exam (K1)	All students who have enrolled the subject for the first time in the current academic year can access the first queue. In the content of the 1st Column the first half of the tuition is entered. Colloquy is an oral test.	Week 8	There is a possibility of a correction deadline for the colloquium.
Partial exam (K2)	2. Colleges can be accessed by students who have passed the 1st Colloquium. The second half of the semester enters the second half of the tuition. Colloquy is an oral test. Students placing both oral colloquia get a final grade from a subject that is the arithmetic mean of the grades from the first and second colloquia.	15th week	There is a possibility of a correction deadline for the colloquium.
Written exam	The written exam consists of 6 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. For passage on a written exam you need to collect more than 58% points.	According to the test schedule	-
Oral exam	The requirement for the oral part of the exam is at least 58% of the points collected on the written part of the exam. The final grade is obtained according to the formula (ZIx100) / 100		-

Obligatory literature

1. Oršanić, M., I. Anić, D. Drvodelić, 2005: Šumsko sjemenarstvo i rasadničarstvo (Interna skripta). Zagreb. 228 str.
2. Oršanić, M., I. Anić, D. Drvodelić, D., 2005: Priručnik za razmnožavanje drveća i grmlja (Interna skripta). Zagreb. 125 str.
3. Oršanić, M., I. Anić, D. Drvodelić, D., 2005: Šumske kulture i plantaže (Interna skripta). Zagreb. 115 str.
4. Matić, S., B. Prpić, 1983: Pošumljavanje. Savez inženjera i tehničara šumarstva i drvne industrije Hrvatske. 79 str.

Recommended literature

1. Chapman, G. A., T. G. Allan, 1978: Establishment Techniques for Forest plantations. G.W. FAO, Resources Div., Forestry Dept.
2. Chapman, G. A., R. D. Wray, 1987: Christmas Trees for Pleasure and Profit. Rutgers University Press. Third Edition.
3. Shepherd, B., 1986: Plantation Silviculture. Forestry Sciences.
4. Savill, P. E., J. Auclair, D. J. Falck, 1997: Plantation Silviculture in Europe. Oxford University Press.
5. Dobson, M., A. J. Moffat, 1993: The Potential for Woodland Establishment on Landfill sites. Department of the Environment. HMSO. London.
6. Šmelkova, L., 2001: Lesne školky. TU Zvolen.
7. Farmer, R. E., 1997: Seed Ecophysiology of Temperate and Boreal Zone Forest Trees. St.Lucie Press.
8. Bärtels, A., 1995: Der Baumschulbetrieb. Verlag Eugen Ulmer.
9. Krüssmann, G., 1997: Die Baumschule. Paul Parey Verlag.
10. Davidson, H., R. Mecklenburg, 2000: Nursery Management. Prentice Hall.

Forestry phytocenology

ŠP4002

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 3 days

Lecturer
Prof.dr.sc. Dario Baričević
Prof.dr sc. Joso Vukelić

Associate teacher for exercises
Prof.dr.sc. Dario Baričević
Prof.dr sc. Joso Vukelić
Dr.sc. Irena Šapić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Definition and objectives of phytocenology. The development of vegetation studies in Europe and in Croatia. The forest as a phytocenosis, or biocenosis. The concept of biogeocenosis or the ecosystem. Natural stands. Analytical processing and synthetic classification. Statistical data analysis. Synecology, i.e., relationship of the forest community to climate, soil, relief and biotic factors. Syndynamics. Progressive and regressive succession. Developmental phases and stages. Degradation stage. Synchronology and synchorology. Land area of the forest communities of our country. Spatial distribution and zonation of plant communities. Mapping forest vegetation. Systematics. General overview of phytogeographical divisions of forest vegetation. General overview of forest communities of lowlands, hills and mountains. General overview of forest communities of the Mediterranean region.
This course is based on the classical assumptions of the Braun-Blanquet approach, while including the most up-to-date information and technological aids. The course is comprised of lectures and laboratory exercises using modern teaching aids and a field component in real forest ecosystems.

Type of course:

Forestry phytocenology (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain forest phytocenology and ecosystems (role and tasks, division and historical development of phytocenology, phytochenological directions and schools, biocenosis and natural and anthropogenic ecosystems).	Preliminary exam, final exam	B8
Forest vegetation synmorfology and synecology (qantitative and qualitative indicators, data collection, analytical processing and synthetic development, synmorphology (structure and composition) of plant communities, classification of synecological factors, relation of plant species and plant communities to the synecological factors of their adherence - soil, climatic, geomorphological and biotic factors)	Practical exercises, preliminary exam, final exam	A1, B4, B8
Syndynamics of forest vegetation (vegetation succession, syndynamics units, initial, transitional, permanent and climatic communities, practical importance).	Preliminary exam, final exam	A1, B4, B8
Present the synhorology of forest vgetation (definition and types of area of distribution of plant communities, floral geoelements and area, spatial distribution and zoning of vegetation, altitude and horizontal distribution, disorders and disturbance of vegetation).	Preliminary exam, final exam	D1
Explain systematics of forest vegetation (historical development, nomenclature rules, associations, higher and lower systematic units).	Preliminary exam, final exam	D1
Present the forms of forest vegetation, their development and their distribution in Croatia (forest vegetation, the most important forest communities).	Preliminary exam, final exam	B1, D1

General competences:

The objective of the course is to introduce students to the basic concepts in forestry phytocenology, which will practically show the definition of forest stands as concrete systematic forest units, from which their functioning and application in forestry practices through the management of forest ecosystems will be evident. The principles of naturalness, sustaniable forest management and bio-diversity shall be applied.

Tipe of instruction:

Lectures

According to the curriculum lectures include 7 teaching units in 15 terms.

Exercises

15 exercises are performed in the form of field, computer and auditorial exercises. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is planned for 3 days, according to the curriculum.

Working methods:

Teachers' obligations:

Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-		30	0	1
Creating exercises and field work reports (E)	20%	Partly untidy and incomprehensible, with major corrections and on time	Sufficient (2)	52,5	40	3
		Neat, legibly, with bigger corrections and on time	Good (3)			
		Neat, legibly, with small corrections and on time	Very good (4)			
		Neat, legibly, correct and on time	Excellent (5)			
Partial exam (2)	80%	60-70%	Sufficient (2)	0	60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Vx20 + Pex80)/100**		82,5	100	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80%	Sufficient (2) Good (3)		60	2

		81-90%	Very good (4)
		91-100%	Excellent (5)
TOTAL	**100%**	**(FEx80+Ex20)/100**	

*** Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 80% of the final grade, and the remaining 20% is grade from exercises**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercies + reports	The presence of students is being checked and noted. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (82,5 hours of direct lectures)	-
1. Partial exam	1st partial exam is available to students who have participated lectures, exercises and field work of the first half of the semester. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject, whereupon 60% of the points are to be collected for passing.	8. week	-
2. Partial exam	2nd partial exam is available to students who have participated lectures, exercises and field work and passed the first partial exam. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject. The two partial exams are scored with a total of 80 points, each with 40 points. A total of 48 points of 80 points (60%) have to be collected for passing.	15. week	
Written exam	The exam can attend students with realized exercises and field work. The students in the pre-printed exam answer the questions asked. The written exam is evaluated and participates in the final assessment of the subject, whereby it is necessary to collect 60% points for passing	Exam terms	-
Oral exame	Students who pass a written exam are being asked questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Vukelić, J. & Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.

Recommended literature

1. Dierschke, H., 1994: Pflanzensoziologie. Ulmer, Stuttgart, 686 str.
2. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
3. Podani, J., 1994: Multivariate data analysis in Ecology and Systematics. SPB Academic Publishing bv. Den Haag.

Forest Ecology

ŠP4003

ECTS 6

English language R1
E-learning R1

Teaching hours 83
Lectures30
Exercises 30
Field work 23

Lecturer
Prof.dr.sc. Ivica Tikvić
Izv. prof. dr. sc. Damir Ugarković

Associate teacher for exercises
Izv. prof. dr. sc. Damir Ugarković

Grading
Sufficient (2) 50-62,5%
Good (3) 62,5-75%
Very good (4) 75-87,5%
Excellent (5) 87,5-100%

Course content:

The course forest ecology covers the theoretical foundations of forest ecology as a scientific discipline, a historical overview of the development of forest ecology and ties to other disciplines, the concept and functioning of the forest ecosystem, ecological and biological relationships in main forest ecosystems, the main influences on stability and decay of forest ecosystems, energy and nutritional cycling, distribution of forest ecosystems, conditions and relationship of ecological factors in forest ecosystems, description of light as an ecological factor, relationship of forest trees to light, an overview of temperature as an ecological factor, relationship of forest trees to temperature, an overview of water as an ecological factor, relationship of forest trees to water, impact of water on forest development, chemical and mechanical factors, water and soil pollution, influence of wind and precipitation on the development of forest trees, concept and overview of climate, climatic elements and appearances, influence of climate on development of forest trees, climatic change, microclimate, soil as an ecological factor and changes in soil, relief and influence of relief on the development of forest trees, biotic factors in forest ecosystems, zoocenosis and microbiocenosis as factors of stability, tree and stand biomass, phenology of forest trees, rooting of forest trees, general function of forests, ecological relationships in virgin forests.

Type of course:

Forest Ecology (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
1. Identify tree species on the basis of morphological features, identify tree parts and shapes, and apply theoretical and practical knowledge of economically important indigenous and alohton species of trees and shrubs.	practice exercises, written tests, oral exam	B1
2. Adopt the fundamental principles of protecting the forests of abiotic and biotic factors, especially from the fires, and apply the basic procedures and means to protect the forests.	practice exercises, written tests, oral exam	B3
3. Participate in the implementation of the forest management program.	practice exercises, written tests, oral exam	B4
4. Carry out works on forest inventory.	practice exercises, written tests, oral exam	B5
5. Perform professional field work on the establishment, care and restoration of forest stands.	practice exercises, written tests, oral exam	B6
6. Collaborate on the development of ecological studies and spatial plans.	practice exercises, written tests, oral exam	B8

General competences:

complete qualifications for revirnik jobs
expert associate in all forestry jobs
forest inventory work
participation in the implementation of the forest management program
protection of forests from abiotic and biotic factors
collaboration on the development of ecological studies and spatial plans

Tipe of instruction:

Lectures

As part of the lectures, students are introduced to theoretical and practical knowledge from individual thematic units.

Exercises

As part of the exercise, 15 exercises from the forest ecology are performed. Exercises are an upgrading of the knowledge gained in lectures.

Field work

On the field work, students are introduced with practical examples of the application of knowledge of the forest ecology in forestry. Practitioners take part in it.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Design the theme for the seminars and compiling knowledge tests and their evaluation. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the colloquium and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (La) attendance	5%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	30	-	1
Exercises (Ea) attendance	5%	100% 90% 80%	Excellent (5) Very good (4) Good (3)	30	-	1
Field work (FWa) attendance	3%	100%	Excellent (5)	23	-	0,8
Exercises (E)	40%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	-	35	1,2
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE) 2 written tests or 1 final test	37%	50-62,5%	Sufficient (2)	4	40	1,3
		62,5-75%	Good (3)			
		75-87,5%	Very good (4)			

		87,5-100%	Excellent (5)			
Oral exam (OE)	10%	100% 80% 60% 40%	Excellent (5) Very good (4) Good (3) Sufficient (2)	0,5	17,5	0,7
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)**		87,5	92,5	6

Evaluation elements	**Maximum points or share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures - attendance (La)	*5%*			*30*	*30*	*1*
Exercises - Attendance (Ea)	*5%*	*70-100%* *80-100%*	*2-5* *3-5*	*30*	*30*	*1*
Field Work - Attendance (FWa)	*3%*	*100%*	*5*	*23*	*23*	*0,8*
Exercises and reports from the field work (E)	*40%*	*50-100%*	*2-5*	-	*35*	*1,2*
2 written tests or 1 final test (PE)	*37%*	*50-100%* *40-100%*	*2-5* 2-5	*4*	*44*	*1,3*
Oral Exam (OE)	*10%*			*0,5*	*18*	*0,7*
TOTAL	**100%**	**(Lax0,05)+(Eax0,05+(FWax0,03)+(Ex0,4+(PEx0,37)+(OEx0,1)**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and 20% exercises and can not be absent from the field work. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (83 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures or field work
Exercises and reports from the field work	Exercises are attended by groups. As part of the exercise is carried out 15 practical exercises in forest ecology. At the beginning of each exercise, students receive task templates and the layout of exercise reports in printed form. Estimated accuracy, neatness and regularity (exercise submitted on time). From each exercise, the student gets a grade and the average of all grades in the exercise is taken when calculating the final score from the subject.	In accordance with the agreed terms.	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.

Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	Exam terms	The student has the right three times to go to the exam.
Oral exame	Students who pass a written test and who receive passive grades from exercises, and have passive grades from lectures, exercises, and field work attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)**	Exam terms	The student has the right three times to go to the exam

Obligatory literature

1. ŠUME U HRVATSKOJ, Šumarski fakultet Sveučilišta u Zagrebu, «Hrvatske šume» Zagreb, 1992, (odabrana poglavlja - vezana uz ekologiju šuma).
2. HRAST LUŽNJAK U HRVATSKOJ. HAZU Centar za znanstvni rad Vinkovci, «Hrvatske šume» Zagreb, 1996, (odabrana poglavlja - vezana uz ekologiju šuma).
3. OBIČNA JELA U HRVATSKOJ. Akademija šumarskih znanosti, «Hrvatske šume» Zagreb, 2001, (odabrana poglavlja - vezana uz ekologiju šuma).
4. OBIČNA BUKVA U HRVATSKOJ. Akademija šumarskih znanosti, «Hrvatske šume», Grad Zagreb Gradski ured za poljoprivredu i šumarstvo, 2003, (odabrana poglavlja - vezana uz ekologiju šuma).
5. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987, (odabrana poglavlja - vezana uz ekologiju šuma).
6. Mihovil Gračanin, Ljudevit Ilijanić, UVOD U EKOLOGIJU BILJA, Školska knjiga, Zagreb 1977.

Recommended literature

1. Đikić, D.,Glavač, H., Glavač, V., Hršak, V., jelavić, V., Njegač, D., Simončič, V., Oskar, P.S., Tomašković, I., Vojvodić, V., 2001.: EKOLOŠKI LEKSIKON, Ministarstvo zaštite okoliša i prostornog uređenje RH, ISBN 953-181-039-7, str. 3-361.
2. INTENSIVE MONITORING OF FOPREST ECOSYSTEMS IN EUROPE, FIMCI; Tehnical Report 2003, http://www.icp-forests.org/Manual.htm
3. Stephen H. Spurr, Burton V. Barnes, FOREST ECOLOGY, John Wiley and Sons, New York.
4. Kimmins J.P. 2004: FOREST ECOLOGY, Prentice Hall, New Jesey, str. 1-611.
5. Matić, S., Prpić, B., POŠUMLJAVANJE, 1975.

Forest entomology

ŠP4004

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof.dr.sc. Boris Hrašovec

Associate teacher for exercises
Doc.dr.sc. Milivoj Franjević

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Students get acquainted with the ecologically most important forest animals – insects. Species diversity and richness, height of local populations, presence in every forest niche, multilateral impact on ecological balance and trophic chains, all of these present sound basis for the study of forest insects. Aim of the course is to give the basic taxonomic, biological, physiological, ethological and ecological knowledge of forest insects. Among the aforementioned scientific branches only those segments are given that interfere with the most important aspects of insect impacts throughout the forest ecosystem. Along with the review of the relevant insect fauna of the region, 12 of the most injurious pests are chosen and presented in detail. Accepted knowledge is basis for higher level courses like "Forestry phytopharmacy", "Forest insect outbreaks" and "Integrated forest protection".

Type of course:

Forest entomology (compulsory, 2. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To learn taxonomy, morphology, physiology and nutrition of forest insects, and the importance of insects in the forest ecosystem and urban areas	colloquium, seminar work, final exam	B2
Present growth and ontogenetic development in insects (developmental stage, types of larvae, pupae, physiology of metamorphosis , apolysis, eclosis, ecdosis, hormone system, endocrine glands).	colloquium, seminar work, final exam	B2
Describe the insect sense and communication with the environment in function survival in forest habitat and urban space (sensations of tastes, sight, hearing, smell and taste, intrinsic and interpersonal communication, sexual and aggregate attractants, insect attack symptoms).	colloquium, seminar work, final exam	B2
Define the foundations of the insect ecology of the populations, endangered and rare insect species (fluctuations, oscillations, gradations, gradation types, antagonistic relations and symbiosis, predation and parasitism, endangered and rare insect species, the concept of species preservation through conservation of habitats).	colloquium, seminar work, final exam	B2
Show the most significant pests of urban timber from the group of sucking insects (species from the order of Orthoptera, Thysanoptera and Hemiptera, bionomy, ecology and significance).	colloquium, seminar work, final exam	B2
Show the most significant defoliants of urban wooden plants from the subfamily of butterflies, beetles and other rows.	colloquium, seminar work, final exam	B2
Define the most important xylophages and urban wood destroyers woody plants (xylophagic butterflies, bark beetles, primary and secondary pests in forestry, bionomy, ecology of species and their impact on forest ecosystem).	colloquium, seminar work, final exam	B2
Present insects as molestants and causes allergic reactions to the forest and urban space.	colloquium, seminar work, final exam	B2
Analyze invasive quarantine insect species and their correlation with urban space.	colloquium, seminar work, final exam	B2

General competences:

Define taxonomy, morphology, physiology and nutrition of forests insects, and the importance of insects in the forest ecosystem and urban areas.
Present the growth and ontogenetic development of insects (developmental stage, types of larvae, puppies, physiology of dressing, apolysis, eclysis, eclosis, hormone system, endocrine glands)
Categorize the current development stages in taxonomic groups insect based on the corresponding type of metamorphosis.
Describe the insect sense and communication with the environment in function of survival in the forest habitat and urban space (sensations of tastes, hearing, binge and taste, intrinsic and interpersonal communication, sexual and sexual aggregate attractants, insect attack symptoms)
Define the basics of population ecology of insects, overburdening and endangered and rare insect species (fluctuations, oscillations, gradations, gradation types, antagonistic relations and symbiosis, predation and parasitism, rotten and rare insect species, the concept of species preservation through conservation of habitats)
Show the most significant pests of urban timber from the group of suckers (species from the order of Orthoptera, Thysanoptera and Hemiptera, bionomy, ecology and significance).Describe the most important selected and important types of forest and urban pest traps
Show the most significant defoliants of urban wooden plants from the subfamily of the billiard, butterflies, beetles and other rows. Identify the most significant species of forest pests in the butterfly series
Define the most important xylophages and urban wood destroyers' woody plants (xylophagic butterflies, primers, primary and secondary pests in forestry, bionomy, ecology of species and their impact on forest ecosystem). Explain the reasons for their damage and link it with tree species in which we find them
Present insects as molestants and causes allergic reactions to the forest and urban space. Identify the most important types of forest pests from functional groups of molestants and allergenic urticaria species
Analyze invasive quarantine insect species and their correlation with urban space. Identify the 15 invasive species of pests that dominate on decorative woody and exotic plants

Tipe of instruction:

Lectures

Exercises

Working methods:

Teachers' obligations:

Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%			30	0	1
Exercises (E)	30%	60-70%	Sufficient (2)	30	0	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	30%	60-70%	Sufficient (2)	0	120	4
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		60	120	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(FExy0+Exy0)/100**				**2**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours	semester (45 hours of direct lecturer)	-
Partial exam		15. week	
Written exam		Exam terms	

Oral exame			

Obligatory literature

1. Hrašovec, B., Franjević, M., 2011: Šumarska entomologija – Opća entomologija-Unutarnja i vanjska građa kukaca, fiziologija, opća ekologija i biologija, Skripta, Šumarski fakultet, 44 str.
2. Hrašovec, B., Franjević, M., 2011: Šumarska entomologija – Posebni dio Pregled najznačajnijih vrsta šumskih kukaca i njihova osnovna biološka obilježja. Skripta, Šumarski fakultet, 113 str.
3. Entomološki vodič – skripta "on-line", http://hrast.sumfak.hr/~forbug/ (2004.)

Recommended literature

1. Hrašovec, B. 2004: Kukci – važni pokazatelji bioraznolikosti ali i povremeni uzročnici kalamiteta u šumskom ekosustavu. Hrvatsko šumarsko društvo, Zagreb, 76 str.
2. Kovačević, Ž., 1950: Primijenjena entomologija, I knjiga: Opći dio. Nakladni zavod Hrvatske, 217 str.
3. Kovačević, Ž., 1956: Primijenjena entomologija, III knjiga: Šumski štetnici. Poljoprivredni nakladni zavod, 535 str.
4. Chapman, R.F., 1998: The Insects – Structure & Function. Cambridge University Press, Cambridge, 770 str.
5. Ebner, S. & A. Scherer, 2001: Die wichtigsten Forstschädlinge. Insekten – Pilze – Kleinsäuger. Praxisbuch. Leopold Stocker Verlag, Graz, Österreich. 197 str.
6. Harde, K.W., 2000: A field guide in colour to beetles. Silverdale Books, Enderby, United Kingdom, 334 str.
7. McGavin, G., 2001: Essential entomology. Oxford University Press Inc., New York, 318 str.
8. Novak, I., 2000: A field guide in colour to butterflies and moths. Silverdale Books, Enderby, United Kingdom, 352 str.

Dendrology

ŠP4005

ECTS 6

English language R1

E-learning R2

Teaching hours 99
Lectures 45
Exercises 30
Field work 24

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Associate teacher for exercises
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Biological features, morphological characteristics, number of species and distribution of some of the genera of gymnosperms and angiosperms (dicotyledons and monocotyledons). The genera belong to the following families: *Ginkgoaceae*, *Araucariaceae*, *Pinaceae*, *Taxodiaceae*, *Cupressaceae*, *Taxaceae*, *Cycadaceae*, *Ephedraceae*, *Magnoliaceae*, *Lauraceae*, *Ranunculaceae*, *Berberidaceae*, *Platanaceae*, *Hamamelidaceae*, *Ulmaceae*, *Moraceae*, *Juglandaceae*, *Fagaceae*, *Betulaceae*, *Tiliaceae*, *Cistaceae*, *Tamaricaceae*, *Salicaceae*, *Capparaceae*, *Ericaceae*, *Ebenaceae*, *Pittosporaceae*, *Hydrangeaceae*, *Grossulariaceae*, *Rosaceae*, *Mimosaceae*, *Caesalpiniaceae*, *Fabaceae*, *Elaeagnaceae*, *Myrtaceae*, *Punicaceae*, *Cornaceae*, *Loranthaceae*, *Viscaceae*, *Santalaceae*, *Celastraceae*, *Aquifoliaceae*, *Buxaceae*, *Euphorbiaceae*, *Rhamnaceae*, *Vitaceae*, *Staphyleaceae*, *Hippocastanaceae*, *Aceraceae*, *Anacardiaceae*, *Simaroubaceae*, *Meliaceae*, *Araliaceae*, *Apocynaceae*, *Solanaceae*, *Verbenaceae*, *Lamiaceae*, *Oleaceae*, *Scrophulariaceae*, *Bignoniaceae*, *Caprifoliaceae*, *Asteraceae*, *Liliaceae*, *Smilacaceae*, *Ruscaceae* and *Agavaceae*. Morphological characteristics, intra-species variability, distribution, special characteristics, economic and ecological importance of the species among these genera. The subject covers autochthonous and allochthonous tree and shrub species, and the topics of the lectures follow a systematic order.

Type of course:

Dendrology (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To define and explain biological features and morphological characteristics of the genera of autochthonous gymnosperms (6 genera), allochthonous gymnosperms (18 genera), autochthonous angiosperms (trees - 28 genera, shrubs - 45 genera), allochthonous angiosperms (trees and shrubs - 27 genera), autochthonous and allochthonous angiosperms - vines (10 genera),	partial exams and final exam	B1
To identify and describe the autochthonous and allochthonous gymnosperms according to: habit (21 species), bark (12 species), twigs and buds in winter (5 deciduous species), leaves (49 species), cones and/or seeds (41 species);	partial exams and final exam	B1
To identify and describe the autochthonous and allochthonous angiosperms according to: habit (41 species), bark (27 species), twigs and buds in winter (72 deciduous species), leaves (196 species), flowers (61 species), fruits and/or seeds (123 species);	partial exams and final exam	B1
To use determination keys for autochthonous and allochthonous gymnosperms and angiosperms;	partial exams and final exam	B1
To group autochthonous and allochthonous gymnosperms and angiosperms (trees, shrubs and vines) according to biological features, morphological characteristics, distribution, economic, horticultural and ecological importance;	partial exams and final exam	B1
To choose autochthonous and allochthonous gymnosperms and angiosperms (trees, shrubs and vines) for various purpose in forestry and urban forestry;	partial exams and final exam	B1

General competences:

Students acquire theoretical and practical knowledge about autochthonous and allochthonous tree and shrub species. Theoretical knowledge encompasses biological features, morphological characteristics, intra-species variability, distribution, special characteristics, and the economical and ecological importance of species. Students acquire practical skills to recognize woody species on the basis of different morphological characteristics: habit, bark, leaves and twigs of deciduous species in winter, flowers, cones, fruits and seeds. They also gain knowledge on the practical use of trees and shrubs in forestry and urban forestry.

Type of instruction:

Lectures

Exercises

The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, flowers, cones, fruits and seeds. The students use plant material and determination keys.

Field work

Field work is held for three days in the lowland, mountain and Mediterranean regions of Croatia. During field work students collect herbarium specimens.

Working methods:

Teachers' obligations:

Giving lectures, exercises and field teaching. Holding consultations, partial exams, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material. Preparation of new and maintenance of existing herbarium specimens in the scientific herbarium of the Faculty of Forestry. Digitising herbarium specimens and entering data into the database of scientific herbarium.

Students' obligations:

Regular attendance at lectures, exercises and field work. Writing exercise and field work reports. Doing and submitting homework. Collecting herbarium specimens and passing herbarium exam. Passing partial and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				45		1.5
Exercises (E)	5%	60-70%	Sufficient (2)	30		1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Homework (HW)	5%	70-80%	Sufficient (2)		15	0.5
		81-89%	Good (3)			

		90-94%	Very good (4)			
		95-100%	Excellent (5)			
Field work reports, plant collection and herbarium preparation (FWR)				24		0.8
Herbarium exam (H)					6	0.2
Partial exam - gymnosperms (PEG)	30%	60-70%	Sufficient (2)		15	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - angiosperms (PEA)	60%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex5+HWx5+PEGx30+PEA x60)/100**		99	81	6

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**(FEx60+PEGx30+Ex5+HWx5)/100**				
*** students who do not pass the course through two partial exams during the semester take the final exam that is 60% of the grade and is the same as the partial exam - angiosperms; the remaining 5% is the grade of the exercises, 5% is the grade of the homework and 30% of the partial exam - gymnosperms**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercies and field work	Student attendance is recorded. Student may not be absent more than 20% of lectures and 10% of exercises.	IV semester	
Exercises	The exercises are attended in groups. The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, flowers, cones, fruits and seeds. The students use plant material and determination keys. At the end of each exercise the accuracy of determination is evaluated, and the evaluation affects the final grade.	IV semester	
Homework	After each lecture and practicum exercises, the students do their homework and submit it via the Herbarium DEND application. The homework is evaluated and affects the final grade.	IV semester	
Field work reports	After field work students prepare reports. Professor's signature confirms the accuracy of the report.	IV semester	
Herbarium collection and exam	On field work and field exercises students collect herbarium specimens. During the semester they take herbarium exam.	IV semester	
Partial exam - gymnosperms	Access requirements: regular attendance at lectures and exercises, positively graded gymnosperm exercises and homework. The partial exam consists of written and oral part. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics.	IV semester	
Partial exam - angiosperms	Access requirements: regular attendance at lectures, exercises and field work; positively graded all exercises and homework; signed field work reports; positively graded gymnosperm partial exam; collected herbarium and positively graded herbarium exam. The partial exam consists of written and oral part. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics. The angiosperm partial exam is the same as the final exam.	IV semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures, exercises and field work; positively graded all exercises and homework; signed field work reports; positively graded gymnosperm partial exam; collected herbarium and positively graded herbarium exam). The written exam is the same as the written part of the angiosperm partial exam.	Exam terms	
Oral exam	Access requirement: positively graded written exam. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics. The oral exam is the same as the oral part of the angiosperm partial exam. The final grade is obtained according to the formula: (FEx60+PEGx30+Ex5+HWx5)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2005: Listopadno drveće i grmlje u zimskom razdoblju. Šumarski fakultet Sveučilišta u Zagrebu. 256 pp.
2. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
3. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.
4. Šumarska enciklopedija Vol. I-III, 1980-1987. JLZ Miroslav Krleža, Zagreb.

Recommended literature

1. Anić, M., 1946: Dendrologija. Šumarski priručnik I, Zagreb. 475-582 pp.
2. Bean, W.J., 1989: Trees and shrubs hardy in the British Isles. John Murray Publ., Ltd., London.
3. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim. 915 pp.
4. Herman, J., 1971: Šumarska dendrologija. Stanbiro, Zagreb. 470 pp.
5. Hillier, J., Coombes, A. (Eds.), 2007: The Hillier manual of trees and shrubs. A David and Charles Books, Cincinnati.
6. Roloff, A., A. Bärtels, 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart. 853 pp.
7. Roloff, A., Weisgerber, H., Lang, U.M., Stimm, B. (Eds.), 1994–weiter: Enzyklopädie der Holzgewächse: Handbuch und Atlas der Dendrologie. Wiley-VCH.
8. Šilić, Č., 1973: Atlas drveća i grmlja. Zavod za izdavanje udžbenika, Sarajevo. 218 pp.
9. Vidaković, M., 1993: Četinjače – morfologija i varijabilnost. GZH & Hrvatske šume, Zagreb. 744 pp.

Silviculture I

ŠP5001

ECTS 7

English language R1

E-learning R1

Teaching hours 115
Lectures 45
Exercises 30
Field work 40 hours

Lecturer
Prof.dr.sc. Igor Anić
Doc.dr sc. Stjepan Mikac

Associate teacher for exercises
Prof.dr.sc. Igor Anić
Doc.dr sc. Stjepan Mikac

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The course encompasses the following four units: forest morphology, tending, regeneration, and basic silvicultural systems.
The first unit encompasses the following: the concept of silviculture; literature references; the meaning of silviculture related to the economic, environmental and social services of forests; silviculture and other scientific disciplines; silvicultural ways; features and history of the Zagreb School of Silviculture; place and role of silviculture in forestry science and practice; the concept of forest; forest as vegetation type; forest range; forest margin; forest border; forest production; origin and dynamics of forest; genesis and morphology of degraded forest forms; pioneer, transitory, and final tree species; the concept and elements of a forest stand; horizontal and vertical structure of a forest stand; the relation among the trees in a stand; exchange of tree species; stand forms; development stages of a stand, and stand structure dynamics.
The second unit encompasses the following: concept and aim of forest tending; biological, ecological and economic features of forest tending; inter-species and the inter-population competition; biological relations in tree selection during stand development; classification of trees in a stand; classification of silvicultural tending procedures; soil care; methods for young growth protection; supplementing the insufficiently regenerated areas; young growth care after final felling; cleaning of stands; cleaning methods; concept and purpose of stand thinning; stand thinning in this country – targets, intensity, volume, method and thinning cycle; effects of tending; tending in selection stand; tending in coppice; other forest tending methods; application of mechanisation and chemical substances in forest tending, and planning, organisation and forest care operation.

The third unit encompasses the following: concept of regeneration; regeneration types; regeneration area; beginning and duration of regeneration; methods of natural regeneration; conditions for regeneration; site preparation; ecology and biology of regeneration under canopy and regeneration upon naked regeneration area; natural regeneration by uniform shelterwood cutting: description of method, ecology of regeneration by uniform shelterwood cutting, forms of regeneration cuts, advantages and disadvantages; natural regeneration by selection cutting: description of method, ecology of regeneration by selection cutting, forms of cuts, advantages and disadvantages; natural regeneration by clearcutting: description of method, ecology of regeneration by clearcutting, forms of cuts, advantages and disadvantages; natural regeneration by shelterwood strip cutting: description of method, ecology of regeneration by shelterwood strip cutting, advantages and disadvantages; review of combined regeneration methods and irregular silvicultural system; artificial regeneration: concept, features; methods of regeneration of forest stand types in this country. Application in practice.
The fourth unit encompasses the following: forest management goal and silvicultural planning; high forest systems; coppice system; coppice with standards system; revitalisation of degraded forest forms; silvicultural procedures in forests for special purposes; substitution of stand form; conversion.
The exercises include analysing and practical drills of the following thematic units: the morphogenesis of tree; analyse of forest stand; structure of forest stands; analysis of the even-aged and selection stand structure; classification of trees in a stand; tending procedures in stands of high and coppice systems; tree marking in uniform shelterwood system and selection system, and silvicultural properties of forest stands in Croatia.
Excursions: I – natural and artificial regeneration of stands by uniform shelterwood cuts (preparatory cut, seed cut, additional cuts and final felling – aim, intensity, method); regeneration period; seed period, general and special regeneration period; young growth analysis; tending of young growth; site preparation; quantity of seeds/seedlings for artificial regeneration, and mixture ratio; II – The dynamics of Mediterranean forests, stands of holly oak and black ash (habitat, structure, care, regeneration); degradation forms of holly oak forests (maquis, garigue, stony ground – description, genesis, silvicultural procedures); degradation stages of pubescent oak forests (scrubwood, bushland, stony ground – description, genesis, silvicultural procedures); silvicultural procedures in the coppices of holly oak/pubescent oak; coppice with standards (description and management method), conversion of coppices; pioneer tree species and their role, and stands of Aleppo pine/black pine (tending, regeneration, substitution of stand form); III – morphology and structure of selection stands of single tree structure; morphology and structure of selection stands of group-like structure; natural regeneration by selection cut; selection of trees for cutting and the intensity of selection felling.

Type of course:

Silviculture I (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present morphology, forest dynamics and the structure of the forest stands (morphology of the forest edge and the upper and lower boundaries of the forest, silvidinamic, structure of the forest stands, stand form, dynamics of the stand structure, development stage of the stand).	Partial exam, Exercises, Final exam	B6
Apply the forest tending from the appearance of the young growth to the cleaning (inter-species and the inter-population competition, silvicultural selection, tending under the crowns of old trees, tending of young growth after the final felling, supplementing the insufficiently regenerated areas).	Partial exam, Exercises, Final exam	B6
Explain the tending of forest stand by thinning (goal, intensity, volume, method and interval, influence and effects).	Partial exam, Exercises, Final exam	B6
Present forest regeneration using clearcutting system and edge system (biology and ecology, using of methods, advantages and disadvantages).	Partial exam, Exercises, Final exam	B6
Present forest regeneration using shelterwood system (ecology and biology of process, tree species, shelterwood felling - advantages and disadvantages, preparatory felling, seeding felling, additional fellings, final felling, regeneration period).	Partial exam, Exercises, Final exam	B6
Present forest regeneration using selection system (selection structure, ecological factors in selection forest stand, tree species, functions of tree marking, advantages and disadvantages).	Partial exam, Exercises, Final exam	B6
Present high forest, coppice forest, coppice with standards forest.	Partial exam, Exercises, Final exam	B6

General competences:

The aim of the course is to introduce the student to the basics of silviculture – a scientific and specialist discipline for studying the processes and methods aimed at raising and forming a forest stand in the shortest possible time, at least costs, by sustaining the production ability of the soil, in order to gain optimal and permanent economic and non-commercial services. By taking this course, a student gets acquainted with the following: the genesis, morphology and structure of the forest; the structure and types of forest stands, and the silvicultural procedures in them; the analyses of the characteristics of pure and mixed forest stands, even-aged and selection stands, coppices and coppices with standards, and the features of the other basic silvicultural systems. A student is trained in practical activity in a forest stand, particularly for the implementation and control of the silvicultural procedures in forest tending and the silvicultural procedures of forest regeneration.

Tipe of instruction:

Lectures
Lectures cover 15 units according to the teaching plan.

Exercises
12 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 5 days. Three themes are discussed: regular forest management, selection forest management, forest management in the Mediterranean area. Field teaching is an upgrade to knowledge adopted in lectures.

Working methods:

Teachers obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, colloquia, written exams and oral exams. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	10%	60-70%	Sufficient (2)	70	5	2,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 1 (PE1)	30%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	30%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			

		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 3 (PE3)	30%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10 + Pe1x30 + Pe2x30 + Pe3x30)/100**		115	95	7

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			3
TOTAL	**100%**	**(Fex90+Ex10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (115 hours of direct lecturer)	-
Partial exam 1	The colloquium consists of 20 questions pertaining to the material from the forest morphology. The colloquium is evaluated and participates in the final evaluation of the subject.	4. week	-
Partial exam 2	The colloquium consists of 20 questions pertaining to the material from the forest tending. The colloquium is evaluated and participates in the final evaluation of the subject.	9. week	-
Partial exam 3	The colloquium consists of 20 questions pertaining to the material from the forest regeneration. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exame	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Anić, I., 2007: Uzgajanje šuma I. Skripta za internu uporabu, Sveučilište u Zagrebu, Šumarski fakultet, 97 str.
2. On the web site http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=99, under the subject of Silviculture I, there are links to Exercises, author I. Anić.

Recommended literature

1. Matić, S., 1996: Uzgojni radovi na obnovi i njezi sastojina hrasta lužnjaka. U: D. Klepac (ur.), Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj, HAZU i Hrvatske šume p.o. Zagreb, 167 – 212, Zagreb.
2. Matić, S., 1994: Šume visokih gora i planina dinarskog područja. U: Đ. Rauš (ur.), *Silvae nostrae Croatiae*, Ministarstvo poljoprivrede i šumarstva Republike Hrvatske, 145 – 153, Zagreb.
3. Matić, S., 1991: Njega šuma proredom. Šumarski fakultet, 45 str., Zagreb.
4. Matić, S., J. Skenderović, 1992: Uzgajanje šuma. U: Đ. Rauš (ur.), Šume u Hrvatskoj, Šumarski fakutet Zagreb & Hrvatske šume p. o. Zagreb, 81 – 97.
5. Matić, S., M. Harapin, 1986: Uzgajanje i zaštita šuma. Savez inženjera i tehničara šumarstva i drvne industrije, 177 – 194, Zagreb.

Basic foundations of forest regulation and planning

ŠP5002

ECTS 7

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 30
Field work 15

Lecturer
Prof. Jura Čavlović, PhD
Assist. prof. Krunoslav Teslak, PhD

Associate teacher for exercises
Assist. prof. Krunoslav Teslak, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject contains next topics: an overview of historical development in forest regulation and planning; definition of meaning and role of forests and forest regulation and planning; elements and notions in forest management: elements of stand structure, management system, selection of management form; sustainability (principle of sustainability and continuity); definition of normality (by means of forest area, growing stock, number of trees); calculation of normal (theoretical) growing stock in even-aged forests; calculation of normal growing stock in uneven-aged forests; time as planning element in forestry; maturity and types of maturity; determination of rotation; determination of mature tree diameter and time of felling; spatial forest management planning; categories of spatial forest division; forest division in management units; internal forest division; prescribed cut: in even-aged forests, in uneven-aged forests; management plan; methods of forest regulation and planning in even-aged forests: area methods, methods by growing stock and increment, combined methods; methods of forest regulation and planning in uneven-aged forests: methods by number of trees, methods by basal area, methods by growing stock, method by growing stock and increment, methods of current annual increment, methods of normality, methods based on simulation models.

Type of course:

Basic foundations of forest regulation and planning (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to recognize, to distinguish, to explain and to analyse meanings, content and elements of forest regulations and planning (content and type of plans, forest management systems, elements and dynamics of even-aged and uneven-aged stand structures, structure of volume and volume increment)	computational and computer exercises, partial exams, knowledge tests, final	B4, B5
to explain and to discuss principle of sustainability (monitoring system of sustainable forest management, forest certification, prerequisites and constrains of sustainable forest management)	computational and computer exercises, partial exams, knowledge tests, final	B4
to explain, to derive and to calculate models of theoretical forest (forest normality, theoretical growing stock of even-aged forest, theoretical growing stock of selection/uneven-aged forest)	computational and computer exercises, partial exams, knowledge tests, final	B4
to explain, to calculate and to apply time as component of forest regulation and planning (types of maturity, absolute and economic maturity, rotation lenght, diameter and age of maturity)	computational and computer exercises, partial exams, knowledge tests, final	B4
to explain and to apply space as component of forest regulation and planning and procedures of forest division (basic units of spatial forest dividing, functions of forest management unit dividing, procedures and criteria of forest dividing on compartments/subcompartments)	computational and computer exercises, partial exams, knowledge tests, final	B4, D1
to explain and to calculate possible (theoretical) cut in regulated forest (felling (regeneration) cut, thinning cut, cut in selection/multi-aged forest)	computational and computer exercises, partial exams, knowledge tests, final	B4, D1

General competences:

Acquiring of basic knowledge in forest regulation, which - based on the synthesis of other forestry disciplines (dendrology, ecology, phytocenology, silviculture, utilization, inventory) - represents the basis for forest regulation and planning by space and time.
Acquiring of knowledge and skils in synthesis of main forest disciplines in management plan, and skils of forest management plan usage.
Acquiring of basic knowledge as starting point for elaboration of forest management plans in next study level

Type of education:

Lectures

Exercises

There are perform 4 computational, 2 computer and 2 project exercises which elaborate main topics of course based on actual examples, as upgrade on knowledge acquired on lectures.

Working methods:

Teachers' obligations:

Performing of primary education – lectures, exercises and field work; preparing of exercises, educational materials and knowledge tests; performing of consultations, partial and final exams.

Students' obligations:

Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.

Methods of grading

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures (L)	-	-	-	30	15	1.5
Exercises (E)	10%	Partialy uncluttered, large correction and on time	Sufficient (2)	30	30	2
		Uncluttered, large correction and on time	Good (3)			
		Uncluttered, small correction and on time	Very good (4)			
		Uncluttered, corect and on time	Excellent (5)			
Field education (FE)	-	-	-	15	15	1
Partial exam 1 (PE1)	45%	60-70%	Sufficient (2)	2.5	35	1.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 1 (PE1)	45%	60-70%	Sufficient (2)	2.5	35	1.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10 + PE1x45-PE2x45)/100**		80	130	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	90 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2.5	72.5	2.5
TOTAL	**100%**	**(FEx90+Ex10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Checking and evidence of students attendance. Student is allowed exculpatory to absent of maximal 15% hours of direct teaching (10% of exercises and 20% of lectures)	semester (60 hours of direct teaching)	-
Field work	Checking and evidence of students attendance and their activity. Field teaching is fully obligatory.	semester (15 hours of direct teaching)	Exceptionally, in a case of exculpatory absent student is obliged to prepare seminar or to pass partial exam related on topics of field teaching
Preparing of exercises	Exercises are performing in groups up to 20 students, depending on total enrolled students. There are perform 4 computational, 2 computer and 2 project exercises. At beginning of semester, students get instructions for preparing of files and covers for exercises, and templates which include explanation of topics and actual examples for each exercise. Evaluation include correct, uncluttered and regularity of preparing and delivery of exercise. Exam include	according to defined deadline	Exceptionally student is obliged to work of , in a case of exculpatory absent of several exercise
Written exam	Attendance to exam is allowed to student who regularly get done and complete all exercises and field teaching. Written exam is possible to pass by two partial exams, at the middle and end of semester, or on exam dates scheduled after semester. Student get in advance prepared knowledge test, which include 10 questions (9 questions are in essay form which can include graphs, and 1 question relate on solving of problem example). Exams include testing and evaluation of knowledge and skills gained on lectures, exercises and field teaching. Attendance to the second partial exam is allowed to student who passed the first partial exam. Written exam is evaluated and contribute in final grade of the course.	defined deadlines of partial exams during semester, schedule of exam dates	
Oral exam	Prerequisite for oral exam is sufficient grade achieved on written part of partial exam or exam within scheduled exam date. Theoretical knowledge (from book) and understanding of teaching topics within exercises and field teaching are evaluated. The finish grade is get according to equation: **(WIx40+OIx50+Ex10)/100**		

Obligatory literature

1. Klepac, D., 1965: Uređivanje šuma, Znanje, Zagreb.
2. Čavlović, J., 2000: Metode uređivanja regularnih i prebornih šuma. Internal skript.
3. Knuchel, H., 1953: Planning and control in the managed forest. T. And A. Constable LTD., Edinburgh, p. 360.
4. Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, p. 322.

Recommended literature

1. Davis, L.S. & Johnson, K.N., 1987: Forest management. McGraw-Hill Book Company, New York.
2. *** Forest management plans of forest management units

Logging I

ŠP5003

ECTS 7

English language R1

E-learning R1

Teaching hours 92
Lectures 30
Exercises 30
Field work 32 hours

Lecturer
Prof. dr. sc. Tomislav Poršinsky

Associate teacher for exercises
Prof. dr. sc. Tomislav Poršinsky
Doc. dr. sc. Andreja Đuka
Doc. dr. sc. Dinko Vusić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject is structurally divided into several rounded off subunits, so in this way the problem of tree felling and processing works is separately analysed, as well as wood skidding and a long-range transport, but also their interdependence and interaction in contemporary technologies of logging. The study of work and time in forest utilisation is the basis of planning and work preparation and payment of completed works. Costs in forest utilisation are considered, as well as adequate laws, regulations and instructions. The exercises consider standards and models of manufacturing, models of effects and cost analyses and a breakeven point of the use of technical means and technologies of tree felling, processing and transport as well as models of optimum traffic net density in opening of forest stands.
Field classes refer to tree evaluation, tree felling and forest product processing, standardisation of forest products, wood utilisation in felling and processing, waste and structure of waste, bark, study of time in feeling and processing, the effect of cross-cutting by a motor chainsaw. Practical work also includes one-day field excursions, whose main objective is to be informed about contemporary operative achievements in technique and technology of forest utilisation.

Type of course:

Logging I (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the limiting and influential factors of timber harvesting (terrain characteristics, terrain trafficability and vehicle mobility, forest infrastructure networks and forest accessibility, climatic conditions, impact of stand features).	Exercises, Final exam	B9
Define the harvesting plan (motor-manual tree felling and timer processing, mechanised tree felling and timber processing, volume quality estimation of standing trees, utilisation of timber volume during feeling and processing).	Exercises, Final exam	B9
Present the timber transport (long distance timber transport, determination of optimum distance between forest roads, type of landing sites, timber truck transport, performance analysis and costs of timber truck transport).	Exercises, Final exam	B9
Analyse timber extraction (primary timber transport by: adapted agricultural tractor, tractor-trailer system, skidder, forwarder, forest skyline and helicopter).	Exercises, Final exam	B9
Present timber harvesting systems (production of forest biomass, timber harvesting in an environmentally sound manner).	Exercises, Final exam	B9

General competences:

The focus of the subject is on practical knowledge necessary for the educational profile of the bachelor to fulfil the requirements of less complex tasks in forestry.

Tipe of instruction:

Lectures

Lectures cover 12 units according to the teaching plan.

Exercises

11 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is scheduled for 4 days. Two themes are discussed.

Working methods:

Teachers obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,5
Exercises (E)	20%	60-70%	Sufficient (2)	62	60	2,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	60	3,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + FEx80)/100**		92	120	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			3,0
TOTAL	**100%**	**(Fex80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (92 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exame	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Predavanja (CD) i najnovije objave u domaćim i stranim stručnim i znanstvenim časopisima (Mehanizacija šumarstva, Šumarski list, Drvna industrija, Glasnik za šumske pokuse, FTI, Holzzentralbllat, FERIC i drugi).
2. Laurov, Z., 1999: Pozyskiwanie drewna. Wydawnictwo SGGW, Warszawa, 1-376.
3. Krpan, A.P.B., Zečić, Ž., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1-98.
4. Winkler, I., Košir, B., Krč, J., Medved, M., 1994: Kalkulacije stroškov gozdarskih del. Strokovna in znanstvena dela 113, Biotehnička fakulteta v Ljubljani – Oddelek za gozdarstvo, Inštitut za gozdno in lesno gospodarstvo, 1 – 69.
5. Krpan, A.P.B, 1992: Iskorišćivanje šuma (Forest exploitation). Monografija "Šume u Hrvatskoj", Šumarski fakultet Sveučilišta u Zagrebu i „Hrvatske šume" p.o. Zagreb, 153 – 170.
6. Grammel, R., 1988: Holzernte und Holztransport. Verlag Paul Parey, Hamburg und Berlin, 1-242.
7. Benić, R., 1987: Transport, šumski. Šumarska enciklopedija 3, JLZ "Miroslav Krleža" Zagreb, 519 – 520.
8. Conway, S., 1986: Logging practices, Principles of timber harvesting systems. Miller Freeman Publications, 1-432.
9. Anon., 1966: Šumarsko-tehnički priručnik. Nakladni zavod Znanje, Zagreb, 1-568.
10. Ugrenović, A., Benić, R., 1957: Eksploatacija šuma. Grafički zavod Hrvatske, 1 – 481.

Recommended literature

1. FBVA, 2003: CDR "500 Forstmaschinen – Maschinenbeschreibung und Seibstkostenrechnung". Bundesampt und Forschungszentrum für Wald - Abteilung für Forsttechnik.
2. Dykstra, D.P., Heinrich, R., 1996: FAO model code of harvesting practice. FAO, Rome, 1 – 85.
3. Anon., 1993: Manuel d'exploatation forestière, Tome I. ARMEF & CTBA, Paris, 1-442.
4. Berg, S., 1992: Terrain Classification System For Forestry Work. Forest Operations Institute "Skogsarbeten", 1 – 28.
5. Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.
6. Grammel, R., 1988: Holzernte und Holztransport. Verlag Paul Parey, Hamburg - Berlin, 1 – 242.
7. Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219.
8. Taboršak, D., 1987: Studij rada. Tehnička knjiga Zagreb, 1 – 214.

The basic of forest mechanization

ŠP5004

ECTS 5

English language R1

E-learning R1

Teaching hours 76
Lectures 30
Exercises 30
Field work: 16 hours (2 days)

Lecturer
Prof.dr.sc. Marijan Šušnjar
Doc.dr sc. Zdravko Pandur

Associate teacher for exercises
Prof.dr.sc. Marijan Šušnjar
Doc.dr sc. Zdravko Pandur
Marin Bačić, mag. ing. silv.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students learn about the development, basis and classification of the most important forest machines for mechanisation of works in forestry, principles of their building and their most important energetic and ecological features. The first part of classes deals with chapters on basic knowledge on measurement, measured values, measuring systems, materials for building forest machines and their features and chosen chapters from engineering thermodynamics, technical hydromechanics and technical electrical engineering. After having met the components of forest machines, their driving engines, the lectures include the review of the individual group of machines, like devices for cutting and processing (motor chainsaws), equipment of mechanised loading and unloading (forest cranes and forest winches), special forest vehicles (adapted agricultural tractors, skidders, forwarders, forest trucks).

Type of course:

The basic of forest mechanization (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe metering systems, basic metric sizes	Exercises, Final exam	A3
Interpret materials in the construction of forest machines (material types, properties - choice of materials, strength and hardness of materials).	Exercises, Final exam	B9
Interpret the energy in forestry (energy balance of forestry, energy consumption, environmental suitability, toxicity and ecology of liquid fuels and lubricants).	Exercises, Final exam	B9
Interpret the use of forest vehicles and devices (chainsaws, skidders, forwarders, adapted farming tractors forest trucks)	Exercises, Final exam	B9

General competences:

Apart from the basic knowledge of measured values, materials for building forest machines, with the chosen chapters from the mechanics, engineering thermodynamics, technical hydromechanics and machine elements, important for understanding the principle of building and work of forest machines, students learn about the ways of measuring some values and processing of measurement results by a personal computer using specially made softwares.
The second important objective of the subject is to inform students about the basic analysis of forest machines for mechanisation of specific forest works.

Tipe of instruction:

Lectures
Lectures cover 5 methodical units according to the teaching plan.

Exercises
Exercises are performed in the form of measurement and calculation. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 3 days according to the teaching plan.

Working methods:

Teachers' obligations:
Maintaining original teaching: lectures, exercises and field teaching. Organization of field trips. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Field work				16		0,5
Exercises (E) and writing of reports from filed work	20%	60-70%	Sufficient (2)	30	30	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	80%	60-70%	Sufficient (2)	-	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PEx80)/100**		76	75	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
UKUPNO	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercies and field work	The attendance is checked and the attendance of the students is recorded. Filed work and measuring exercises are obligatory. A student may justifiably be absent with a maximum of 20% of other types of direct teaching hours (lecturers and calculation exercises).	semester (76 hours of direct lecturer)	-
Exercises prepartion	Exercises are attended by groups. 4 measuring tasks are performed within the exercise. Students become acquainted with measurement methods, independently perform measurements and process data. At the beginning of the first exercise, students will receive templates with exercise	in accordance with the agreed terms	-

	assignments, as well as the appearance of the collage, jumper, and list of suggestions in which they will respond to the set tasks in printed form.The accuracy, regularity and regularity (time-honored exercises) are evaluated.		
Written exam	Examinations can be attended by students who have completed exercises and field teaching. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade is calculated according to formula: **Ex20+PEx80/100**	Exam terms	

Obligatory literature

1. CD with lectures in "Windows Power Point" presentations with printed vesrion.
2. B. Kraut: Strojarski priručnik. Tehnička knjiga Zagreb, 1988, s. 53-74, 133-222, 255-287, 313-482.
3. S. Sever: Šumarski strojevi. Tehnička enciklopedija, LZ "Miroslav Krleža", svezak 12, Zagreb, 1992, s. 519-531.
4. Šumarska enciklopedija, LZ "Miroslav Krleža", svezak 1, 2, 3, poglavlja: a) Harvester, s. 50-51., b) Procesor, s. 78-80., c) Skider, s. 208-210., d) Koranje, s. 278-281., e) Traktor, s. 78-80., f) Rasadnik, s. 119-130., g) Žičare, s. 651-659.
5. Selected profesional and scientific papers published in scientific journals which are available for studnets in the libraries of Faculyt of Foresty and Forest Engineering Institute.

Recommended literature

1. C. E. Malmberg: The off-road vechicle. (Volume 1)Atlanta, USA, Montreal, Canada, 1989., s.1-573.
2. C. E. Malmberg: The off-road vechicle. (Volume 2) Atlanta, USA, Montreal, Canada, 1989., s.1-463.
3. Conway, S., 1976: Logging practices., Principles of timber harvesting systems. Miller Freeman Publications, 1 – 432.
4. MacDonald, A.J., 1999: Harvesting Systems and Equipment in British Columbia. FERIC, Handbook No. HB-12, 1 – 197.
5. Owende, P. M. O., Lyons, J., Haarlaa, R., Peltola, A., Spinelli, R., Molano, J., Ward, S. M., 2002: Operations protocol for Eco-efficient Wood Harvesting on Sensitive Sites. Project ECOWOOD, Funded under the EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 – 74.
6. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/Boston/Lancaster, 1 – 371.
7. Professional and scientific papers from international conferences deal with forest work mechanization according to the choice of lecturer (available in the library of Forest Engineering Institute).

Nature and environmental protection

ŠP5005

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Professor Željko Španjol
Associate Professor Damir Barčić

Associate teacher for exercises
Assistant Professor Roman Rosavec

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the historical development of ideas and activities in the field of nature protection in our country and in the world. The introduction introduces topics related to the factors that influence nature, the organization of nature protection in our country and in the world, the most important laws, documents and conventions in the field of nature protection. Particular attention is focused on the categories of protected natural values, their basic characteristics and the state of tendency of the movement of nature protection in our country and in the world. The lectures also cover issues of sustainability, sustainable development in the management of natural resources.

Type of course:

Nature and environmental protection (compulsory/elective course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze the protection of flora and fauna and the protection of forest ecosystems (rare and endangered species, endemic species of biological diversity, forest management on the basis of endurance, forest in protected areas).	Partial exam , seminars, Final exam	B8
Explain the protection of air, water, soil and biological and landscape diversity of Croatia (protection measures and wastewater treatment, ecological value of soil, factors affecting air pollution and contamination).	Partial exam, seminars, Final exam	B8
Improve waste management, sustainable sustainable development and renewable energy sources (waste management, soil, water and air impact, anthropogenic greenhouse effect).	Partial exam, seminars, Final exam	D1

General competences:

Overview of Structure and Methods of Institution Management in Protected Areas.
Structure of public institutions for the protection of natural values.
Planning of basic activities in environmental protection.
Analysis of basic monitoring and inventory methods.

Tipe of instruction:

Lectures

Exercises

Seminars are conducted as part of the exercise. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, written exams, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30	0	0,5
Exercises (E)	10%	50-70%	Sufficient (2)	11	10	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	45%	50-70%	Sufficient (2)	2	25	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	45%	50-70%	Sufficient (2)	2	25	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + P1x40 + P2x40)/100**		45	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			4
TOTAL	**100%**	**(Fex80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (45 hours of direct lecturer)	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Ex20)/100**		

Obligatory literature

1. Barčić, D., Španjol, Ž. 2017: Nature and environmental protection. Script for internal use, Department of Forest Ecology and Silviculture, Faculty of Forestry University of Zagreb, Zagreb.
2. Rauš, Đ. 1991*:* Zaštita prirode i čovjekova okoliša**.** Šumarski fakultet, Sveučilište u Zagrebu, Zagreb

Recommended literature

1. Carter, N. 2004: *Strategije zaštite okoliša,* Barbat, Zagreb.
2. Glavač, V. 1999**:** *Uvod u globalnu ekologiju***,** Državna uprava za zaštitu prirode i okoliša i Hrvatske šume d.o.o. Zagreb.
3. Martinović, J. 1997: *Tloznanstvo u zaštiti okoliša***,** Državna uprava za zaštitu okoliša. Zagreb.
4. Potočnik, V. 1997: *Obrada komunalnog otpada – svjetska iskustva***,** MTG Consulting, ZGO d.o.o., Državna uprava za zaštitu okoliša. Zagreb.
5. Potočnik, V., Lay, V. 2002: *Obnovljivi izvori energije i zaštita okoliša u Hrvatskoj*, Ministarstvo zaštite okoliša i prostornog uređenja RH i «Barbat». Zagreb.
6. Španjol, Ž., 1994: *Problematika nacionalnih parkova u svijetu i u Republici Hrvatskoj*. Glas.šum. pokuse 30: 61-94, Zagreb.
7. Španjol, Ž. 1993**:** *Uloga posebno zaštićenih objekata prirode u turizmu***,** Glas. šum. pokuse, posebno izdanje 4: 231-242, *Zagreb.*
8. *Ekološki leksikon***,** 2001: Barbat i Ministarstvo zaštite okoliša i prostornog uređenja RH. Zagreb.
9. *World Resources 2000-2001: People and Ecosystems: The Fraying Web of life***,** 2000: Elsevier Science. Oxford.

Forest Roads

ŠP6001

ECTS credits 5

English R1

E-learning R1

Teaching hours 92
Lectures 30
Practical exercises 30
Field classes 32 hours (4 days)

Lecturers
Prof. Tibor Pentek
Assist. Prof. Ivica Papa

Practical exercises led by:
Prof. Tibor Pentek
Assist. Prof. Ivica Papa
Assist. Prof. Kruno Lepoglavec

Grading system
Fair (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The course Forest Roads introduces students to the basic features of forest roads for overall forest management. It provides definitions, technical features and classification of primary forest roads and secondary forest roads – skid roads and trails. Furthermore, it divides the basic components of a complex procedure for actually establishing an optimal forest road network to planning, design, construction and maintenance. The course focuses on different systems of providing primary and secondary accessibility of forest roads. It also explains the process of forest road designing and determines the basic types of design and their basic components. Students gain knowledge of the construction elements of forest roads, traffic load and vehicle movement theory. The course also presents the rules of horizontal and vertical development of the forest road route and gives information on positioning plan, vertical and cross section of primary forest roads. It also defines upper and lower forest road layers as well as types of pavement constructions. This course also deals with the process of construction and maintenance of forest roads studying the machines used for this purpose.

Course category:

Forest roads (compulsory course, 6th semester, 3rd year)

Learning outcomes and assessment

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain forest roads, planning and design. Gain knowledge of technical features of secondary forest roads, relative forest opennes, forest roads inventory, conceptual and general project, register of forest road infrastructure.	practical exercises in computer classroom, midterm exam, knowledge test, final exam	B10
Explain the zero line, operational and axial polygon of forest roads (designing zero lines on forest management map and on the ground, integrating the operational polygon into non-linear forest road polygon).	practical exercises in computer classroom, midterm exams, knowledge test, final exam	B10
Define the ground plan of the forest road (constructive elements of the forest road, main elements of the horizontal circular curves, detailed positioning plan, profiling the axis of the forest road route).	practical exercises in computer classroom, midterm exams, knowledge test, final exam	B10
Analyze vertical and normal cross-sections of the forest road (constructive elements of the forest road in the design, incurved and curved grade level, calculation of constituents, leveling of the axis profile of forest road).	practical exercises in computer classroom, midterm exams, knowledge test, final exam	B10
Explain upper and lower forest road layers (calculation of earth volume, earth volume diagram, evidence of measures – preliminary estimate of works and costs).	practical exercises in computer classroom, midterm exams, knowledge test, final exam	B10
Explain the construction and maintenance of forest roads / roads (technology of construction on plains and slopes, type of forest road maintenance, secondary forest road).	practical exercises in computer classroom, midterm exams, knowledge test, final exam	B10

General competencies:

The objective and aim of the course Forest Roads is to transfer to students the basic knowledge on forest roads, their role in the forest ecosystem, classification, planning, design, construction and maintenance as a basis for future courses related to this topic. Also, through practical exercises and field classes, students gain specific knowledge applicable in practice if they are graduate students.

Course modalities:

Lectures

Lectures cover 15 units according to the teaching plan.

Practical exercises

Practical exercises in design consist of fifteen sessions in planning and design of forest roads. These exercises build on the knowledge acquired in lectures.

Field classes

In field classes, students apply the knowledge acquired in lectures and practical exercises on specific examples. Through practical field work, applying the direct method of field survey, they collect all data needed to develop the main/implementing project design of forest roads.

Working methods:

Teachers' obligations:

Teaching activities - lectures, practical exercises and field classes. Organization of field classes, office hours, midterm exams and written and oral exams. Preparation of teaching materials.

Students' obligations:

Regularly attend and actively participate in lectures, practical exercises and field classes. Take midterm exams, or written and oral exams.

Assessment method=Exam

Evaluation elements	Share in evaluat.	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Completion of practical exercises and assignments for field classes (V)	20 %	Partly disordered and incomprehensible, with major corrections and within time	Sufficient (2)	62	10	2
		Neat, legible, with major corrections and in time	Good (3)			
		Neat, legible, with minor corrections and within time	Very good (4)			
		Neat, legible, accurate and within time	Excellent (5)			
Midterm exam I, II and III	(80) %	60-70 %	Sufficient (2)	0	30	1
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
Exam (WE)	80 %	60-70 %	Sufficient (2)	0	30	1
		71-80 %	Good (3)			
		81-90 %	Very good(4)			
		91-100 %	Excellent (5)			
TOTAL	**100%**	**(Vx20 + (K3x80) + PIx80)/100**		92	70	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)		60-70 % 71-80 % 81-90 % 91-100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)			1
TOTAL	**100 %**	**(ZIx80+Vx20)/100 e.g.**				

*** students who do not pass the midterm exams during the semester shall take the final exam that makes up for 80% of the grade, the remaining 20% being the grade for practical exercises**

Detailed explanation of rules for preparing and taking midterm exams, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + practical training	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	Semester (60 hours of direct teaching)	-
Completion of practical exercises	Students attend practical exercises in groups. A total of 15 design exercises are carried out using a suitable computer program. At the beginning of the first practical exercise, students get templates with data on one forest road, and the appearance of the file where all documents of the designed forest road will be stored after certain exercises. Assessment is given for accuracy, commitment and attendance in practical exercises.	As agreed	Exceptionally, in case of justified reason students may subsequently perform individual practical exercises
Midterm exam I	All students can take the first midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	5^{th} week	
Midterm exam II	Only students who passed the first midterm exam can take the second midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	10^{th} week	
Midterm exam III	Only students who passed the previous midterm exams can take the third midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	15^{th} week	
Written exam	The exam can be taken by students who have attended practical exercises. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course:**(Vx20 + (K3x80) + PIx80)/100**		

Obligatory literature

1. Pentek, T., 2012: Šumske prometnice (.pptx and .pdf lectures 1-15), Faculty of Forestry, University of Zagreb.
2. Pičman, D., 2007: Šumske prometnice (sveučilišni udžbenik), Faculty of Forestry, University of Zagreb, pp 1-460, selected chapters.
3. Šikić, D. i dr., 1989: Tehnički uvjeti za gospodarske ceste, Znanstveni savjet za promet JAZU, Zagreb, pp 1-40, selected chapters.

Recommended literature

1. Dobre, A., 1994: Gozdne prometnice (skripta), Univerza v Ljubljani, Biotehniška fakulteta, pp 1-71.
2. Jeličić, V., 1983: Šumske ceste i putevi, SIZ odgoja i usmjerenog obrazovanja šumarstva i drvne industrije SRH, Zagreb, Palmotićeva 17a, pp 1-193.
3. Potočnik, I., 2007: Gozdne prometnice (skripta), Univerza v Ljubljani, Biotehniška fakulteta, pp 1-221.

Organization basics in forestry

ŠP6002

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 3 days

Lecturer
Prof. Mario Šporčić, PhD.
Assist. prof. Matija Landekić. PhD.

Associate teacher for exercises
Prof. Ivan Martinić, PhD.
Assist. prof. Matija Landekić, PhD.
Matija Bakarić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basics of forestry organization theory and forestry companies with reference to particularities in forestry industry, review of legislation dealing with forests and forestry, organizational forms and company structure in forestry. Organizational units, functions, activities and models of their production and business linkage.

Mandate of forestry and forestry companies. Long-term planning and annual plans for the sector of forest managing. Structure and functional interrelatedness of bottom units by means of horizontal and vertical information flows.

Scientific systems of work research, methods of work experiment research and regular work research, identifying of work process implementation regularities, differentiated basis systems for evaluation of work process components in forestry. Level of normal (optimal) work and extent of efforts invested while working, issues of individual and group work, methods of identifying and balancing means of production capacities, research methods of work conditions in forestry.

Business operation actors and locations, foreseeing methods and techniques, and production planning, work preparation and production design, monitoring and regulating of business events, business performance analysis. Performance of annual production/business tasks illustrated with various work-site situations. Inductive and deductive production/business flows.

Improvement of acquiring and distribution of income, payment and stimulating of workers, doing business with the environment. Data as basis for information production for the purpose of business decision making. Appropriate leading, management skill, and decision making.

Type of course:

Organization basics in forestry (compulsory course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the study of forestry work (models of study for different levels of application, comparative analysis of existing models).	Exercises, colloquia, test of knowledge, final exam	C1
Apply time and work study (features of work study in forestry, main areas and procedures, work design, work value study).	Exercises, colloquia, test of knowledge, final exam	C1
Analyze work study methods (current observation method, calculation-analytical method of study, work motion study).	Exercises, colloquia, test of knowledge, final exam	C1
Present shaping of organization, organizational structure and types of organizations (organizational design factors and company organizing process, elements and types of organizational structure).	Exercises, colloquia, test of knowledge, final exam	C1
Define economic organizations, organization management and organizational changes (types of economic organizations, business processes, governance bodies, sources and organizational change drivers).	Exercises, colloquia, test of knowledge, final exam	C1

General competences:

The purpose is to master the organization in the business, in the company, in the organizational part of the company, in the workplace, in the process of control, records and performance analysis.

Tipe of instruction:

Lectures

Lectures include 6 methodological units, according to the teaching plan.

Exercises

Exercises are performed in the form of methodical, measuring and calculating exercises. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Within the course, students have 3 days of field work according to the curriculum.

Working methods:

Teachers' obligations:

Holding the original teaching: lectures, exercises and field work. Organization of field work, having consultations, colloquia and exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, exercises and field work. Taking the colloquia, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30		1
Field work				24		0,75
Exercises (E) and writing of seminars from field work	20%	Partly disordered and incomprehensible, with major corrections, on time	Sufficient (2)	30	15	1,5
		Orderly and comprehensible, with major corrections, on time	Good (3)			
		Orderly and comprehensible, with minor corrections, on time	Very good (4)			
		Orderly, comprehensible and accurate, on time	Excellent (5)			
Colloquia (C2)	80%	60-70%	Sufficient (2)		55	1,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + C2x80)/100**		84	70	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,75
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercies and field work	The student attendance is checked and recorded. Field work and measuring exercises are mandatory. The student can justifiably be absent with a maximum of 20% of the hours of other forms of direct teaching (lectures and calculation exercises).	semester (60 hours of direct lecturer)	-
Excersises	Exercises are attended in groups. Within exercises methodical, measuring and calculating exercises are performed. Students become acquainted with measurement methods and independently solve practical problems and tasks from forestry practice. At the beginning of the first exercise, students receive templates with exercise assignments, as well as the appearance of the file, skin, and template list in which they will answer to the set tasks in printed form. The accuracy, orderliness and regularity (exercises handed on time) are evaluated	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student works of the absence of the individual exercise
Colloquia from held teaching material	Students can pass the exam through two colloquia. The students in the prepared printed exam answer the questions asked and solve the calculation tasks. The Colloquia is evaluated and participates in the final grade of the subject upon performed and submitted exercises, according to the formula (Ex20 + C2x80) / 100	8. and 15. week	Students who do not pass the colloquia, approach the final exam
Written exam	Exam can be attended by students who solved and submitted exercises. The students in the prepared printed exam answer the questions asked and solve the calculation tasks. The written exam is evaluated and participates in the final grade of the subject	Exam terms	
Oral exame	Students who pass a written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula (FEx80+Ex20)/100		

Obligatory literature

1. Žugaj, M., Šehanović, J., Cingula, M.: Organizacija. TIVA Tiskara Varaždin, 2004.
2. Sikavica, P., Novak, M., 1999: Poslovna organizacija. Informator, Zagreb, 1999.

Recommended literature

1. Žugaj, M., Schatten, M.: Arhitektura suvremenih organizacija. Tonimir, Varaždinske Toplice, 2005.
2. Buble. M.: Metodika projektiranja organizacije. Sinergija-nakladništvo d.o.o., Zagreb 2006.
3. Šporčić, M., 2003: Uspostava modela potvrđivanja izvoditelja šumskih radova. Magistarski rad, Šumarski fakultet Sveučilišta u Zagrebu.
4. Šporčić, M., 2007: Ocjena uspješnosti poslovanja organizacijskih cjelina u šumarstvu neparametarskim modelom. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu
5. Peter F. Drucker: Upravljanje u budućem društvu. M.E.P. Consult, Zagreb, 2006.
6. Šporčić, M., Landekić, M., Lovrić, M., Bogdan, S., Šegotić, K., 2010: Višekriterijsko odlučivanje kao podrška u gospodarenju šumama – modeli i iskustva. Šumarski list 134 (5-6): 275-286.
7. ** propisi iz područja poslovanja u šumarstvu

Work safety in forestry

ŠP6003

ECTS 3

English language R1

E-learning R1

Teaching hours 53
Lectures 30
Exercises 15
Field work 8

Lecturer
Prof. Ivan Martinić
Assist. prof. Matija Landekić

Associate teacher for exercises
Prof. Mario Šporčić
Assist. Prof. Matija Landekić
Matija Bakarić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to work safety in forestry. The concept, subject and tasks of work safety as an integral part of the concept of modern business.
Overview of various aspects of health, legal, technical and social work safety in forestry.
Biomechanics of the human organism, physiological processes at rest and at work, work ability and adaptation of the human organism to the type of work (oxygen consumption and heart rate, fatigue and recovery).
Sources and types of hazards (mechanical, chemical, biological), occupational diseases (hearing loss, vibration disease, low back syndrome, etc.), monitoring the level of the working technique as an important requirement of work safety.
Study and risk calculation for forestry operations.
Analysis of the legislative framework for forest safety. Occupational safety and health act. Ordinance on occupational safety and health in forestry and the international standards on exposure to hazardous in forest activities.
The principles and measures of safety at work in forestry: the organization of occupational safety functions in the forestry company, the implementation of safety at worksites, personal protective equipment, hygiene standards and first medical aid.
Analysis of features and statistical injury indicators of forest work in Croatia

View of the safety working rules with the most common forestry jobs (felling and cutting, skidding, remote transport etc.)
Safety working rules in silviculture. Biological hazards in forest work.
Analysis of misconduct and risky situations. Training for safe work.
Analysis of working techniques and safety working rules on trees in urban environments. The technique of working from the ground and at the height.
Dealing with injuries at work: investigation, preparation of record, documenting, reporting and others.

Type of course:

Work safety in forestry (compulsory, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain work safety in forestry - theoretical basics (role of anthropometry, biomechanics and ergonomics in forestry)	practice exercises, partial exam, knowledge test, final exam	C3
Interpret the legal framework of safety in forestry and risk assessment (types of hazards, design and implementation of protection measures).	practice exercises, partial exam, knowledge test, final exam	C3
Present the safety working rules for major forestry works (felling and cutting, skidding / forwarding, silviculture, biological hazards in forestry - hornet sting, tick-borne disease).	practice exercises, partial exam, knowledge test, final exam	C3
Present the organization of safe work on forest working sites (planning of a temporary forest site, procedure in case of accident at work).	practice exercises, partial exam, knowledge test, final exam	C3

General competences:

Ability to conclude the basic legalities of human interaction and the factors of the working process.
Developing the skill of assessing requirements and risk analysis in forest work and mastering the techniques of improving work processes.
Professional adoption of engineering knowledge for designing and organizing safer and economically efficient work.

Type of instruction:

Lectures

Exercises

As part of the methodical exercises, fourteen units are performed, which contain individual measurements and / or calculations, and critical video reviews, where they are related to forest safety. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Within the field work (1 day), an active timber harvesting site is visited at the forest office level, where the groups evaluate the work performance of forest workers at phase I and phase II according to the field manuals and the previously conducted preparation for field work!

Working methods:

Teachers' obligations:

Maintaining original teaching – lectures, exercises, field work. Compiling partial exams, knowledge tests and evaluating them. Maintenance of partial exams, written and oral exams and consultation. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, exercises and field work. Taking partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	10%	Partially untidy and incomprehensible, with major corrections and on time	Sufficient (2)	15	-	0,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Field work (FW)	10%	Present, participates passively	Sufficient (2)	8	-	0,3
		Present, closely follows and participates	Good (3)			
		Present, includes with questions and comments	Very good (4)			
		Present, suggests concrete suggestions related to the theme of field work	Excellent (5)			
Partial exam (PE)	10%	60-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Final exam (FE)	70%	60-70%	Sufficient (2)	-	22	0,7
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FWx10+Ex10 + PEx10 + FEx70)/100**		53	37	3

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,2
TOTAL	**100%**	**(FEx80+Ex10 + FWx10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	The attendance of the students is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Making exercise	Exercises are attended in groups. As part of the exercise, 14 practical units are performed. Before starting each individual exercise, students receive task templates. At the first exercise session, students receive the folder layout and suggested printed form of sheet in which they will respond to set tasks. Accuracy, neatness and regularity is evaluated (exercise submitted on time).	in accordance with the agreed time	Exceptionally, in the case of a justified reason, the student compensates the absence from the individual exercise
Field work	Within the field work (1 day), an active wood harvesting site is visited, where the groups evaluate the performance of the forestry workers at working phase I and phase II.	according to the plan of field work	Exceptionally, in the case of a justified reason, the student is allowed to compensate field work later on
Partial exam	Students on the previously designed printed exam answer questions, rounds out the correct answers, supplement the key terms within sentences. The partial exam is evaluated and participates in the final grade of the subject.	11. week	Students who pass the partial exam can access the final exam
Written exam	Exams can be attended by students who have fulfilled the requirement of attending lectures and passed partial exam. Students on the previously designed printed exam answer questions, rounds out the correct answers, supplement the key terms within sentences. The written exam is evaluated	Exam terms	

	and participates in the final grade of the subject.		
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula **Ex10+FWx10+PEx10+FEx70/100**		

Obligatory literature

1. Collection of presentations from the subject „Work safety in forestry“ (for existing academic year)
2. Landekić, M., Martinić, I., Bakarić, M., Ricart, R.M., Šporčić, M., 2017: Vocational training of workers in the forestry sector – the situation in Croatia and trends in Europe. Šumarski list. 141 (7/8), 395-407
3. Landekić, M., 2010: Development of Safety Responsibility Model in Private Forestry Sector. Nova mehanizacija šumarstva. 31 (2010); 45-52
4. Hrvatske šume Ltd., 2007: Instructions for working safely when felling and cutting wood.
5. Occupational safety and health act (NN 96/18)
6. Ordinance on occupational safety and health in forestry (NN 10/86)
7. Ordinance on occupational safety and health in HŠ Ltd.

Recommended literature

1. Martinić, I., Landekić, M., Šporčić, M., Lovrić, M., 2011: Forestry at the Doorstep of EU – How Much are We Ready in the Area of Occupational Safety in Forestry? Croatian journal of forest engineering. 32 (2011), 1; 431-441
2. Landekić, M., Martinić, I., Šporčić, M., Pentek, T., Poršinsky, T., Bakarić, M., 2018: Current State and Improvement Potential of Forestry Workers Training in Croatia. Croatian journal of forest engineering. 39 (2), 289-298
3. Safety and health in forestry work - An ILO Code of practice. ILO, Geneva1998, str. 1-166
4. (razni autori) 1990: Zbornik savjetovanja “Životni i radni uvjeti proizvodnih radnika u šumarstvu i njihov utjecaj na zdravstveno stanje i socioekonomski položaj “, Rovinj. Objavljeno u: Radovi 25/1, šumarski institut Jastrebarsko, 1-222.

Forest phytopathology

ŠP6004

ECTS credits 5

English R1

E-learning R1

Teaching hours 76
Lectures 30
Practical exercises 30
Field classes 16

Lecturer
Prof. Danko Diminić

Practical exercises led by
Jelena Kranjec Orlović, PhD

Grading system
Insufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Forest phytopathology studies causative agents and diseases of forest trees. Contents are divided into general and special part.
In general part students get acquainted with groups of biotic causative agents of diseases.
Since fungi are most significant causative agents of diseases, course deals with symptoms they cause, their systematics, pathogenesis, specialization, physiology and biology.
Students get knowledge about susceptibility of plants to diseases. In special part of course students get to know the most significant fungi which cause diseases of forest trees.
This topic is studied through separate units: diseases of forest seeds and fruits, plant diseases in nurseries, broadleaves diseases, conifers diseases and causative agents of wood rot.
For each fungal species students learn about its distribution, morphological-taxonomical characteristics, biology, disease symptoms and harmful effect.

Type of course:

Forest phytopathology (obligatory course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcome (LO)	Assessment	Connection with LO of the study program
Explain causative agents of plant diseases (non-parasitic, parasitic, morphology, reproduction and classification of fungi).	Separate fungi among different biotic factors as most common and numerous causative agents of shrubs and trees diseases.	B2
Explain biology and physiology of fungi (reproduction, nutrition, specialization, ecological associations).	Interpret ecological associations among fungi.	B2
Explain pathogenesis and plant resistance towards pathogens (types and sources of infection, incubation, fructification, resistance factors, plant reaction on pathogenic organism).	Compare and understand infection, incubation and fructification as parts of pathogenesis.	B3
Explain diseases of fruits and seeds and seedlings (disease symptoms, plant hosts, pathogen harmful effect, and consequences for health of fruits, seeds and seedlings).	List, describe and explain most common causative agents of fruits, seeds and seedlings diseases.	B2, B3
Analyse diseases of needles and leaves, bark, shoots, branches and stems of forest trees (disease symptoms, biology and harmful effect of the pathogen).	Explain biology and harmful effects of individual pathogen, that is, describe consequences of disease.	B2, B3
Analyse rot fungi of forest trees (their species, most common rot fungi in Croatia, disease symptoms, biology and harmful effect of pathogens, consequences for the health status of affected trees and their economical value).	Identify conditions under which it comes to process of rot in forest ecosystems.	B2, B3
Explain anthropological and abiotic damage on trees (mechanical damage on bark during cut and skidding and forwarding, frost cracks, drought damage, sunscald wounds).	Interpret genesis of frost cracks and their consequences for a tree.	B2, B3, B6
Explain harmful hemiparasitic plants (most common hemiparasitic flowering plants on forest trees).	Identify symptoms caused by hemiparasitic flowering plants.	B2, B3

General competencies:

Basics of knowledge of plants in order to keep their health status intact.

Application of modern science principles which encompass precise knowledge of pathogenic plant organisms and their association with plants during pathogenesis.

Understanding of micro world and biogenic processes, and effect of environmental factors on plant host and pathogen.

Type of instruction:

Lectures

Practical exercises

As a part of laboratory exercises students learn how o recognize causative agent of shrubs and trees disease macroscopically and microscopically.

Field work

Field classes are held in forest ecosystems where examples of disease are shown directly on forest trees

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures, practical exercises and field classes. Taking partial exams, written and oral exams.

Assessment method

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students' workload outside the direct teaching**	**ECTS**
Lectures	-	-	-	30	0	1
Practical exercises (V)	-	-	-	30	0	1
Field classes and field class seminar (TN)	-	-	-	16	4	0,7
Midterm exam on basics of phytopathology (K)	20%	60-70%	sufficient (2)	0	18	0,6
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
Exam (PUI)	80%	60-70%	sufficient (2)	0	50	1,7
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Kx20 + PUIx80)/100**		76	72	5

Evaluation elements	**Maximum points or share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam* (ZI)		60-70% 71-80% 81-90% 91-100%	sufficient (2) good (3) very good(4) excellent (5)	0	68	2,3

TOTAL	**100%**	**(ZIx100)/100**
*** * students who do not pass the midterm exams during the semester shall take the final exam that makes up 100 % of the grade.**		

Detailed explanation of rules for preparing and taking midterm exams, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + practical exercises	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (60 direct teaching hours)	-
Completion of practical exercises	Students attend practical exercises in groups. A total of 15 practical exercises are carried out about microscopic and macroscopic identification of forest shrubs and trees pathogens.	semester (30 direct teaching hours)	In case of justified reason student can additionally compensate for the absence from the exercise.
Midterm exam on basics of phytopathology	All students can take the first midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	From 15th week	Students who passed midterm exam can take written exam.
Written exam	The exam can be taken by students who attended practical exercises and passes the midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written exam is graded and taken into account for the final grade of this course	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **Kx20+PUIx80/100**		

Obligatory literature

1. Glavaš, M., 1996: Osnove šumarske fitopatologije. Sveučilište u Zagrebu, Šumarski fakultet, 140 str.
2. Glavaš, M., 1999: Gljivične bolesti šumskoga drveća. Sveučilište u Zagrebu, Šumarski fakultet, 281 str.
3. Na internetskoj stranici Merlin sustav za e-učenje Sveučilišta u Zagrebu (https://moodle.srce.hr/2018-2019/?redirect=0) pod predmetom Šumarska fitopatologija studentima su dostupna sva predavanja u formi prezentacija (MicrosoftPowerPoint).

Recommended literature

1. Butin, H., 1995: Tree Diseases and Disorders. Oxford University Press, 252 p.

Fundamentals of forest protection

ŠP6005

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. Josip Margaletić, PhD
Asst. prof. Marko Vucelja, PhD

Associate teacher for exercises
Asst. prof. Marko Vucelja, PhD

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The task of the protection is to ensure normal growth and development for plants and forests and to protect them directly from harmful organisms and the influence of abiotic factors. Methods of forest protection include forest-economic, biological, chemical and mechanical measures. By acquiring theoretical and practical knowledge it is noticed how to protect fruits and seeds from insects, fungi and small rodents. Plants in nurseries are exposed to numerous soil and epigean harmful insects, fungi, animals and weeds for which specific knowledge of protection is needed. The complex protection specific for lowland, mountainous and coastal forests becomes significant in forests and forest cultures. Therefore, special material is dealt with for each area.

Type of course:

Fundamentals of forest protection (obligatory course, 2. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describing forest protection methods (forest management, biology, biotechnical, chemical and mechanical methods).	Colloquim exam, Written and oral exam	B3
Interpreting the damage caused by abiotic and biotic factors in the forests (abiotic factors (late and early frost, floods, sunburn, abundance, drought, wind, snow, ice, fire), damage from fungal pathogenic organisms, large game and small rodents, also interpreting the protection methods).	Colloquim exam, Written and oral exam	B3
Describing chemical preparations (chemical plant protection products, substitutes for forest protection).	Colloquim exam, Written and oral exam	B3
Appliying the protection of forest seeds and young plants.	Colloquim exam, Written and oral exam	B6
Describing forest fires as a damage cause to forest ecosystems (forest outbreaks and types of forest fires, classification of forests regarding the fire risk levels).	Colloquim exam, Written and oral exam	B3

General competences:

Forest ecosystems consist of all the components of the life of forests and environments. The influence of biotic and abiotic harmful factors for a forest is connected with the way of forest management, environmental influence and numerous other factors in a given time and space. Due to these reasons, forest protection demands the integration of all previously acquired knowledge about forests and practical and fast solutions. The skill of forest protection depends exclusively on taking the forest profession as a whole.

Type of instruction:

Lectures

Working methods:

Teachers' obligations:
Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	-	1
Exercise	-	-	-	15	-	0,5

Colloquium exam 1	25%	60-70%	Sufficient (2)	-	7,5	0,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Colloquium exam 2	25%	60-70%	Sufficient (2)	-	7,5	0,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam	50%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			45	45	3

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	100 %	60-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Attendance of exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer	Attendance of exercises
Colloquium exam 1 Colloquium exam 2	Colloquium exam is evaluated and participate in the final assessment of the subject	8th week 15th week	Students passing a colloquium can take the exam
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exame.	Exam terms	
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	

Obligatory literature

1. articles in different scientific journals
2. Group of authors: 1977: Guidelines for the control of some important forest pests for diagnostic and prognostic purposes in SR Croatia. Works, pp 31, 65.
3. Vajda, Z., 1973: Science of forest protection. Školska knjiga Zagreb, 482 str.
4. The fundamentals of forest protection; e-learning course on remote learning system: https://moodle.srce.hr/2018-2019/mod/page/view.php?id=720086

Recommended literature

1. Professional articles in domestic journals

Manners of game hunting

ŠP6006

ECTS 1

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof.dr.sc. Marijan Grubešić

Associate teacher for exercises
-

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The aim of this subject as supplement to the obligatory subject Bases of Hunting Management is to present to the students in a more detailed way and to educate them in a very significant segment of hunting management i.e. organization and implementation of hunting. During teaching, manners of game hunting in individual and group hunts, rules in preparing of hunt, rules in implementation of hunt, precaution measures during the hunt, especially during handling of weapons and ammunition, will be presented to the students in detail. Manners of game catching, catching means and treatment of captured game will be presented. Hunting tradition and especially hunting clothes and equipment will be presented. An overview of the required forms for hunting files, game kill and appertaining documentation, game traffic and its respective parts will also be given. Teaching will be conducted under the use of photo and video material.

Type of course:

Manners of game hunting (elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret trapping and capturing of wild animals (different modes of hunting, a common hunting methods of capturing wild animals traps, ways to capture live wildlife, falconry).	final exam	A1, C2
Present hunting and security measures, and hunting ethics (rules of behavior and safety measures in hunting, procedure for deprived or caught game, hunting records and game offspring).	final exam	A1, C2
Describe hunting clothes and equipment	final exam	C2

General competences:

Students will get to know the manners of game hunting, organization and implementation of hunts. Students will get to know the rules of hunting, safety measures during hunting and hunting equipment. Detailed preparation for the use of the knowledge in practice.

Tipe of instruction:

Lectures

In the lectures, students will be familiar with the theoretical part of the legislative framework and the practical implementation of hunting.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Maintenance of oral exams and consultations. Preparation and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Partial exam (PE)	100%	60-70%	Sufficient (2)	-	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+PE)/100**		15	15	1,0

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	15	1,0
TOTAL	**100%**	**(FExy0+Exy0)/100**		**15**	**15**	**1,0**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Oral exame	Students are asked questions from different parts of the program content. **(FEx100)/100**	Exam terms	-

Obligatory literature

1. Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str.
2. Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str.
3. Tucak, Z., Florijančić, T., Grubešić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K., 2002: Lovstvo. Drugo prošireno izdanje. Uđbenik, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet Osijek, 405 str.

Recommended literature

1. Grup of autors: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str.

Ornamental Dendrology

ŠP5006

ECTS 1

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

International Code of Nomenclature for Cultivated Plants. The horticultural importance of particular genera of gymnosperms and angiosperms, with their biological features, morphological characteristics, number of species and distribution is taught in the course of Dendrology. For genera not included in the Dendrology course learning biological features, morphological characteristics, number of species and distribution. Cultivars of species and genera whose morphological characteristics, natural range, special features, economic and ecological importance the students have been taught in the course of Dendrology. For species not included in the Dendrology course learning the morphological characteristics, distribution and cultivars. The course covers the most common ornamental tree and shrub species which are important for urban forestry in Croatia, and the topics of the lectures follow a systematic order.

Type of course:

Ornamental Dendrology (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To use International Code of Nomenclature for Cultivated Plants;	exam	B5
To categorise the most common ornamental species and cultivars of gymnosperms and angiosperms according to morphological characteristics and horticultural importance in Croatia, using a plant list and literature;	exam	B5
To choose the most common ornamental species and cultivars of gymnosperms and angiosperms for various purpose in urban forestry and horticulture, using a plant list and literature;	exam	B5

General competences:

Students acquire basic theoretical and practical knowledge about the most common ornamental woody taxa in Croatia. Theoretical knowledge encompasses biological features, morphological characteristics, variability (with special emphasis on cultivars), distribution, special characteristics, as well as the horticultural importance of taxa. Students acquire practical skills to recognize the most common ornamental woody taxa on the basis of different morphological characteristics.

Type of instruction:

Lectures

Working methods:

Teachers' obligations:

Giving lectures. Holding consultations, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material.

Students' obligations:

Regular attendance at lectures. Passing final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15		0.5
TOTAL				15		0.5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	0.5
TOTAL	**100%**	**(FEx100)/100**				
*** students take the final exam that is 100% of the grade**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is recorded. Student may not be absent more than 20% of lectures.	VI semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures).	Exam terms	
Oral exam	Access requirement: positively graded written exam. The final grade is obtained according to the formula: (FEx100)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2005: Listopadno drveće i grmlje u zimskom razdoblju. Šumarski fakultet Sveučilišta u Zagrebu. 256 pp.
2. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
3. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.

Recommended literature

1. Bärtles, A., Schmidt, P.A., 2014: Enzyklopädie der Gartengehölze. Verlag Eugen Ulmer, Stuttgart.
2. Brickell, C. (Ed.), 2003: RHS A-Z encyclopedia of garden plants, Vol. I-II. Dorling Kindersley, London.

3. Cullen, J., Knees, S.G., Cubey, H.S. (Eds.), 2011: The European garden flora flowering plants: a manual for the identification of plants cultivated in Europe, both out-of-doors and under glass. Vol. I-V. Second edition. Cambridge University Press.
4. Dirr, M.A., 2011: Dirr's encyclopedia of trees and shrubs. Timber Press.
5. Farjon, A., 2010: A handbook of the world's conifers. Vol. I-II. Brill, Leiden.
6. Fiala, J.L., 2008: Liliacs – a gardener's encyclopedia. Timber Press, Portland, London.
7. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim.
8. Fryer, J., Hylmö, B., 2009: Cotoneasters: a comprehensive guide to shrubs for flowers, fruit, and foliage. Timber Press, Portland & London.
9. Galle, F.C., 1997: Hollies: the genus *Ilex*. Timber Press, Portland.
10. Gooch, R., Gooch, J., 2011: *Clematis* – an essential guide. The Crowood Press Ltd., Wiltshire.
11. Krüssmann, G., 1972: Handbuch der Nadelgehölze. Verlag Paul Parey, Berlin und Hamburg.
12. Krüssmann, G., 1976: Handbuch der Laubgehölze. Band I-III. Verlag Paul Parey, Berlin und Hamburg.
13. Lis-Balchin, M. (Ed.), 2002: Lavender: The genus *Lavandula*. Taylor & Francis, London.
14. Quest-Ritson, C., Quest-Ritson, B., 2003: The Royal Horticultiral Society encyclopedia of roses. Dorling Kindersley Ltd., London.
15. Roloff, A., Bärtels, A., 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart.
16. van Gelderen, D.M., de Jong, P.C., Oterdoom, H.J., 1994: Maples of the world. Timber Press, Portland, Oregon.
17. van Gelderen, D.M., van Hoey Smith, J.R.P., 1996: Conifers: The illustrated encyclopedia. Timber Press, Portland, Oregon.
18. Vertrees, J.D., 2001: Japanese maples. Timber Press, Portland.

Basics knowing of fungi

PU6006

ECTS 1

English R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Danko Diminić

Grading system
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Course goal is to introduce students with basic of fungi (macro fungi), group which produces characteristic fruiting bodies (size from few up to several dozen centimetres) on various substrates in forest ecosystems. Most of these fungi are saprotrophs or mycorrhizal fungi and their fruiting bodies are interesting from the human consummation point of view.
Course covers following topics: position of macro fungi in Fungi kingdom, systematics of macro fungi, structure, reproduction and nutrition of macro fungi.
Role of mycorrhizal fungi is specially covered. Students get acquainted with morphological features of fungal fruiting bodies and with identification key for species identification. They also get acquainted with most common fungal species from Basidiomycotina and Ascomycotina ad their role in the forest ecosystems.
Examples of species from genera: Agaricus, Amanita, Armillaria, Bjerkandera, Boletus, Cortinarius, Fomes, Ganoderma, Hypoxylon, Inonotus, Lactarius, Laetiporus, Macrolepiota, Phellinus, Pleurotus, Polyporus, Russula, Stereum, Trametes, Xylaria. In the end students learn about chemical and healing properties of fungi and fungal toxins according to effects and possibilities of treatment.

Type of course:

Basics knowing of fungi (elective course, 6th. semester, 3rd. year)

Learning outcomes and evaluation methods

Learning outcome (LO)	Assessment	Connection with LO of the study program
Describe fungi as eukaryotic organisms. Explain role and systematics of fungi. Explain mycorrhizae (ecto and endomycorrhizae).	Separate fungi from other organisms in land ecosystems.	B2

Describe and connect fungal habitats and substrates.		
Describe, list and differentiate among fungal fruiting bodies characteristics significant for identification. Describe and recognize characteristics of cap and hymenophore. Describe and recognize characteristics of stipe (stalk) and volva and their origin. Explain importance of spore colour in a mass for the identification. Describe and recognize characteristics of hymenium and spores in ascomycetes and basidiomycetes. Describe and recognize importance of sterile elements of hymenium in basidiomycetes. Explain, describe and list anatomical and histological characteristics of fruiting body. Explain other characteristics and chemical reactions in fungi and their importance for identification.	List, describe and explain basic morphological and microscopic features of macro fungi.	B2
Describe chemical structure of fungi. Describe and list medical properties of fungi. List and explain fungal toxins, their harmful impact on human health, symptoms they cause and possible medical treatments.	List, describe and explain other features of macro fungi.	B2

General competencies:

Basics of knowing land ecosystem macro fungi.

Application of modern science principles which encompass precise knowledge of fungi and their role in land ecosystems.

Type of instruction:

Lectures

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures. Taking written and oral exams and seminar preparation.

Assessment method

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	0,5
Seminar (S)	35%	-	-	0	7,5	0,25

Exam (PUI)	65%	60-70%	sufficient (2)	0	7,5	0,25
		71-80%	good (3)			
		81-90%	Very good(4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Sx35 + PUIx65)/100**		15	15	1

Detailed explanation of rules for preparing and taking midterm exams, seminars, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	semester (15 direct teaching hours)	-
Seminar	Seminar presentation is graded and the grade influences on the final course grade.	after 3rd week	-
Oral exam	Students are asked question from different parts of the program. The following formula is used to calculate the final grade for this course: **Sx35+PUIx65/100**	Exam terms	

Obligatory literature

1. Na internetskoj stranici Merlin sustav za e-učenje Sveučilišta u Zagrebu (https://moodle.srce.hr/2018-2019/?redirect=0) pod predmetom Osnove poznavanja gljiva studentima su dostupna sva predavanja u formi prezentacija (MicrosoftPowerPoint).
2. Usčuplić, M., 2004: Svijet gljiva. Akademija nauka i umjetnosti Bosne i Hercegovine, Sarajevo, 243 str.
3. Božac, R., 1989: Gljive naših krajeva. Grafički zavod Hrvatske, Zagreb, 399 str.
4. Garnweidner, E., 1990: Gljive - džepni gljivarski vodič. Cankarjeva založba, Ljubljana - Zagreb, 255 str.

Recommended literature

1. Breitenbach, J., Kränzlin, F., 1984: Fungi of Switzerland Volume 1: Ascomycetes, Edition Mykologia, Luzern, Švicarska, 313 str.
2. Breitenbach, J., Kränzlin, F., 1986: Fungi of Switzerland Volume 2: Non Gilled Fungi, Edition Mykologia, Luzern, Švicarska, 412 str.
3. Breitenbach, J., Kränzlin, F., 1991: Fungi of Switzerland Volume 3: Boletes and Agarics (1 st part). Edition Mykologia, Luzern, Švicarska, 359 str.
4. Breitenbach, J., Kränzlin, F., 1995: Fungi of Switzerland Volume 4: Agarics (2 nd part). Edition Mykologia, Luzern, Švicarska, 370 str.
5. Breitenbach, J., Kränzlin, F., 2000: Fungi of Switzerland Volume 5: Agarics (3 rd part). Edition Mykologia, Luzern, Švicarska, 342 str.
6. Kränzlin, F., 2005: Fungi of Switzerland Volume 6: Russulacceae. Edition Mykologia, Luzern, Švicarska, 317 str.

Fires of open space

ŠP6007

ECTS 1

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Professor Željko Španjol
Assistant Professor Roman Rosavec

Associate teacher for exercises
-

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Over the last few years there has been an increase in the number of open fire and burned areas in the wider Mediterranean, and also in our country. Open-air fireplaces largely prevent the protection of the forest ecosystem, which is closely linked to biodiversity and sustained sustainable development. Improvement of prevention methods and combating forest fires makes it possible to significantly reduce burnt forest areas. Knowing the factors that cause the fires as well as the factors that cause the initial spread of the fire is essential for the preparation and conduct of preventive activities. One of the most important preventive measures is knowledge of the characteristics of forest fuels, primarily their combustibility, fuel and moisture content.
The purpose of the course is to familiarize students with the basic settings of the mentioned problem. The envisaged teaching units are the basic prerequisites for a good understanding and knowledge of the open space fire.

Type of course:

Fires of open space (compulsory/elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the relevance and relevance of the subject matter, consider previous experience at the national and international levels, identify and recognize implementation in similar legal frameworks.	Final exam	B7
Identify the key factors of open space fire, summarize and correlate the importance of the occurrence factors, differentiate between flammability, fuel and moisture content factors.	Final exam	B3
Group firefighting techniques, adapt firefighting systems, describe ways and forms of propaganda.	Final exam	B3

General competence:

Interpretation of forest fires
Knowledge of fire of open space management
Analyze the location, time and manner of fires of open space

Type of instruction:

Lectures

Exercises

Working methods:

Teachers obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exam, written exams, oral exams and consultations. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	0	0,5
Seminar (S)	20%	50-70%	Sufficient (2)		5	0,166
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
Partial exam (P1)	40%	50-70%	Sufficient (2)		5	0,166
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	40%	50-70%	Sufficient (2)		5	0,166
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx20 + P1x40 + P2x40)/100**		15	15	1

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	10	0,33
TOTAL	**100%**	**(Fex80+Sx20)/100**		**15**	**15**	**1**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (15 hours of direct lecturer)	
Seminar	Seminar papers are produced in accordance with assigned topics related to the teaching units.		
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam

Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Sx20)/100**		

Obligatory literature

1. Bertović, S. i dr. (1987): Osnove zaštite šuma od požara, Zagreb

Recommended literature

1. Barčić, D. & Španjol, Ž. (2001): Sukcesija vegetacije na požarištima kultura alepskog bora (*Pinus halepensis* Mill.) u šumariji Pula. Znanost u potrajnom gospodarenju hrvatskim šumama, Šumarski fakultet Sveučilišta u Zagrebu. Šumarski institut Jastrebarsko: 19-29, Zagreb.
2. Dimitrov, T. (1994): Šumski požari u priobalnom dijelu Jadrana s otocima tijekom 1994. godine. Izvanr. meteorol. hidrol. prilike Hrvat. 18, 121-125, Zagreb.
3. Dimitrov, T. (1994): Biološki parametri prikladni za poboljšanje indeksa opasnosti od šumskih požara. Šumarski list, CXVIII (3-4): 105-113, Zagreb.
4. Dimitrov, T. (1996): Kratak prikaz razvoja kanadskoga sustava procjene opasnosti od šumskog požara (CFFDRS) i mogućnost primjene u našoj zemlji. Šumarski list, CXX, 5-6: 267-273, Zagreb.
5. Dimitrov, T (2000): Budući šumski požari u odnosu na globalno zatopljenje. Šumarski list, CXXIV, (3-4): 203-209, Zagreb
6. Gaži-Boskova, V. & Šegulja, N. (1978): Prilog poznavanju promjena vegetacije izazvanih požarom. Šumarski list, CII, (11-12): 477-488, Zagreb.
7. Martinović, J. (1978): Utjecaj požara vegetacije na tlo i ishranu šumskog drveća. Šumarski list (3-4): 139-148, Zagreb.
8. Španjol Ž. (1997): sanacija požarišta sastojina alepskog bora (*Pinus halepensis* Mill.) u makarskom primorju. Glas. šum. pokuse 34: 67-93, Zagreb.
9. Španjol, Ž. & Barčić, D. (2001): Biološka sanacija šumskih požara u sastojinama crnog bora (*Pinus nigra* Arnold) – Šumarija Senj. Znanost u potrajnom gospodarenju hrvatskim šumama, Šumarski fakultet Sveučilišta u Zagrebu. Šumarski institut Jastrebarsko: 141-152, Zagreb.
10. Trinajstić, I. (1993): problem sukcesije vegetacije na požarištima alepskog bora (Pinus halepensis Mill.) u Hrvatskom primorju. Šumarski list CXVII (3-5): 131-137, Zagreb.
11. Španjol Ž. (1996): Prilog poznavanju šumskih požara u sastojinama alepskog bora (*Pinus halepensis* Mill.). Unapređenje proizvodnje biomase šumskih ekosustava, Šumarski fakultet Sveučilišta u Zagrebu. Šumarski institut Jastrebarsko, Knjiga 1: 391-412, Zagreb.

Management of forest genetic resources

ŠP 6008

ECTS points 1

E-learning R2

Teaching hours 15
Lectures 15

Lecturers
prof. dr. sc. Saša Bogdan

Gradeing
Adequate (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Terms of biological and genetic diversity; Determining genetic diversity; Factors of shaping genetic diversity (mutation, gene migration, selection, genetic drift, inbreeding); Geographic variability of forest trees; Spatial and temporal changes of genetic variability at the population level; Effective population size, analysis of population sustainability, minimum population density; Legislation on biodiversity; Methods of *in situ* and *ex situ* conservation of genetic diversity; Management of genetic conservation units.

Course Type:

Management of Forest Genetic Resources (elective course, 6th semester, 3rd year)

Learning Outcomes and Methods of Verification

Learning Outcome (LO)	Verification	Link to the LO of the Study Program
To explain and to distinguish categories of forest genetic resources; To explain the basic methods and procedures for conservation of genetic diversity of forest trees; To identify key legal acts, rules and subjects in the field of conservation of genetic diversity of forest trees.	Final Exam	B4, B6, B8
To discuss the current understanding of the impact of various management interventions on the genetic diversity of forest trees; To apply practical recommendations for good forest management practices.	Final Exam	B4, B6, B8

General competences:

interpretation of the theoretical settings for conservation of genetic diversity of forest trees.
to interpret the importance of genetic diversity in forest management.
selection and application of *in situ* and *ex situ* conservation of genetic diversity of forest trees.
knowledge on relevant legislation.

Forms of teaching:

Lectures

Working methods:

Teacher's obligations:
Maintaining original teaching - lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Examination and consultation. Creating teaching materials.

Student's obligations:
Regular attendance and active participation in lectures. Taking exam.

Assessment method

Tracking elements	Share in gradeing	Score scale / gradeing	Grade	Number of direct teaching hours	Number of working hours of an average student outside direct teaching	ECTS
Lectures	-	-	-	15	0	0.5
TOTAL	-			15	0	0.5

Tracking elements	Maximum points or share in gradeing	Score scale / gradeing	Grade	Number of direct teaching hours	Number of working hours of an average student outside direct teaching	ECTS
Final exam (ZI)	100%	60-70% 71-80% 81-90% 91-100%	adequate (2) good (3) very good (4) excellent (5)	0	15	0.5
TOTAL	**100%**			**15**	**15**	**1.0**

Detailed explanation of the preparation, execution and arrangement of colloquia, seminar papers, partial exams, written and oral exams:

Tracking elements	Description	Deadline	Compensation
Lectures	The attendance of students is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct teaching)	-
Written exam	Exams can be taken by students who regularly attended lectures. The students answer the questions from the entire course content, rounding out the exact answers. The written exam is evaluated and participates in the final grade of the course.	examination deadlines	-
Oral exam	Students who pass a written exam are being asked questions from different parts of the entire course content.	examination deadlines	-

Compulsory literature

1. Bogdan, S. i I. Katičić Bogdan, 2015. Genetika s oplemenjivanjem drveća i grmlja. Interna recenzirana skripta. 224. str. (Nastavni materijal pozitivno ocijenjen od strane stručnog povjerenstva i objavljen na web stranici Šumarskog fakulteta Sveučilišta u Zagrebu) http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=109.

Recommended literature

2. Young, A., Boshier, D., Boyle, T. 2000. Forest Conservation Genetics: Principles and Practice. CABI. 368 p.
3. Frankham, R., Ballou J.D., Briscoe, D.A., 2002. Introduction to Conservation Genetics. Cambridge University Press. 640 p.
4. Oudraogo, A.S., Palmberg-Lerche, C. J., Turok, J., Skroppa, T., 1998.Conservation of Forest Genetic Resources in Europe. International Plant Genetics Research Institute.
5. Forest Genetic Resources Conservation and Management: In Managed Natural Forests and Protected Areas (in Situ). International Plant Genetics Research Institute (2002).

Exotic Woody Plants

PU6009

ECTS 1

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

The economical importance, morphological characteristics and distrbution of selected species and genera of gymnosperms and angiosperms. The subject covers exotic woody species which are important for wood production, use of bark, plant fibers, edible plant parts, essential oil, honey, various industrial products etc. Medicinal herbs are not included. The genera belong to the following families: *Aceraceae*, *Agavaceae*, *Anacardiaceae*, *Apocynaceae*, *Araliaceae*, *Araucariaceae*, *Arecaceae*, *Asparagaceae*, *Asteraceae*, *Betulaceae*, *Bombaceae*, *Buddlejaceae*, *Burseraceae*, *Buxaceae*, *Caesalpiniaceae*, *Capparaceae*, *Caprifoliaceae*, *Caricaceae*, *Celastraceae*, *Cornaceae*, *Cupressaceae*, *Cycadaceae*, *Ebenaceae*, *Elaeagnaceae*, *Ericaceae*, *Euphorbiaceae*, *Fabaceae*, *Fagaceae*, *Ginkgoaceae*, *Grossulariaceae*, *Hamamelidaceae*, *Juglandaceae*, *Lamiaceae*, *Lauraceae*, *Meliaceae*, *Mimosaceae*, *Moraceae*, *Musaceae*, *Myrtaceae*, *Oleaceae*, *Pinaceae*, *Poaceae*, *Punicaceae*, *Rhamnaceae*, *Rhizophoraceae*, *Rosaceae*, *Rubiaceae*, *Ruscaceae*, *Rutaceae*, *Salicaceae*, *Santalaceae*, *Simaroubaceae*, *Smilacaceae*, *Sterculiaceae*, *Styracaceae*, *Taxaceae*, *Thymelaeaceae*, *Ulmaceae* and *Verbenaceae*.

Type of course:

Exotic Woody Plants (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To learn botanical and common names and distribution of exotic fruits, nuts and citrus species, species used for spices, beverages and syrups, species important for wood production, use of bark, plant fibers, resins, gum and oil;	exam	B5, B8
To identify and describe exotic fruits, nuts and citrus species;	exam	B5, B8
To describe which plant parts of exotic woody species are used for spices, beverages and syrups;	exam	B5, B8

General competences:

Students acquire basic knowledge about economically important exotic woody plants. Theoretical knowledge encompasses morphological characteristics, economic importance and distribution. Particularly emphasized is the use of certain plant parts.

Type of instruction:

Lectures

Working methods:

Teachers' obligations:

Giving lectures. Holding consultations, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material.

Students' obligations:

Regular attendance at lectures. Passing final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15		0.5
TOTAL				15		0.5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of verage students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	0.5
TOTAL	**100%**	**(FEx100)/100**		15	**15**	**1,0**
*** students take the final exam that is 100% of the grade**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is recorded. Student may not be absent more than 20% of lectures.	VI semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures).	Exam terms	
Oral exam	Access requirement: positively graded written exam. The final grade is obtained according to the formula: (FEx100)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
2. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.
3. Šumarska enciklopedija Vol. I–III, 1980-1987. JLZ Miroslav Krleža, Zagreb.

Recommended literature

1. Duarte, O., Paull, R.E., 2015. Exotic fruits and nuts of the New World. CABI, Wallingford.
2. Farjon, A., 2010. A handbook of the world's conifers. Vol. I-II. Brill, Leiden.
3. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim.
4. Hu, S., 2005. Food plants of China. The Chinese University Press, Hong Kong.
5. Janick, J., Paull, R.E., 2008. The encyclopedia of fruits and nuts. CABI International, London.
6. Krüssmann, G., 1972: Handbuch der Nadelgehölze. Verlag Paul Parey, Berlin und Hamburg.
7. Krüssmann, G., 1976: Handbuch der Laubgehölze. Band I-III. Verlag Paul Parey, Berlin und Hamburg.
8. Louppe, D., Oteng-Amoako, A.A., Brink, M. (Eds.), 2008. Plant resources of tropical Africa 7(1). Timbers 1. PROTA Foundation, Wageningen, Backhuys Publishers, Leiden, CTA, Wageningen.
9. Lyle, S., 2007. Discovering fruit and nuts. David Bateman Ltd., Auckland.
10. Morton, J., 1987: Fruits of warm climates. Florida Flair Books. 505 pp.
11. Roloff, A., Bärtels, A., 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart.

Graduate study Forestry

B. SILVICULTURE AND FOREST MANAGEMENT PLANNING WITH WILDLIFE MANAGEMENT

Forestry is the profession, science and art of managing and protecting forest ecosystems for the long-term benefit of society, the environment, and economy. Students at the graduate level are trained in the management of forest ecosystems from a biological-ecological, technological and economic aspect. The study is based on upgrading and improving the basic knowledge in the field of forestry acquired in undergraduate studies with directing students to highly professional work in all aspects of forestry organizations and forest enterprises, and student involvement in scientific research and guidance on further education at the doctoral and specialist studies. Students gain the necessary knowledge and skills to solve the most complex tasks in forestry and for coping with the constant technological change, innovation and knowledge. Graduate study in forestry is designed so that students are led in a logical sequence from the basic biological and technical disciplines, through disciplines in which they are introduced to the components of forest ecosystems and to the techniques of forest management, to those that embrace the knowledge of forest and forest land management. Through optional and optional compulsory subjects from a list submitted in the study program, students have the opportunity to broaden their knowledge. Through fieldwork students acquire necessary practical experience they are acquainted with the practical application of aquired knowledge. Students acquire conditions for performing the most complex jobs in forestry and for continuation of education in doctoral and specialist studies by individual making of master thesis. Defending the master thesis is requirement for study conclusion.

Master Enginnering of forestry with the knowledge gained by the completion of graduate study Forestry - Silviculture and Management Planning with Wildlife Management are completely qualified for management of forest ecosystems through individual and team work in the fields of silviculture, forest protection, forest management and hunting; tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship; work as a county/national inspector, as a professional assistant in research institutions in the field of forestry and wildlife management; as a manager/supervisor in protected natural areas, as a manager or assistant on the market of forest products, as a teacher in professional secondary and related schools. Employment is not necessarily limited to the area of forestry.

DESCRIPTION OF THE PROGRAM

List of compulsory and elective courses

I. YEAR

Code	Course title	Lectures (classes)	Exercises (classes)	Field work (days)	ECTS
1. semester					
	Compulsory courses				
ŠDU1001	PHYTOPHARMACY IN FORESTRY	2	1	0	4
ŠDU1002	FOREST VEGETATION	2	1	2	6
ŠDU1003	GENERAL AND LANDSCAPE ECOLOGY	2	1	2	6
ŠDU1004	PLANT NUTRITION	2	1	0	4
ŠDU1005	GROWTH AND INCREMENT	2	1	0	4
	Elective courses				
ŠDU1006	PHOTOINTERPRETATION IN FORESTRY	1	0	0	2
ŠDU1007	SYNMORPHOLOGY AND MAPPING FOREST VEGETATION	1	0	0	2
ŠDU1008	DIGITAL CARTOGRAPHY IN FORESTRY	1	0	0	2
ŠDU1010	ZOONOSES IN FOREST ECOSYSTEMS	1	0	0	2
ŠDU1011	METHODS OF PLANT TAXONOMY	1	0	0	2
ŠDU1012	BIRDS ECOLOGY	1	0	0	2
ŠDU1013	BEHAVIOURAL ECOLOGY	1	0	0	2
ŠDU1014	MONITORING OF ANIMAL SPECIES	1	0	0	2
ŠDU1015	ZOOECOLOGY IN FOREST ECOSYSTEMS	1	0	0	2
Total		**13**	**5**	**4**	**30**
2. semester					
	Compulsory courses				
ŠDU2001	SILVICULTURE II	2	1	2	5
ŠDU2002	FOREST KARST MELIORATIONS	2	1	2	3
ŠDU2003	HUNTING MANAGEMENT I	2	1	2	3
ŠDU2004	FOREST TREE BREEDING	2	1	2	3
ŠDU2005	MANAGEMENT AND PROTECTION OF FOREST SOIL	2	1	1	4
	INTRODUCTION TO GRADUATE WORK I				6
	Elective courses				
ŠDU2006	ECOLOGICAL MONITORING	1	0	0	2
ŠDU2007	FOREST TYPOLOGY	1	0	0	2
ŠDU2008	WILDLIFE FEEDING	1	0	0	2
ŠDU2009	HUNTING CINOLOGY	1	0	0	2

ŠDU2010	MECHANIZATION IN FOREST SILVICULTURE	1	0	0	2
ŠDU2011	FOREST AREA MEASUREMENT	1	0	0	2
ŠDU2012	QUANTITATIVE METHODS FOR PLANNING IN FORESTRY	1	0	0	2
ŠDU2013	FORESTRY POLITICS AND LEGISLATION	1	0	0	2
ŠDU2014	REGULATIONS FOR FOREST MANAGEMENT PLANNING	1	0	0	2
ŠDU2015	CLONAL FORESTRY	1	0	0	2
ŠDU2016	BIOTECHNOLOGY OF FOREST TREES	1	0	0	2
Total		**13**	**5**	**9**	**30**

II. YEAR

Code	Course title	Lectures (classes)	Exercises (classes)	Field work (days)	ECTS
3. semester					
	Compulsory courses				
ŠDU3001	SILVICULTURE OF SPECIAL PURPOSE FORESTS	2	1	2	5
ŠDU3002	ECONOMICS OF FOREST COMPANY	2	1	1	4
ŠDU3003	HUNTING MANAGEMENT II	2	1	2	4
ŠDU3004	FORESTRY TECHNIQUES AND TECHNOLOGIES	2	2	3	5
	INTRODUCTION TO GRADUATE WORK II				6
	Elective courses				
ŠDU3005	SPATIAL ANALYSIS AND VALORIZATION	1	0	0	2
ŠDU3006	PREPARATION AND MEASUREMENT OF HUNTING TROPHIES	1	0	0	2
ŠDU3007	POST-FIRE RESTORATION	1	0	0	2
ŠDU3008	ECOLOGY OF FOREST TREE SPECIES	1	0	0	2
ŠDU3009	MANAGEMENT BY SELECTION SYSTEM AND SUBALPINE FOREST ECOSYSTEMS	1	0	0	2
ŠDU3010	POPULATION OUTBREAKS AND MONITORING OF FOREST INSECTS	1	0	0	2
ŠDU3011	STATISTICAL METHODS AND MODELS	1	0	0	2
ŠDU3012	FLOODPLAIN FORESTS	1	0	0	2
ŠDU3013	BIOENERGY PLANTATIONS AND PHYTOREMEDIATION	1	0	0	2
ŠDU3014	RECOVERY OF DEGRADED TERRAINS	1	0	0	2
ŠDU3015	HISTORY OF FORESTRY	1	0	0	2
Total		**11**	**5**	**8**	**30**

4. semester					
	Compulsory courses				
ŠDU4001	INTEGRATED FOREST PROTECTION	2	2	2	6
ŠDU4002	FOREST MANAGEMENT PLANNING	2	3	4	6
	GRADUATE WORK				18
Total		**4**	**5**	**6**	**30**

List of learning outcomes for graduate study Forestry - Programme: Silviculture and Forest Management Planning with Wildlife Management

Master Enginnering of forestry with the knowledge gained by the completion of graduate study Forestry - Silviculture and Management Planning with Wildlife Management will be able to:

A - With general engineering competence

A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem anlysed in different ways
A2. explain position and trends of forestry proffesion in the country and worldwide
A3. apply simplier methods of operation research

B - With focused engineering competence

B1. organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical
B2. establish forest management programs and wildlife management programs
B3. implement forest management programs
B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management
B5. organise and manage professional works on establishing, caring for, and renewing forest stands
B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region
B7. organise and manage professional works on inventorying forests
B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests
B9. prepare ecological studies and forestry parts of spatial plans
B10. apply knowledge related to forest machines, techniques and standard technologies used in forestry
B11. apply knowledge related to marketing of forest main and secondary forest products
B12. apply knowledge related to marketing of forest main and secondary forest products
B13. apply knowledge related to the methods for preparing and planning technical works in forestry
B14. manage forest, human resource, and technical potential during performance of forest works
B15. develop current technologies as well as implement new technologies

C - With organizational engineering competence

C1. plan, organise and works of organization of production in forestry
C2. organise and manage works on organization of hunting areasa
C3. plan and calculate production, calculate basic indicators of successful buisness, compose basic financial reports, recognise and analyse types of costs
C4. manage the most complex tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship
C5. manage tasks of county and national institutions competent for forestry; inspection services
C6. perform jobs of manager/supervisor in protected natural areas

D - With developing engineering competence

D1. conduct buisnesses of scientific and professional associate in scientific-research institutions in the field of forestry
D2. conduct courses in professional secondary and other similar schools
D3. conduct businessses and tasks in publicist writing and media connected with forestry
D4. professionally and scientifically upgrade through different educational ways and postgraduate study
D5. gather, process and interpret reference sources and prepare simplier written professional or scientific paper.

The link of the learning outcomes of the courses with the learning outcomes of the program

Course code	General engineering competence			Focused engineering competence															Organizational engineering competence						Developing engineering competence				
	A1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5
ŠDU1001					+																								
ŠDU1002	+					+						+													+	+		+	+
ŠDU1003						+	+		+	+	+																		
ŠDU1004				+					+		+																		
ŠDU1005	+				+		+			+															+	+		+	
ŠDU1006	+				+							+						+										+	
ŠDU1007	+		+									+					+	+							+	+		+	+
ŠDU1008	+				+							+						+										+	
ŠDU1010		+										+					+			+									
ŠDU1011	+											+													+	+			+
ŠDU1012	+				+	+							+												+				
ŠDU1013					+																								
ŠDU1014					+																								
ŠDU1015					+	+	+																		+	+			
ŠDU2001							+	+																					
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ŠDU2003	+		+		+															+					+	+			
ŠDU2004								+																					
ŠDU2005	+	+			+	+			+			+				+							+		+				
ŠDU2006				+		+	+	+			+																		
ŠDU2007	+		+			+						+					+								+	+		+	+
ŠDU2008							+																						
ŠDU2009	+																					+			+	+			
ŠDU2010													+																
ŠDU2011	+				+		+					+														+			
ŠDU2012			+				+									+	+		+	+		+							
ŠDU2013	+	+																									+		
ŠDU2014					+																								
ŠDU2015								+																					
ŠDU2016								+																					
ŠDU3001		+					+	+	+		+			+				+											
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ŠDU3007									+		+																		
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ŠDU3009				+	+	+												+											
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ŠDU3015		+																											
ŠDU4001							+				+													+					
ŠDU4002					+					+												+	+						

Phytopharmacy in forestry

ŠDU1001

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof. Boris Hrašovec, Ph.D.
Assistant Prof. Milivoj Franjević, Ph.D.

Associate teacher for exercises
Assistant Prof. Milivoj Franjević, Ph.D.

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The aim of the course is to prepare the students for the usage of wide spectrum of suppressive tactics and compounds against pests and diseases in forestry. The course encompasses detailed insight into the list of available chemical compounds and today's commercial products, their pathways of entrance into the target organism, toxicology, hazards and first aid in case of accidents and relevant legislative in the field of plant protection. More detailed review of available formulations and their characteristics is given in the course parallel with the active involvement of students in the process of preparation of the formulations (both calculus simulation and dummy pesticide mixing). Students get acquainted with various insecticides, acaricides, nematocides, limacides, fungicides, herbicides and rodenticides. Forest rodent control methods and tactics are discussed in detail. Development of resistance on chemical and other ingredients is explained. Special emphasis is on biological and biotechnical methods (pheromones) and their use against forest pests and diseases, both in forests as well as in forest cultures and forest nurseries.

Type of course:

Phytopharmacy in forestry (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Describe the emergence, development and role of contemporary phytofarmacy in the integrated protection of forests from plant pests.	Colloquium, final exam.	B2
Explain the underlying concepts and vocabulary (active substance, carrier, working fluid, additives, powder, suspension, emulsion, etc.) and formulas for calculating the required concentration and dose in specific application.	Colloquium, final exam.	B2
Present application methods of plant protection products (introduction to manual and motorized terrestrial devices for the application of plant protection products related to the production of different dimensions of wet particles - sprayers, sprayers).	Colloquium, final exam.	B2
Present the basic groups of insecticides / acaricides (pyrethroids, naturalites, GABA receptor inhibitors, neonicotinoids, IGR formulations), fungicides / bactericides (emphasis on recent active substances and preparations - ingredients of contemporary fungicides), and herbicides, rodenticides and nematocides (in particular, of undesirable phytotoxic effects on a protected plant) according to their chemical, toxicological, functional and other essential properties.	Colloquium, final exam.	B2
Recommend biological preparations, their basic properties, benefits and deficiencies (insecticidal biopesticides - entomopathogenic products fungi, viruses and bacteria with an emphasis on the most important bacterial biopesticides based on *Bacillus thuringiensis* bacteria).	Colloquium, final exam.	B2
Establish legal regulations for the implementation of plant protection activities in forestry.	Colloquium, final exam.	B2

General competences

Describe the emergence, development and role of contemporary phytofarmacy in an integrated protect the forests from plant pests. Describe phytofarming procedures once and for all today and explain the importance of the position of contemporary plant protection in the context of an integrated approach suppressing plant diseases and pests. Explain basic concepts and vocabulary (active substance, carrier, working fluid, additives, powders, suspensions, emulsions, etc.) and the formula which calculates the required concentrations and doses in the specific application. Calculate the required concentrations, doses, and amounts of active substance per unit of treated area under all conditions of forestry and nursery production. Present the application methods of plant protection products (introduction to manual and motorized terrestrial plants for the application of herbal resources protection associated with the production of different dimensions of wet particles - sprayers, sprayers, blisters). Identify fundamental differences between devices that produce different dimension of wet particles, and compare different application devices plant protection resources from the point of view of their effectiveness and appropriateness in forestry production (nurseries - stands). Present basic groups of insecticides / acaricides (pyrethroids, naturalites, GABA receptor inhibitors, neonicotinoids, IGR preparations), fungicides / bactericides (emphasis is on recent active substances and compositions - ingredients of contemporary fungicides), and herbicides, rodenticides and nematocide (in particular, the possibility of unwanted phytotoxicity is analyzed effect on a protected plant) according to their chemical, toxicological, functional and other essential properties. Analyze and break down the possible scenarios of suppression and on that basis create the best order and hodogram of each

application insecticides, fungicides and herbicides to minimize the occurrence of resistance and avoiding the risk of unwanted phytotoxic effects. Recommend biological preparations, their basic properties, benefits and deficiencies (insecticidal biopesticides - entomopathogenic products fungi, viruses and bacteria with an emphasis on the most important bacterial biopesticides based on Bacillus thuringiensis bacteria) Choose the most suitable method of applying a biopesticide or alternative formulation with respect to its technological properties (powdery, suspension, emulsion). Establish legal regulations for the implementation of plant protection activities in forestry. Suggest legal solutions in order to minimize pollution the environment and the risks to human health

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:

Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Exercise (E)	0%	none	none	15	0	1
Partial exam (PE1) (written)	0%	The student in the oral colloquium corresponds exactly to 65% of the calculations of concentrations and doses when using pesticides.	none (pass)	0	15	0,5
		The student in the oral colloquium corresponds exactly to 65% of the	none (repeating)			

		calculations of concentrations and doses when using pesticides.				
Final exam (FE)	100%	65-74%	sufficient (2)	0	45	1,5
		75-84%	good (3)			
		85-94%	very good (4)			
		95-100%	excellent (5)			
UKUPNO	**100%**	**(Ex0 + PE1, PE2, Pe3x0 + FE100/100**		**45**	**75**	**4**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Final exam (FE)	80 %	60-70%	Sufficient (2)			1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FExy100+Exy0)/100**				**1,5**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours	semester (45 hours of direct lecturer)	-
Partial exam	In the form of a written colloquy, the student demonstrates the knowledge of the application of the required and predetermined concentrations and doses in the application of pesticidal compositions. There is no formal assessment but the accuracy of the solution of written assignments of over 65% is considered as a qualified colloquium	15. week	
Written exam	The final written exam can also be passed by a student who has not passed the exam, but then also answers to questions from the entire teaching material.	exam terms	
Oral exam	Students who complete the concentration and dose calculation and fulfill their student obligations (attendance) get the right to go to the final exam The final grade in the course is entirely the result of the oral exam result. The final written exam can also be passed by a student who has not passed the exam, but then also answers to questions from the entire teaching material.		

Obligatory literature

1. Bokulić, A., Budinšćak, Ž., Čelig, D., Dežđek, B., Hamel, D., Ivić, D., Novak, M., Mrnjavčić Vojvoda, A., Nikl, N., Novak, N., Novaković, V., Pavunić Miljanović, Z., Peček, G., Poje, I., Prpić, I., Rehak, T., Ševar, M., Šimala, M., Turk, R., 2015: Priručnik za sigurno rukovanje i primjenu sredstava za zaštitu bilja. Ministarstvo poljoprivrede RH, 220 str.
2. Androić, M., 1965: Aviokemijska metoda zaštite šuma. Poslovno udruženje šumsko-privrednih organizacija, Zagreb, 128 str.
3. Maceljski, M., B. Cvjetković, J. Igrc Barčić i Z. Ostojić, 1997: Priručnik iz zaštite bilja, Zavod za zaštitu bilja u poljoprivredi i šumarstvu RH, Tiskara MD, Zagreb, 187 str.

Recommended literature

1. Bohmont, B.L., 1981: The New Pesticide User's Guide. B & K Enterprises, Inc., Fort Collins, Colorado, USA, 170 str.
2. Glavaš. M., 2004: sredstva za zaštitu bilja u šumarstvu. Zavod za zaštitu šuma i lovstvo, interna skripta, 54 str.
3. Meehan, A.P., 1984: Rats and mice, Their biology and control, 383 str.
4. Brooks, J.E., Rowe, F.B., 1987: Commensal rodent control.
5. Igrc-Barčić, J. & M. Maceljski, 2001: Ekološki prihvatljiva zaštita bilja od štetnika. Zrinski d.d., Čakovec, 247 str.

Forest vegetation

ŠDU 1002

ECTS 6

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Joso Vukelić, Ph.D.
Prof. Dario Baričević, Ph.D.

Associate teacher for exercises
Irena Šapić, Ph.D.
Prof. Joso Vukelić, Ph.D.
Prof. Dario Baričević, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

During the course, students will become well acquainted with the forest vegetation of the Republic of Croatia, and the Mediterranean vegetation region will be studied in two vegetation belts in five vegetation's zones, from the steno-Mediterranean to the epi-Mediterranean. The Euro Siberian-North American forest region will be studied, the European sub-region through five vegetation belts and fifteen vegetation zones, from lowland to subalpine. In the described association, we will list the distribution, basic synecological factors defining their presence, development and distribution and the organization of the association of the most important species, whether they are characteristic, distinctive, edificatory or dominant. Only those sub-associations which are very significant for scientific or economic interests will be described in detail. Of the larger units, general information will be provided on the distribution, type and composition of the units belonging to them.
The course is based on the classic assumptions of the Braun-Blanquet approach, but also uses the most up-to-date information and technological aids. The course consists of lectures and laboratory exercises using modern teaching aids, and a field component in a real forest ecosystem.

Type of course:

Forest vegetation (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the forest vegetation of Croatia from the ecological, flora-genetic, syntaxonomic and biogeographic point of view (synecological conditions for the development of different vegetation types in Croatia, horizontal and vertical classification, phytogeogaphic features, syntaxonomy of forest communities, threatened and rare forest communities, protected, rare and threatened species).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Present occasionally floody and humid forest communities (planar belt of the continental region, floodplain and wetland communities forests and bushy communities, moist lowland communities, protected and threatened plant species, community status towards National classification of habitats and Natura 2000 network).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Classify the oak-hornbeam forests and the thermophilic acid forest communities of the coline-submontane belt (ecological factors in the formation of vegetation types and forest communities of the coline-submontane belt, acidophilic vegetation macrotypes in the coline-submontane belt of Europe, threatened forest communities).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Compare the beech forests of Croatia and the Illyrian floral province (development in the Holocene, Central European beech forests, beech forests of the Illyrian floral province, beech forests in Croatia, syntaxonomic classification, bio-geographic features).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Present forest communities of Noble hardwoods (areal, characteristics of habitat, biogeographical analysis, the main vegetation macrotypes in Europe, forest communities of the Dinaric area, forest communities of the Pannonian-mountainous belt, evaluation and vulnerability of forest communities).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Classify the thermophilic forests and coppice of pubescent oak, Hungarian oak and turkey oak (areal and ecological conditions, main vegetative macrotype, syntaxonomic classification, community status towards National classification of habitats and Natura 2000 network threatened and protected plant species).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Present dry, basophilic pine forests on dolomites (historical and ecological factors for the development of the forest, main vegetation macrotypes, syntaxonomic classification, endemic species and relics).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5

Present the boreal coniferous forest (areal and ecological characteristics of the boreal zone in Europe, forests and other boreal vegetation types in Croatia).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5
Classify forest vegetation of the coastal zone of the Mediterranean region (horizontal and vertical classification, ecological conditions, vegetation types, degradation stages, flora of Mediterranean forests in urban areas).	Preliminary exam, final exam.	A1, B3, B9, D1, D2, D4, D5

General competences

The objective of the course is to introduce students to the basic rules of horizontal and vertical distributions of forest vegetation in the Republic of Croatia, a syntaxonomical overview of the forest vegetation of the Republic of Croatia and a concrete description of the 55 main forest associations, categorized into 18 alliances, 8 orders and 6 classes. The student will be able to apply all the achieved knowledge in the management of forest ecosystems, on the principles of naturalness, sustainable forest management and bio-diversity.

Type of instruction

Lectures

According to the curriculum lectures include 15 terms by two school hours.

Exercises

15 exercises are performed in the form of field, computer and auditorial exercises. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is planned for 2 days, according to the curriculum.

Working methods:

Teachers' obligations:

Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload	ECTS

					outside the direct teaching	
Lectures (L)	-	-		30	0	1
Creating exercises and field work reports (E)	20%	Partly untidy and incomprehensible, with major corrections and on time .	Sufficient (2)	30	30	2
		Neat, legibly, with bigger corrections and on time.	Good (3)			
		Neat, legibly, with small corrections and on time.	Very good (4)			
		Neat, legibly, correct and on time.	Excellent (5)			
Partial exam x3 (Pe)	80%	60-70%	Sufficient (2)	0	90	3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + Pex80)/100**		**60**	**120**	**6**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam* (FE)		60-70%	Sufficient (2)		90	3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80+Ex20)/100**				

* Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 80% of the final grade, and the remaining 20% is grade from exercises

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercise + reports	The presence of students is being checked and noted. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lectures)	-
1. Partial exam	1st partial exam is available to students who have participated lectures, exercises and field work of the first half of the semester. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject, whereupon 60% of the points are to be collected for passing.	8. week	-
2. Partial exam	2nd partial exam is available to students who have participated lectures, exercises and field work and passed the first partial exam. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject. The two partial exams are scored with a total of 80 points, each with 40 points. The total is required to collect 60% of points on both the partial exam for passing.	15. week	
3. Partial exam	The third partial exam can be accessed by students who have completed lectures, exercises and field teaching. Students on pre-prepared herbal materials must identify plant species and associate them with the type of habitat and the communities they are associated with. The partial exam is evaluated with a rating passed or repeated. Passage is a condition for entering a final grade.	end of semester, exam terms	
Written exam	The exam can attend students with realized exercises and field work. The students in the pre-printed exam answer the questions asked. The written exam is evaluated and participates in the final assessment of the subject, whereby it is necessary to collect 60% points for passing	exam terms	-
Oral exam	Students who pass a written exam are being asked questions from different parts of the program content.	exam terms	-

Obligatory literature

1. Vukelić, J., Rauš, Đ., 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.
2. Vukelić, J., 2012: Šumska vegetacija Hrvatske. Šumarski fakultet Sveučilišta u Zagrebu, DZZP, 403 str.

Recommended literature

1. Dierschke, H., 1994: Pflanzensoziologie. Ulmer, Stuttgart, 686 str.
2. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
3. Horvat, I., Glavač, V., H. Ellenberg, 1974: Vegetation Südosteuropas. Gustav Fischer Verlag, Stuttgart, 768 str.

General and Landscape Ecology

ŠDU1003

ECTS 6

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Ivica Tikvić, Ph.D.
Associate Prof. Damir Ugarković, Ph.D.

Associate teacher for exercises
Associate Prof. Damir Ugarković, Ph.D.

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:

The course General and Landscape Management covers the basics of ecology, the historical development of ecology and its sub-branches, relationship and position of ecology with other scientific disciplines, significance of ecology for human civilization, global and regional ecological problems. Introduction into landscape ecology, concept of landscape, definition of landscape, function and changes of landscape, elements of landscape. Concept of ecosystem, the main types of ecosystems on Earth, biological relationship, processes of production and decomposition in ecosystems, homeostatic relationships in ecosystems, endangerment and decay of ecosystems. Landscape diversity, energy cycling, changes and stability of landscapes. Types of biogeochemical cycling of matter, ecological patterns, physical factors crucial for the development of organisms, temperature, light, radiation, water, air, climate, nutrients, organisms in ecosystems, plants, animals, microorganisms, relationships of organisms at the population and community levels, types of interactions and types in ecosystems. The ecology of fresh water systems, ecological relationships in lakes and streams, ecology of the sea, organisms and zones in seas. Ecology of terrestrial ecosystems on earth, tundra, evergreen forests of northern regions, rainforests of North America, forests in moderate regions, subtropical deciduous forests, grasslands of moderate regions, tropical savannas, tropical rain forests, deserts. Influence of agriculture, forestry and hunting on natural resources. Ecology of man, landscape structures, analysis of landscape elements, natural processes in landscapes, forms of relief, hydrological systems, geological foundations, anthropogenic influences. Landscape planning and management.

Type of course:

General and landscape ecology (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Adopt basic principles for the protection of forests against abiotic and biotic factors and apply basic procedures and means for forest protection.	Practical exercises, test of knowledge, oral exam.	B3
Participate in the implementation of the forest management program.	Practical exercises, test of knowledge, oral exam.	B4
Perform professional field work on founding, care and restoration of forest stands.	Practical exercises, test of knowledge, oral exam.	B6
Perform professional work on melioration and landscaping of forest areas in the Mediterranean area.	Practical exercises, test of knowledge, oral exam.	B7
Cooperate on the development of ecological studies and spatial plans.	Practical exercises, test of knowledge, oral exam.	B8

General competences

Knowledge of the position and trends of forestry profession in the country and the world. Complete training for the management of forest ecosystems in all respects. Realization of the forest management program.

Type of instruction

Lectures

As part of the lectures, students are introduced to theoretical and practical knowledge from individual thematic units.

Exercises

As part of the exercise, 10 exercises from the general and landscape ecology are performed. Exercises are an upgrading of the knowledge gained in lectures.

Field work

On the field work, students are introduced with practical examples of the application of knowledge of the general and landscape ecology in forestry. Practitioners take part in it.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Design the theme for the seminars and compiling tests and their evaluation. Providing written tests, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the tests and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures attendance (La)	5%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	30	0	1
Execises attendance (Ea)	5%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	15	0	0.5
Field work attendance (FWa)	3%	100%	Excellent (5)	15	0	0.5
Writing exercises and field practice report (E)	40%	Partly disordered and incomprehensible, with major corrections and on time.	Sufficient (2)	0	50	1,8
		In order, easy, with bigger corrections and on time.	Good (3)			
		In order, easy, with minor corrections and on time.	Very good (4)			
		In order, easy, accurate and timely.	Excellent (5)			
Partial exam (PE)	37%	50%-62.5%	Sufficient (2)	0	48	1,6
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam	10	50%-62.5%	Sufficient (2)	0	18	0,6

(OE)		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4) +(PEx0,37)+(OEx0,1)**		**60**	**116**	**6**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and 20% exercises and cannot be absent from the field work. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (60 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures or field work
Exercises and reports from the field work	Exercises are attended by groups. As part of the exercise is carried out 15 practical exercises in forest ecology. At the beginning of each exercise, students receive task templates and the layout of exercise reports in printed form. Estimated accuracy, neatness and regularity (exercise submitted on time). From each exercise, the student gets a grade and the average of all grades in the exercise is taken when calculating the final score from the subject.	in accordance with the agreed terms.	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	exam terms	The student has the right three times to go to the exam.
Oral exame	Students who pass a written test and who receive passive grades from exercises, and have passive grades from lectures, exercises, and field work attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(**Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)	exam terms	The student has the right three times to go to the exam.

Obligatory literature

1. EKOLOŠKI LEKSIKON, Glavni urednik Oskar Springer, Zagreb: Barbat, Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, 2001., 361 str.
2. Vjekoslav Glavač, 1999. UVOD U GLOBALNU EKOLOGIJU, Državna uprava za zaštitu prirode i okoliša : Hrvatske šume. 207 str., Zagreb.
3. Mihovil Gračanin, Ljudevit Ilijanić, UVOD U EKOLOGIJU BILJA, Školska knjiga, Zagreb 1977.
4. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.

Recommended literature

1. Daniel B. Botkin, Edward A. Keller; : ENVIRONMENTAL SCIENCE EARTH AS A LIVING PLANET (1-649 str.)
2. Eugene P. Odum, 1971.: FUNDAMENTALS OF ECOLOGY (1-574 str.)
3. Robert E. Ricklefs, 1990.: ECOLOGY (1-885 str.)
4. BIOLOŠKA I KRAJOBRAZNA RAZNOLIKOST HRVATSKE, Državna uprava za zaštitu prirode i okoliša, Zagreb 1999, str. 151.
5. Richard T.T. Forman, Michel Godron, 1986: LANDSCAPE ECOLOGY. John Wiley and Sons, Inc. New York, p. 1-620.
6. BIODIVERSITY, E.O.Wilson, Editor, National Academy of Science, 1988, p. 521

Plant nutrition

ŠDU1004

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Assistant Prof. Krunoslav Sever, Ph.D.
Assistant Prof. Tomislav Karažija, Ph.D.
Prof. Željko Škvorc, Ph.D.

Associate teacher for exercises
Assistant Prof. Krunoslav Sever, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction of students to the tasks of a contemporary science of plant nutrition and its relations with the related disciplines. Introduction of students to definitions and classifications of biogenic elements, i.e. plant nutrients, as well as to basic functions of plant nutrients. Furthermore, the course is aimed at the introduction of students to content of mineral substances in the plant and the soil as a source of plant nutrients. Definition of « Q factor of capacity» and « I factor of intensity», that is, stable and volatile pools as important factors having an impact upon nutrition of plants from the soil and absorption of nutrients from the soil. In addition, they will learn about effect of ecological factors and plant metabolism upon absorption of nutrients, absorption of plant nutrients through epigeal plant organs, and upon factors having impact upon absorption of nutrients through epigeal organs. In the end, students are to be introduced to the biogenic elements: nitrogen, phosphorus, potassium, magnesium, sulphur, iron, manganese, zinc, copper, boron, molybdenum, and chlor. They will learn about their forms that can be found in the soil, forms accessible to plants, about the way they enter into the plant and a physiological role they play once in there, about symptoms of insufficient and excessive plant nutrition with biogenic elements. Manures and dressing with manure, classification of manures, time of use and quantity of manure.

Type of course:

Plant nutrition (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Valorize soil as a source of plant nutrients and their absorption mechanisms (soil nutrients, nutrients in helat form, nutrients in mineral and organic matter, dynamic equilibrium among nutrients forms in the soil).	Partial exam, final exam.	B1
To determine the macronutrients (nitrogen, sulfur, phosphorus, potassium, calcium, magnesium; forms of nutrients and their availability, their assimilation in the plant, role in plant metabolism, symptoms of insufficiency) and micronutrients (iron, manganese, copper, zinc, molybdenum and chlorine, their forms in the soil and availability, their role and symptoms of insufficiency).	Partial exam, final exam.	B1
Interpret redistribution of nutrients in the plant (transfer of nutrients among the roots, stems and leaves, the impact of nutrients on vegetative growth and reproductive cycle).	Partial exam, final exam.	B1
To determine the nutrient status of trees in natural ecosystems (absorption, efficiency of nutrients use in forest stands and loss of nutrients form plant and ecosystem).	Partial exam, final exam.	B6, B8
Plan soil fertilization (soil sampling for chemical analysis with the aim of determining appropriate fertilization treatments - mineral, organic or natural fertilizers).	Partial exam, final exam.	B6

General competences

Acquisition of basic knowledge needed for continuation of studies at the adequate PhD studies, as well as the provision of training needed for the performance of certain works related to management of plant nutrition of young plantations.

Type of instruction

Lectures

Exercises

Exercises are performed in the laboratory in small groups. Exercises are the upgrading of knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	15	0	0,5
Partial exam - exercises (PEE)	30%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE1)	35%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE2)	35%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PEE*30+PE1*35+PE2*35)/100**		**45**	**75**	**4**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct	ECTS points

				teaching	
Final exam (FE)	70%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	60	2
TOTAL	**100%**	**(FE*70+PEE*30)/100**			

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	The attendance of students is checked and recorded at the lectures. Student may not be absent more than 20% of lectures and 10% of exercises. The exercises are attended in groups. Exercises are performed in the laboratory. Students have templates for each exercise	semester	Exceptionally, in the case of a justified reason, the student may compensate the absence of an individual exercise.
Partial exam - exercises (PEE)	After the exercises are done, the students are obliged to take the partial exam. The students answer the questions on previously printed exam.	in accordance to the agreed deadline	
Partial exam (PE1)	The students answer the questions on previously printed exam. Students are not obligatory to access the 1st **p**artial exam. If they do not access the partial exam, they have to take the final exam.	in accordance to the agreed deadline	
Partial exam (PE2)	The students answer the questions on previously printed exam. Students are not obligatory to access the 2nd **p**artial exam. If they do not access the partial exam, they have to take the final exam. If the students have a positive grade in partial exams according to the formula PEEx30 + PE1x35 + PE2x35 they are not required to access the final exam.	in accordance to the agreed deadline	
Exercises	Students who fail to pass the Partial exam are obligatory to attend the final exam. The final exam consists of a written and oral part. In a written part students answer the questions on previously printed exam. Students who pass a written exam are oraly asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula FEx70 + PEEx30	in accordance to the exam schedule	

Obligatory literature

1. Sever, K., Škvorc, Ž., 2018: Ishrana bilja (interna skripta), 1-89. Zagreb

Recommended literature

1. Vukadinović, V., V. Vukadinović, 2011: Ishrana bilja, Poljoprivredni fakultet Osijek, 442 str. Osijek.
2. Pevalek-Kozlina, B., 2003: Fiziologija bilja, Profil, 568 str., Zagreb.
3. Pallardy S. G. 2008: Physiology of Woody Plants, 3. izd. Elsevier Inc.

Growth and increment

ŠDU1005

ECTS points 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof. Mario Božić, Ph.D.
Assistant Prof. Ernest Goršić, Ph.D.

Associate teacher for exercises
Assistant Prof. Ernest Goršić, Ph.D.
Prof. Mario Božić, Ph.D.

Evaluation
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:

In the framework of the subject the following thematic wholes are covered: defining of basic terms; growth and increment of individual trees; stem analysis, tree height growth and increment determination; tree diameter growth and increment, basal area and volume growth and increment; comparison of growth and increment for different tree species; growth and increment of even-aged stands, pure and mixed; growth and increment of uneven-aged stands; description of factors by which trees growth and development of stands are defined, site quality; influence of competition on growth and increment; influence of geomorphological factors on growth and increment; influence of climatic factors on growth and increment; influence of biotic factors on growth and increment; influence of anthropogenic factors (thinning, hydrotechnical interventions, infrastructure, contamination) on growth and increment; determining the connection between elements of increment and management activities in even-aged stands; determining the connection between elements of increment and management activities in uneven-aged stands; modeling of growth and development on spatial and temporal scale; models of single trees and stand models; eco-physiological, successive and bio-models.

Type of course:

Growth and increment (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Knowledge proof	Connection with the study program LO
Determining factors which affect growth and increment	Preliminary exams, final proof.	B2, B4
To analyze growth and increment of individual trees (height, diameter, cross section area and volume increment)	Practise correction and validation, preliminary exams, final proof.	A1, B2, B4, D1, D4
To present development and stand increment (in even-aged stands, pure and mixed; growth and increment of uneven-aged stands, influence of management and habitat changes on tree and stand increment)	Practise correction and validation, preliminary exams, final proof.	A1, B2, B4, D2
To determine stand increment when making management plans (methods of stand growth, data quality of increment calculated for management unit/class level)	Practise correction and validation, preliminary exams, final proof.	A1, B2, B4, B7
To present growth and increment models (simple and complex models with stratified and nonstratified samples).	Practise correction and validation, preliminary exams, final proof.	B2, B4

General competences

This collegium gives base for achieving necessary skills needed to understand general principle of tree growth and increment of dominant species in forest stands, with factors which affect their growth and increment and methods for increment measurement. The emphasis is on understanding the growth and increment in area of natural and artificially grown forest stands.

Type of instructions

Lectures

Exercises

Practise in course Growth and increment is performed in laboratory and computer classroom.

Working methods:

Teachers obligations:

Lectures and practise. Defining and composing practise and exam tests with their evaluation. Holding colloquium, written and oral exams and consultations. Creating teaching materials.

Students obligations:

Continuous attending and active engagement in lectures and exercises, making and submitting of exercises in required time schedule. Passing the colloquiums and exams.

Grade evaluation=Passing the exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partially not clear, with major corrections but on time.	Sufficient (2)	15	15	1
		Clear, with major corrections but on time	Good (3)			
		Tidy, clear, with minor corrections and on time	Very good (4)			
		Tidy, clear, without necessary corrections and on time.	Excellent (5)			
Partial exam 1 (PE1)	40%	[60-70%)	Sufficient (2)	0	30	1
		[70-79,9%)	Good (3)			
		[80-90%)	Very good (4)			
		[90-100%]	Excellent (5)			
Partial exam 2 (PE2)	40%	[60-70%)	Sufficient (2)	0	30	1
		[70-80%)	Good (3)			
		[80-90%)	Very good (4)			
		[90-100%]	Excellent (5)			
Total	**100%**	**(Ex20+ PE1x40+PE2x40)/100**		**45**	**75**	**4**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam*	80 %	[60-70%)	Sufficient (2)		60	2
		[70-80%)	Good (3)			

(FE)		[80-90%)	Very good (4)
		[90-100%]	Excellent (5)
TOTAL	**100%**	**(FEx80+Ex20)/100**	
*** students which during semester do not pass the exam through colloquium must attend the exam which comprises 80% of grade. Remaining 20% is grade from practise.**			

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Student presence is recorded. Maximum lecture absence of 20% and practise absence of 10% are tolerated.	semester (45 hours of classes)	-
Exercises (Ex)	In the beginning students are instructed how practise files should look. At the beginning of every practise they get templates and learning materials which contain description of practise thematics with examples. Every practise is evaluated based on accuracy, tidiness and regularity of practise construction and submission.	according to calendar arrangement	-
Partial exam	To be able to attend the first colloquium students are required to have correct practise that is related to the colloquium. Colloquium is comprised of 12 questions. To pass the colloquium student needs to collect 60% of maximal points. To attend the second colloquium students are required to pass the first colloquium and have correct practise course. Second colloquium is comprised of 12 questions. To pass the colloquium student needs to collect 60% of maximal points. Students which pass both colloquiums are passed the exam and get the grade.	middle and end of semester	-
Written exam (We)	The exam comprises of 12 questions and includes theoretical and practical knowledge that student learned during lectures, practise and field work. To pass the exam student needs to achieve minimum of 60% of exam points.	exam schedule defined on the beginning of semester	-
Oral exam (Oe)	Requirement for approaching an oral exam is passed written exam within timeframe of registrated exam date Theoretical knowledge with subject understanding of lectured classes is checked. Final grade is calculated according to following formula (Wex40+Oex50+Ex10)/100		-

Obligatory literature

1. Božić, M., Goršić, E.: Rast i prirast, Prezentacije s predavanja i vježbi
2. Klepac, D., 1963: Rast i prirast šumskih vrsta drveća i sastojina, Znanje, Zagreb.
3. Božić, M., 2003: Utjecaj stanišnih i sastojinskih elemenata na prirast obične jele (Abies alba Mill.) u jelovim sastojinama na kršu u Hrvatskoj. Disertacija. Šumarski fakultet Sveučilišta u Zagrebu. Zagreb.
4. Pretzsch, H., 2001: Modellirung des Waldwachstums. Parey Buchverlag, Berlin.

5. Pretzsch, H., 2002: Grundlagen der Waldwachstumsforschung. Parey Buchverlag, Berlin.

Recommended literature

1. Assmann, E., 1961: Waldertragskunde. BLV Verlagsgesellschaft, München, Bonn, Wien.
2. Fritts, H.C., 1976: Tree Rings and Climate. The Blackburn Press, Caldwell, New Jersey.
3. Schweingruber, F., H., 1988: Tree rings: Basic applications of Dendrochronology. Kluwer academic publishers, Dordrecht, Boston, London.

Photointerpretation in forestry

ŠDU1006

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Renata Pernar, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The lectures include the following thematic wholes: Fundamentals of photointerpretation; Methods of photointerpretation; Interpretation of various types of aerial photographs in terms of photointerpretation; Influence of certain factors on readability of photographs (shadows, clouds, scale, quality of photographs, time of taking photos, type of photolayer); Instruments of photointerpretation; Picture components of importance for photointerpretation (color, tone, size, pattern, shape, …); Procedures of picture analysis (discovery, delineation, measuring, differentiation, classification, coding, …); Types and characteristics of the photointerpretation keys, Assessment of classification accuracy; Success in photointerpretation and possible errors; Applications in forestry.

Type of course:

Photointerpretation in forestry (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of photo interpretation. Explain the visual, measured and digital interpretation. Observe the influence of individual factors on the readability of the images.	Comprehensive exam.	D4
Prepare and describe the image components. Present procedures for image analysis.	Comprehensive exam.	D4

Describe the types and characteristics of Photo interpretation keys. Explain how to make a Photointerpretation key. Analyze the application of photointerpretation in breeding, managing, protection of forests, hunting, ...	Comprehensive exam.	A1, B2, B9, B15, D4
Define scale of aerial photographs. Show aerial photographs orientation. Explain the methods of measurement interpretation to determine the constituent and structural parameters.	Comprehensive exam.	A1, B2, B9, B15, D4
List the methods of digital image processing. Explain the digital interpretation. Identify and compare a controlled and uncontrolled classification. Explain the accuracy of the classification.	Comprehensive exam.	A1, B2, B9, B15, D4

General competences

Students will get to know the latest achievements in the field of photointerpretation in our country and in the world, theoretical fundamentals, types of photographing systems and methods of photographing, and possibilities for application of aerial and satellite images in forestry.

Type of instruction

Lectures

Lectures are performed with computer presentations. Within the course, with regular attendance, seminar work is being done during the semester.

Working methods:

Teachers' obligations:

Maintaining Original Teaching - Lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, production and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5

Comprehensive exam (CE)	100%	60-70%	Sufficient (2)	7,5	37,5	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(CEx100)/100**		**22,5**	**37,5**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (15 hours of direct lecturer)	The student work off for absence from the individual lectures term.
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures).	published examination deadlines	-

Obligatory literature

1. Oluić, M. (2001): Snimanje i istraživanje Zemlje iz svemira, HAZU, Zagreb, 580 str.
2. Tomašegović, Z. (1986): Fotogrametrija i fotointerpretacija u šumarstvu, Zagreb, 154 str.
3. Pernar, R.: Prezentacije s predavanja.

Recommended literature

1. Huss, S. (ed.) (1984): Luftbildung und Fernerkundung in der Forstwirtschaft, Karlsruhe, 375 str.
2. Tomašegović Z. (ed.) 1973: Fotointerpretacija, American Society of Photogrametry; 924 str.

Synmorphology and mapping forest vegetation

ŠDU1007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Dario Baričević, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Plant community. Floral composition. Vegetation structure. Significance of species. Phytocenological recording on the field. Methodology and assessment dynamics. Field data. Forest cover. Sociability. Layers. Phenology. Vitality. Processing field data. Phases of synthetic classification. Creation of final phytocenological tables. Biological form. Determining geo-elements. Eco-indicator characteristics of plant species and characterizing habitats. Numerical multivariate analysis. Cluster analysis. Multidimensional scaling. Application of results in practice. Mapping forest vegetation. Types and measures of vegetation maps. Colour and depicting units. Field work in mapping and data compilation. GIS and new mapping technology. Remote sensing. Air photos. Satellite photos. Sensors for vegetation photography. Application of vegetation mapping.
The course is based on the classic assumptions of the Braun-Blanquet approach, but also uses the most up-to-date information and technological aids. The course also relies on the principles of naturalness, sustainable forest management and bio-diversity. The course is comprised of lectures using modern teaching aids.

Type of course:

Synmorphology and mapping forest vegetation (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Interpret the application of vegetation research (synecological and vegetation research and their interpretation - identification and description of forest communities, systematic position, change in floral composition and surface, stability of phytocoenoses).	Seminar, final exam.	A1, A3, B9, B15, D1, D2, D4, D5
Valorize the floral composition as an indicator of the disturbance of forest ecosystems (phytocenological recording, biodiversity index, creating an eco-diagram, analysis of the obtained results and making detailed conclusions).	Seminar, final exam.	A1, A3, B9, D1, D4, D5
Present the mapping of forest vegetation (mapping, technical preparation, field work, processing of collected data, creation of a vegetation map).	Seminar, final exam.	A1, A3, B9, B14, B15, D2, D4, D5

General competences

The objective of the course is for students to become acquainted with the basic concepts of synmorphology and mapping forest vegetation, and to prepare students for independent phytocenological assessment, processing and interpretation of the same, as well as creation of vegetation maps and interpretation of the same, in a classical way, as well as through use of the most up-to-date information, methods and aids.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining original teaching: Lectures. Designing seminar papers. Consultation, written exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS

Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	-
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100	Exam terms	-

Obligatory literature

1. Podani, J., 1994: Multivariate data analysis in Ecology and Systematics. SPB Academic Publishing bv. Den Haag.
2. Vukelić, J. & Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.

3. Vukelić J. i sur. 2008: Šumska staništa i šumske zajednice u Hrvatskoj. Nacionalna ekološka mreža. DZZP, 263 str.

Recommended literature

1. Digby, P.G.N., R.A. Kempton, 1987: Multivariate Analysis of Ecological communities. Chapman and Hall Ltd.
2. Ellenberg, H., 1979: Zeigerwerte der Gefässpflanzen Mitteleuropas. Verlag E. Goltze KG, Göttingen.
3. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
4. Horvat, I. i sur., 1950: Priručnik za tipološko istraživanje i kartiranje vegetacije. Ministarstvo šumarstva FNRJ, 227 str.
5. Kachigan, S.K., 1991: Multivariate Statistical Analysis. Radius Press, New York.
6. Oberdorfer, E., 1983: Pflanzensoziologische Exkursions flora. Verlag Eugen Ulmer Stuttgart, 1051 str.
7. Šegulja, N. & V. Hršak, 1988: Priručnik za fitocenološka i ekološka istraživanja vegetacije. Mala ekološka biblioteka, knjiga 1, HED, 91 str.

Digital cartography in forestry

ŠDU1008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Renata Pernar, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The lectures include the following thematic wholes: Elementary of digital cartography; Data form and type; Map digitalization; Scanning; Vectorization; Cartographic projections; Transformations of coordinates; Georeferencing of maps; Orthorectification; Standardization of procedures, colors and symbols for automation of map making, Making of topographic and thematic maps; Advantages and disadvantages of digital cartography.

Type of course:

Digital cartography in forestry (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of digital cartography. Describe the goals and tasks of digital cartography. Describe equipment and software support for digital cartography needs. Specify/note the advantages and disadvantages of digital cartography. Categorize types and forms of data.	Comprehensive exam.	D4
Explain the classification and types of maps. Compare the topographic and thematic map. Pronounce the term of cartographic generalization. List the basic elements and characteristics of the map.	Comprehensive exam.	D4

List sources of data collection. Explain the term of digitalization. Compare and analyze vector and raster digitalization. Explain and show the georeferencing and orthorectifying procedure.	Comprehensive exam.	A1, B2, B9, B15, D4
Link the use of remote research in digital cartography. Combine a topographic, thematic map with a digital relief model and a digital orthophoto. Present a database editing and performing various searching with a purpose to obtain a new digital cartographic layer.	Comprehensive exam.	A1, B2, B9, B15, D4

General competences

The task of this subject is to make students acquainted with the latest achievements in the field of digital cartography in our country and in the world, theoretical fundamentals and possibilities for use in forestry.

Type of instruction

Lectures

Lectures are performed with computer presentations. Within the course, along with regular attendance of lectures, students during the semester creates seminars.

Working methods:

Teachers' obligations:

Maintaining original teaching – lectures. Designing topics for seminar papers, compiling knowledge tests and evaluating them. Maintaining oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation on lectures, preparation and presentation of seminar work. Taking an exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
Comprehensive exam (CE)	100%	60-70%	Sufficient (2)	7,5	37,5	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

UKUPNO	**100%**	**(CEx100)/100**		22,5	37,5	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (15 hours of direct lecturer)	The student work off for absence from the individual lectures term.
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures).	published examination deadlines	-

Obligatory literature

1. Frančula, N. (2000): Digitalna kartografija, Zagreb, 187 str.
2. Kereković, D. (1998) GIS u Hrvatskoj. INA-INFO, Zagreb, 450 str.
3. Kušan (ed.) (1994): Nove tehnike izmjere i kartografije, Zagreb, 75 str.
4. Pernar, R.: Prezentacije s predavanja.

Recommended literature

1. Göpfert, W., 1991: Raumbezogene Informationssysteme, Karlsruhe, 318 str.
2. Digital Photogrametric Systems, Karlsruhe, 1991, 344 str.

Zoonoses in forest ecosystems

ŠDU1010

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Josip Margaletić, PhD
Assistant Prof. Marko Vucelja, PhD

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Students are introduced to the following content: definition of zoonoses, pathogenesis, infection potential, transmission, risk groups, and consequences of zoonoses. Epidemic and pandemic. Historical overview of the occurrence of certain zoonoses. Horizontal and vertical distribution of zoonoses and their association with forest communities. Different zoonoses that are common in the forests of Croatia (leptospirosis, lyme borelosis, hemorrhagic fever, rabies, tick borne meningoencephalitis). Understanding zoonotic agents (bacteria from the genus of leptospira and borrelia, hantaviruses, rabies virus, West Nile virus). Transmission of zoonotic agents. Symptoms of selected zoonoses. Animal groups that are a reservoirs or zoonotic vectors, (small rodents, ticks, roe deer, wild boar, birds, foxes, dogs, cats, domestic animals). Interactions between humans and animals as possible zoonotic reservoirs. Importance of understanding zoonoses. Understanding zoonotic agents (importance, risk, education, prevention, treatment, legal frameworks).

Type of course:

Zoonoses in forest ecosystems (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Comprehend the definition of zoonoses, reservoirs and disease vectors, list the causes of zoonoses and link them to specific zoonoses.	Colloquium exam and written and oral exam	A2, B9

Identify the occurrence of hemorrhagic fever with renal syndrome (HFRS) and tick borne encephalitis in managed forests in Croatia.	Colloquium exam and written and oral exam	A2
Describe and interpret the role of small rodents (mice, voles, rats) in the spread of certain zoonoses (HFRS, leptospirosis).	Colloquium exam and written and oral exam	A2, B14
List the causes and reservoirs of the mentioned zoonoses and also the phases of certain diseases and their symptoms in order to provide opportunely medical attention.	Colloquium exam and written and oral exam	A2, B14, C2
Conduct a research of zoonotic agents and assess the risk factors for the possible occurrence of the epidemics of zoonotic diseases.	Colloquium exam and written and oral exam	B14, C2

General competences

The course is designed on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Writing seminar. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	-	0,5
Seminar	-	-	-	-	2,5	0,08
Colloquium exam 1	25%	60-74%	Sufficient (2)	-	5,5	0,17
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			

Colloquium exam 2	25%	60-74%	Sufficient (2)	-	7,5	0,25
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Exam	50%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			**15**	**45**	**2**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS points**
Final exam (FE)	100 %	60-74%	Sufficient (2)		30	1
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Writing seminar	Students write and present their seminar work related to relevant forest protection topics	semester	-
Colloquium exam 1 Colloquium exam 2	Colloquium exam is evaluated and participate in the final assessment of the subject	8th week 15th week	Students passing a colloquium can take the exam.
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exame.	exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	exam terms	-

Obligatory literature

1. Shakespeare, M., 2002: Zoonoses. Pharmaceutical Press, 285 str.

2. Casil,.M., 2005: Hantavirus. The Rosen Publishing Group, 64 str.

Recommended literature

1. Articles in scientific journals

Methods of plant taxonomy

ŠDU1011

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Jozo Franjić, Ph.D.
Prof. Željko Škvorc, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Taxonomy definition - the relationship between taxonomy and other scientific disciplines, basic taxonomic terminology. Phylogeny. Nomenclature, understanding of the taxon concept. Taxonomic ranks (above and below the rank of species). The process of speciation, apomixes, hybridization, introgression, polyploidy. Identification of plants, usage of plant identification keys and floristic handbooks. Significance of herbarium collections. Methods of collecting and processing various types of taxonomic data - comparative morphology, paleobotany, geography, cytology, serology, biochemistry, molecular taxonomy and systematics, cladistics. Statistical analysis methods of taxonomic data from various sources. Data analysis software.

Type of course:

Methods of plant taxonomy (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain basic principles and terminology in plant taxonomy (phylogeny, plant nomenclature, understanding of the taxon concept, evolution, speciation)	Seminar presentation, written exam.	D1, D2
To use plant identification keys, floristic handbooks, herbarium collections and herbarium material for plant identification.	Written exam.	A1, B9

To define taxonomic problems and to recommend appropriate methods of collecting and processing suitable types of taxonomic data (morphology, anatomy, cytology and biochemistry, phytogeography, paleobotany, molecular taxonomy).	Seminar presentation, written exam.	A1, D5
To analyse taxonomic data and to interpret the obtained results.	Seminar presentation, written exam.	A1, D5

General competences

In this course students gain an understanding of the basic principles, key concepts and available methods in plant taxonomy. This allows them to define and interpret taxonomic problems correctly as well as to collect and process required plant material.
They get acquainted with the latest methodologies and tools for the analyses of various types of taxonomic data, including molecular tools which are becoming widely accessible due to rapid development of science and technology.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Lecturing. Helping students with defining taxonomic problems and topics for their seminars. Preparation of exams and their grading. Organizing consultations. Preparation of lecture material.

Students' obligations:

Regular attendance and activity during the lectures, preparation and presentation of the seminars. Attending the written exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	14	0	0,5
Seminar (S)	50%	Seminar delivered on time.	Sufficient (2)	1	15	0,5
		In addition to prior, student follows the given topic and guidelines, seminar is written clearly.	Good (3)			

		In addition to prior, student gives an oral presentation of the seminar. Seminar content reflects student's effort and interest for a given topic.	Very good (4)			
		In addition to prior, seminar reflects deep understanding of the topic.	Excellent (5)			
Partial exam (PE)	50%	55-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx50 + PEx50)/100**		**15**	**45**	**2**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS points**
Final exam (FE)	50 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex50+Sx50)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures	Attendance of the lectures is recorded. Students can be excused from 20% of the total lecture hours.	semester (14 hours)	-
Seminar	Individual student seminars in which they present a minor taxonomic problem (oral student presentations). Quality of the seminar contributes to the final grade.	15. week or according to defined term.	Written seminars.
Written partial exam	Students who presented their seminar are allowed to approach the partial written exam. The exam has a total of	during the semester	-

	100 points, 55% of which are needed for a positive grade. Final grade accoring to: (Sx50 + Pix50)/100		
Written final exam	Students who presented their seminar are allowed to approach the final written exam. The exam content is composed of the whole course material and has a total of 100 points, 60% of which are needed for a positive grade. Final grade accoring to: (Fex50+Sx50)/100	exam terms	-

Obligatory literature

1. Vidaković, M., J. Franjić, 2004: Golosjemenjače. Sveučilište u Zagrebu-Šumarski fakultet. Zagreb
2. Franjić, J., Ž. Škvorc, 2010: Šumsko drveće i grmlje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 432 str. Zagreb.
3. Franjić, J., Ž. Škvorc, 2014: Šumsko zeljasto bilje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 626 str. Zagreb.
4. Judd, W. S., C. S. Campbell, E. A. Kellogg, P. F. Stevens 2007: Plant Systematics. A Phylogenetic Approach. 3rd edition. Sinauer Associates. Sunderland.

Recommended literature

1. Stuessy, T. F. 2009: Plant taxonomy: The systematic evaluation of comparative data. 2nd edition. Columbia University Press, New York.
2. Nikolić, T., 1996: Herbarijski priručnik, 1-167. Zagreb.
3. Nikolić, T., 2013: Sistematska botanika - Raznolikost i evolucija biljnog svijeta. Alfa d.d., 882 str. Zagreb.
4. Domac, R., 1994: Flora Hrvatske, priručnik za određivanje bilja. Školska knjiga, Zagreb.
5. Singh, G. 2016: Plant Systematics, 3rd edition: An Integrated Approach. CRC Press.
6. Besse, P. (ur.) 2014: Molecular plant taxonomy: methods and protocols. Humana Press.
7. Winston, J.E. 1999: Describing Species, Practical Taxonomic Procedure for Biologist. Columbia University Press, New York
8. Clive, S., 2005: Plant taxonomy and biosystematics-does DNA provide all the answers? Taxon 54: 999-1007.

Birds ecology

ŠDU1012

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Assistant Prof. Kristijan Tomljanović, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the following content: Introduction to Bird Ecology. Methods of research in the ecology of birds. Nesting. Impairment between and within species during nesting. Nutrition. Moving. Birds and climate change. Community of forest birds. Red Book.

Type of course:

Birds ecology (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Definition of ornithophore research methods. technique and technology used in bird research.	Final exam.	A1, D1
The definition requires certain groups of birds, anatomy, mating, nesting, intrageneric and interspecific predation.	Final exam.	A1, B2, D1
Presentation of individual groups (taxonomic categories) with important common features, requirements and specifics of importance to management.	Final exam.	B3, B10

General competences

Students learn about the most important segments of bird ecology, and the relation of ornithophones to relevant abiotic and biotic ecological factors. Teaching is performed using modern sources of knowledge (original reality, multimedia, video, etc.).

Type of instruction

Lectures

Teaching is performed using modern sources of knowledge (original reality, multimedia, video, etc.).

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Maintenance of oral exams and consultations. Preparation and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Examination.

Methods of grading

<table>
<tr><th>Evaluation elements</th><th>Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures (L)</td><td>-</td><td>-</td><td>-</td><td>15</td><td>15</td><td>1</td></tr>
<tr><td rowspan="4">Exam (E)</td><td rowspan="4">100%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="4">0</td><td rowspan="4">30</td><td rowspan="4">1</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td>TOTAL</td><td>100%</td><td colspan="2">(L+Ex100)/100</td><td>15</td><td>45</td><td>2</td></tr>
</table>

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct	-

		lecturer)	
Oral exam	Students are asked questions from different parts of the program content. (FEx100)/100	exam terms	-

Obligatory literature

1. Perrins, C.M., Birkhead, T. R. 1983: Avian Ecology. Chapman and Hall, New York.
2. Dolenec, Z. 2009: Ptice tu oko nas. Školska knjiga, Zagreb.

Recommended literature

1. Sutherland, W.J., Newton, I, Green, R. E. 2008: Bird Ecology and Conservation. Oxford University Press, Oxford.
2. Sterry, P. 2004: Birds of Mediterrean. C. Helm, London.
3. Perrins, C.M., Birkhead, T. R. 1983: Avian Ecology. Chapman and Hall, New York.

Behavioural Ecology

ŠDU1013

ECTS 2

English language R3

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Josip Margaletić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The course is planned in a way to cover the central features in behavioural ecology. Particular emphasis will be put on animal behaviour in evolutionary perspective. Course also handles different behavioural mechanisms, which are important for basic understanding of behavioural ecology (e.g. interaction between species, individual interests, social behavior and life history, the role of behavioural ecology in conservation biology etc.).

Type of course:

Behavioural Ecology (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the main scientists and their research that set the foundations of ethological research. Identify the difference between the ultimate and proximal causes of animal behavior. List the types of innate and learned behaviors. Identify the mechanisms responsible for the innate and learned behavior. Identify examples of natural and sexual selection and the impact of both on the development and behavior of animal species. Identify in nature different types of behavior and appearance	Written and oral exam.	B2

of animals due to natural and sexual selection. Classify different reproductive strategies of animals with an emphasis on monogamy and polygamy. Identify various mechanisms in females and males responsible for brood care. Identify sexual dimorphism and identify intrasexual and intersexual selection. Recognize types of animal behavior in nature depending on their habitats. Recognize link between the importance of habitat adaptation and the protection of animal species. Summarize the main hormones with an emphasis on sex hormones and their role in animal behavior.	

General competences

This course should familiarize the students with central features in behavioural ecology and animal behaviour in an evolutionary perspective. Obtained knowledge should also provide the forestry students with a link between the importance of behavioural ecology and conservation of free living animals.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	-	0,5
Exam (PE)		60-70%	Sufficient (2)			
		71-80%	Good (3)			

	100%	81-90%	Very good (4)	-	45	1,5
		91-100%	Excellent (5)			
TOTAL	**100%**			**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam..	exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	exam terms	-

Obligatory literature

1. Alcock J. Animal Behavior: An Evolutionary Approach. Seventh Edition. Sunderland (MA): Sinauer Publishers, 2001.

Recommended literature

1. Eibel-Eibesfeldt, I. Grundriss der vergleichenden Verhaltensforschung. München: Verlag Piper, 1969.
2. Pullin, A. S. Conservation Biology. Cambridge University Press, 2002.

Monitoring of animal species

ŠDU1014

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Josip Margaletić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the following content: Definition of animal populations. Structure of the population. Biological potential. Parent and offspring relationship. Calamities. Communication and evolution of signal transmission. Mimicry, fraud and sincerity. Horizontal and vertical distribution of animal species. Dynamics of the animal species numbers. Primary, secondary and tertiary methods for determining the density of animal populations. Influence of ecological factors on the number of animal species. The role of senses in daily and periodic migrations. Periodicity of forest mammalian feeding. Stress and animal care. Territoriality. Changes in behavior. Reproduction and selection. Animal behavioral phylogeny. Life in a group or group. Types of social groups. Dominance. Cooperation of unrelated animals.

Type of course:

Monitoring of animal species (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the definition of animal population. List and describe all the properties of the animal population. Identify scientists who set the foundations of population ecology research. Identify and interpret significance of the Lotka-Volterra model. Understand the structure of animal populations, its biotic		

potential and its dynamics. Identify different methods of determining the density of animal populations. Select and link different methods of determining density of animal populations depending on animal species and their habitat properties. Predict the obstacles that can arise when assessing the density of animal populations. List and classify different types of intraspecific and interspecific relationships of animal populations. Identify different methods of regulating animal populations with an emphasis on biological methods.	Written and oral exam.	B2

General competences

Students acquire knowledge about animal populations in forest ecosystems of protected natural and urban environments. Defining the importance and role of animals contributes to a better understanding of natural relations as guarantee for the forest stability and ecosystem conservation.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	-	0,5
Exam (PE)	100%	60-70%	Sufficient (2)	-	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

TOTAL	**100%**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam..	exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	exam terms	-

Obligatory literature

1. Zabel, C.J., Anthony, R.G., 2003: Mammal Community Dynamics. Cambridge university press, 709 str.
2. Manning, A., Dawkins, M.S., 1998: Animal behaviour. Cambridge university press, 450 str.
3. Lacey, E.A., Patton, J.L., Cameron, G.N., 2000: Life unredground the biology of subterranean rodents. The University of Chicago Press, 449 str.

Recommended literature

1. Alibhai, S.K., Gipps, J.H.W., 1985: The population dinamics of bank voles. Symposia of the zoological Society of London, 55: 277─313.
2. Bujalska, G., 1981: Formation of seks structure in populations of bank vole (Clethrionomys glareolus Schreber 1780). Wiad. Ekol., 27: 37–48.
3. Delany, M.J., 1974: The ecology of small mammals. Studies in biology, 51 Edward Arnold, London, 60 str.
4. Flowerdew, J.R. & Gardner, G., 1978: Small rodent populations and food supply in a Derbshire ashwood. J. Anim. Ecol., 47: 725-740.
5. Flowerdew, J.R., 1985: The population dinamics of wood mice and yellow-necked mice. Symposia of the zoological Society of London, 55: 315─338.
6. Margaletić, J., 1998: Rodents and their harmful effects on Turopoljski lug (Turopolje Grove) and on Croatian forests. Glasnik za šumske pokuse, 35:143–189.
7. Margaletic, J., Glavas, M. & Bäumler, W., 2002: The development of mice and voles in an oak forest with a surplus acorns. Anzeiger für Schädlingskunde / Journal of Pest Science, 75(4): 95–98.
8. Margaletić, J., Glavaš, M. & Pavić, K., 2003: Brojnost glodavaca i njihova štetnost u GJ ”Južna Krndija I (Kutjevačka)” i u rasadniku ”Hajderovac”. Šumarski list, 127(3-4): 99-107.

Zooecology in forest ecosystems

ŠDU1015

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Josip Margaletić, Ph.D.
Assistant Prof. Marko Vucelja, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Students are acquainted with the basic ecological factors which lead to the excessive reproduction of certain animal species which can result in significant damage in forest ecosystems. They are acquainted with ecological valences and ways in which a certain pest reacts to specific ecological factors, with the objective of successfully eliminating pest species and preventing damages which they can cause in forests.

Type of course:

Zooecology in forest ecosystems (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Presenting analytical zooecology (ecological factors affecting the dynamics of animal populations in forest ecosystems, homotypic and heterotypic relationships within animal populations, animal population dynamics and methods determining abundance (primary, secondary, tertiary), spatial (micro distribution and macrodistribution) distribution of animal populations in forests.	Colloquium exam and written and oral exam.	B2, B3, B4, D1, D2
Determining the dynamics of animal populations (oscillations and fluctuation types, spatial aspect of population dynamics, population theory, sinocology, zoocenosis - species and	Colloquium exam and written and oral exam.	B2, B3, B4, D1, D2

dynamics, biological equilibrium ecosystem succession and equilibrium, animal population structural changes).

General competences

The course is designed on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Writing seminar. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	-	0,5
Seminar	-	-	-	-	2,5	0,08
Colloquium exam 1	25%	60-74%	Sufficient (2)	-	5,5	0,17
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Colloquium exam 2	25%	60-74%	Sufficient (2)	-	7,5	0,25
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Exam	50%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			**15**	**45**	**2**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam (FE)	100 %	60-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Writing seminar	Students write and present their seminar work related to relevant forest protection topics	semester	-
Colloquium exam 1 Colloquium exam 2	Colloquium exam is evaluated and participate in the final assessment of the subject	8th week 15th week	Students passing a colloquium can take the exam.
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam.	exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	exam terms	-

Obligatory literature

1. Androić, M., 1970: Osnovi zooekologije s osobitim osvrtom na entomofaunu, Izdavačko-tiskarsko poduzeće «A. G. Matoš», Samobor, 152 str.

Recommended literature

1. 1. Elton, C, 1968: Animal Ecology, Methuen & Co. LTD and Science Paperbacks, London, 207 pp.
2. Stoddart, D. M., 1979: Ecology of small mammals, Chapman and Hall Ltd, London, 279 pp.
3. Flowerdew, J. R., Gurnell, J., Gipps, J. H. W., 1985: The Ecology Woodland Rodents Bank Voles and Wood Mice. The Zoological Society of London, Clarendon Press, Oxford 409 pp.
4. Zabel C. J., Anthony R. G., 2003: Mammal Community Dynamics, Cambridge University Press, London, 709 pp.

Silviculture II

ŠDU2001

ECTS 5

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Igor Anić, Ph.D.
Assistant Prof. Stjepan Mikac, Ph.D.

Associate teacher for exercises
Prof. Igor Anić, Ph.D.
Assistant Prof. Stjepan Mikac, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are acquainted with the primary forest and its significance for forest management. The course entails the definition of the primary forest; its range in the world, Europe and Croatia; the development stages and phases of the primary forest; its development cycle; primary forest texture and structure; knowledge about primary forests that is significant for silviculture, with special relation to regeneration and production in primary forests.
The course includes the following: the analyses of the forest stand genesis, the biological, ecological and economic preconditions for natural regeneration, with their impact upon regeneration success; the biology and ecology of generative and vegetative regeneration; features of natural and artificial regeneration.
The course deals with the concept, purpose, technique, and influence of forest care in younger development stadia of the stand until the first thinning. Besides thinning methods, it includes the analyses of how theory and practice of thinning has been developing in this country, and in other European forestry schools. The course also deals with the influence of thinning upon stand structure, habitat, stability, qualitative and quantitative increment, and tending rationalisation analysis.
Silvicultural procedures in management stands of all stand and silvicultural forms are analysed, together with the silvicultural procedures in protection forests and the forests for special purposes; in cases of dieback and stand and habitat deterioration, and the silvicultural procedures for revitalisation of degraded forests, expecially in the Karst region.

The aims and types of silvicultural systems; silvicultural systems in Croatia today and in the past; development of silvicultural systems in Croatia, and silvicultural systems in some European countries. Other silvicultural systems. Choice and conversion of systems.
The concept of permanent forest and sustainable forest management accompanied by the concept of bio-diversity is studied together with the impact of silvicultural procedures upon the bio-diversity of forest stands.
The exercises are aimed at reinforcement, analysis, and practical study of the following teaching unit: structure analysis of the primary forest; methods of thinning; irregular shelterwood regeneration methods; impacts of changes in site conditions upon structure, development and production of lowland forest ecosystems; revitalisation of degraded ecosystems after pedunculate oak dieback; impact of clearcut and shelterwood strip methods on regeneration of narrow-leaf ash and pine stands; silvicultural procedures in beech coppices and degraded beech stands; silvicultural procedures in fir-beech stands damaged by dieback; stand form conversion: examples of Mediterranean forest stands; silvicultural planning.
Field work deals with the following two teaching units: I – stands of common beech and sessile oak stands, common beech and common hornbeam (habitat, structure, tending, regeneration); stand tending by thinning illustrated by stands of sessile oak, beech, and common hornbeam, and stands of common beech; and natural regeneration upon small areas by shelterwood cuts; II – causes and consequences of pedunculate oak stand dieback, and site deterioration; silvicultural procedures after the dieback and deterioration (forest-management plan, cause removal, regeneration, tending); biological rehabilitation of habitat (choice of species, quantity of seeds/seedlings); pioneer tree species and their role in biological habitat preparation; artificial regeneration; young stands: description of development stadia; tending by cleaning and silvicultural tracks; quantity of seeds/seedlings for artificial stand regeneration, and mixture ratio.

Type of course:

Silviculture II (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present silvicultural forming of the forest stands (structure of the virgin forest stands and managed forest stands, principles and methods of silvicultural forming of the forest stand).	Exercises, final exam.	B5
Identify the genesis of forest stands and the choice of regeneration methods (physiological, habitat, orographic and biotic preconditions for generative and vegetative natural regeneration, features of artificial regeneration of forest stands).	Exercises, final exam.	B5
Present regeneration of the forests on small surfaces and combined regeneration methods (irregular shelterwood systems).	Exercises, final exam.	B5
Present the silvicultural aspects of special forest management and conversion methods (forests with protective function, forests of special purpose, cases of drying and decay of trees and stands of different tree species, conversion of degradation forms of forests).	Exercises, final exam.	B5

Formulate silvicultural planning (sustainable forest management and multipurpose progressive sustainable management concept).	Exercises, final exam.	B4

General competences

This course is established in the science and practice of close-to-nature silviculture, which has been here developed under the name of "Zagreb school of silviculture". It is conceived as the forest silviculture that directs the stand development by the principles of primary forest development, but based on the criteria emerging from management targets. The course trains students for independent silvicultural stand analysis, silvicultural procedures in all types of forest stands, and independent solution of silvicultural problems with making decisions on the implementation of the silvicultural procedures in all types of forest management. By taking this course, a student learns to answer the question, what and how to do in a forest stand, in order to fulfil the aim of management. The student is trained in classical silviculture and is taught about the polyvalent silviculture. The tuition is organised through lectures, exercises and fieldwork, using modern teaching devices. The lectures encompass thematic units, which are reinforced during exercises. The fieldwork includes special units and silvicultural issues in accordance with the curriculum.

Type of instruction

Lectures

Lectures cover 14 units according to the teaching plan.

Exercises

10 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is scheduled for 2 days. Two themes are discussed.

Working methods:

Teachers obligations:

Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching	Number of average students	ECTS

				hours	workload outside the direct teaching	
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	60-70%	Sufficient (2)	71	4	2,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (Ex)	80%	60-70%	Sufficient (2)	0	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + Pex80)/100**		**101**	**49**	**5**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	exam terms	-

Obligatory literature

1. Anić, I., 2009: Uzgajanje šuma II. Skripta za internu uporabu, Sveučilište u Zagrebu, Šumarski fakultet, 100 str.
2. Na internetskoj stranici http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=99 pod predmet Uzgajanje šuma II, nalaze se poveznice Vježbe, autor I. Anić.

3. Matić, S., I. Anić, M. Oršanić, 2003: Uzgojni postupci u bukovim šumama. U: S. Matić (ur.), Obična bukva (Fagus sylvatica L.) u Hrvatskoj, Akademija šumarskih znanosti, 340 – 369, Zagreb.
4. Matić, S., M. Oršanić, I. Anić, 2003: Uzgojni postupci u niskim i degradiranim bukovim sastojinama. U: S. Matić (ur.), Obična bukva (Fagus sylvatica L.) u Hrvatskoj, Akademija šumarskih znanosti, 393 - 405, Zagreb.
5. Matić, S., I. Anić, M. Oršanić, 2001: Uzgojni postupci u prebornim šumama. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 407–460, Zagreb.
6. Matić, S., B. Prpić, I. Anić, M. Oršanić, 2001: Uzgojni postupci u jelovim šumama oštećenima propadanjem. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 461–478, Zagreb.
7. Matić, S., 1996: Uzgojni radovi na obnovi i njezi sastojina hrasta lužnjaka. U: D. Klepac (ur.), Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj, HAZU i Hrvatske šume p.o. Zagreb, 167 – 212, Zagreb.

Recommended literature

1. Burschel, P., J. Huss, 1997: Grundriss des Waldbaus. Parey Buchverlag, 487 str., Berlin.
2. Korpel, Š., J. Penaz, M. Saniga, V. Tesar, 1991: Pestovanie lesa. Priroda, 465 str., Bratislava.
3. Matić, S., 1994: Šume visokih gora i planina dinarskog područja. U: Đ. Rauš (ur.), *Silvae nostrae Croatiae*, Ministarstvo poljoprivrede i šumarstva Republike Hrvatske, 145 – 153, Zagreb.
4. Matić, S., 1991: Njega šuma proredom. Šumarski fakultet, 45 str., Zagreb.
5. Matić, S., J. Skenderović, 1992: Uzgajanje šuma. U: Đ. Rauš (ur.), Šume u Hrvatskoj, Šumarski fakutet Zagreb & Hrvatske šume p. o. Zagreb, 81 – 97.
6. Matić, S., M. Harapin, 1986: Uzgajanje i zaštita šuma. Savez inženjera i tehničara šumarstva i drvne industrije, 177 – 194, Zagreb.
7. Matthews, J. D., 1991: Silvicultural systems. Clarendon press, 284 str., Oxford.

Forest Karst Meliorations

ŠDU2002

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Željko Španjol, Ph.D.
Associate Prof. Damir Barčić, Ph.D.

Associate teacher for exercises
Assistant Prof. Roman Rosavec, Ph.D.

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the meaning of the Dinaric karst in the international context, highlighting the landscape value, geomorphological and hydrogeological features of the area, which includes 54% of the Republic of Croatia. The description includes: an explanation and definition of karst or chamois with its characteristics (geological and morphological), acquaintance of the main vegetation, pedological and climatic factors related to the karst area of Croatia, the genesis of the process of regression of vegetation and soil degradation on karst, an explanation of melioration , the reasons and purpose of application of biological and technical melioration works on degraded forest terrain, a basic view of the problem of protection and restoration of autochthonous climatic vegetation on karst, issues of raising and protection of forest cultures from the point of view of melioration, selection of tree species and shrubs for karst filling. The subject explores the problems of flooding and soil erosion, the causes of devastation and degradation on karst, the fires of open space and the rehabilitation of forest areas affected by fire, windshields and other protective forest belts, and the concept of agroforestry. The ecological evaluation of karst in Croatia as well as its significance in biodiversity is being studied, as more than 60% of the protected areas are in karst (for example, all eight national parks). An integral part of the course is lectures, exercises, seminars and field work.

Type of course:

Forest Karst Meliorations (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Assess the role and meaning of the karst ecosystem (melioration works, ecological requirements and silvicultural treatment characteristics of the pioneer species).	Partial exam , seminars, final exam.	B6
Present the problem of erosion and torrents on karst, and degraded amelioration forest terrain (causes and consequences of erosion processes and torrents, ways reconstruction, raising of wind and rain protection belts at karst, meliorative factors of forest vegetation on karst).	Partial exam, seminars, final exam.	B6
Predict the renewal of forest vegetation after open space fire (issues of open space fire and impact on forest vegetation, protection measures).	Partial exam, seminars, final exam.	B5

General competences

Interpretation of Forest Management Issues. Management models in specific mediterranean and continental karst conditions. Analyze renewal methods of degraded and fire-affected areas.

Type of instruction

Lectures

Exercises

Seminars are conducted as part of the exercise. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is performed in the areas of state forests and on forest in the Faculty of Forestry. Students familiarize themselves with the work in practice concerning the forest management on forests and forest land in the Karst area of Croatia.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written exams, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L) + Exercises (E)				45	-	1,5
Seminar work (Sw)	10%	50-70%	Sufficient (2)	-	10	0,33
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	45%	50-70%	Sufficient (2)	-	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	45%	50-70%	Sufficient (2)	-	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + P1x45 + P2x45)/100**		**45**	**50**	**3**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam (FE)	90 %	50-70%	Sufficient (2) Good (3)		40	1,34

		71-80%	Very good (4)
		81-90%	
		91-100%	Excellent (5)
TOTAL	**100%**	**(Fex90+Swx10)/100**	

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (45 hours of direct lecturer)	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam.
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: (Fex90+Swx10)/100		-

Obligatory literature

1. Barčić, D., Španjol, Ž. 2017: Šumske melioracije krša. Skripta za internu upotrebu, Zavod za ekologiju i uzgajanje šuma, Šumarski fakultet Sveučilište u Zagrebu, Zagreb.

Recommended literature

1. Horvat, A., 1965: Melioracije degradiranih šumskih terena, Svezak I, Krš, Šumarski fakultet, Zagreb. pp. 178.
2. Androić, M., 1971: Zaštita šuma na kršu. Simpozij o zaštiti prirode u našem kršu, 93-107, Zagreb.
3. Bakšić, N., 2017: Vlažnost mrtvog šumskog goriva kao čimbenik nastanka požara. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.

4. Balen, J., 1931: Naš goli krš,pp. 311, Zagreb.
5. Balen, J., 1935: Prilog poznavanju naših mediteranskih šuma. Šumarski list, Zagreb.
6. Barčić, D., 2003: Meliorativne značajke borovih kultura u stanišnim prilikama otoka Raba, Magistarski rad, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.
7. Barčić, D., 2007: Odnosi stanišnih čimbenika u sastojinama crnoga bora (*Pinud nigra* J.F. Arnold) u Hrvatskom primorju i u Istri. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.
8. Barčić, D., Španjol, Ž., Rosavec, R. 2011: Utjecaj na stanište i razvoj šumskih kultura crnoga bora (*Pinus nigra* J.F. Arnold) na krškom submediteranskom području**.** Croatian Journal of Forest Engineering, vol. 32, No 1, 131-140, Zagreb.
9. Barčić, D., Španjol, Ž., Rosavec, R. 2011: Čimbenici utjecaja šumske prostirke na požare u šumskim ekosustavima. Vatrogastvo i upravljanje požarima, br. 1-2, vol. I, 26-35, Zagreb.
10. Barčić, D., Dubravac, T., Rosavec, R. 2016: Utjecaj požara otvorenog prostora na šumarstvo sredozemnog područja krša. Vatrogastvo i upravljanje požarima, br. 2, vol. VI, 78-97, Zagreb.
11. Meštrović, Š., 1977: Značaj šumskih kultura u primorskom području krša. Šumarski list, CI (8-9): 382-385, Zagreb.
12. Rosavec, R., 2010: Odnos čimbenika klime i zapaljivosti nekih mediteranskih vrsta kod šumskih požara. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.
13. Španjol, Ž., 1995: Prirodna obilježja Raba, Rab-Zagreb.
14. Španjol, Ž., 1996: Prilog poznavanju šumskih požara u sastojinama alepskog bora (*Pinus halepensis* Mill.). Znanstvena knjiga 1, 391-412, HŠD, Zagreb.
15. Španjol, Ž., 1996: Biološko-ekološke i vegetacijske posljedice požara u borovim sastojinama i obnova. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.
16. Tomašević, A., 1986: Rekultivacija kraških goleti pošumljavanjem u Hrvatskoj. Glas.šum. pokuse, posebno izdanje. Zagreb.
17. Tomašević, A., 1990: Podrivanje kao prva faza pripreme tla za pošumljavanje. Glas.šum. pokuse 26: 393-404. Zagreb.
18. Tomašević, A., 1994: Meliorativni utjecaj kulture alepskog bora i pinijena degradirano stanište hrasta medunca (*Querco-Carpinetum orientalis* H-ić 1939) u zadarskom području. Glas.šum. pokuse 30:223-298, Zagreb.
19. Tomašević, A., 1995: Višegodišnji rezultati istraživanja uspjeha pošumljavanja na kršu alepskim borom (*Pinus halepensis* Mill.), crnim borom (*Pinus nigra* Arn.) i primorskim borom (*Pinus pinaster* Ait.) kod tri različite metode pripreme tla za pošumljavanje.Šum. list CXIX, (7-8): 227-238, Zagreb.
20. Topić, V., 1992: Količina i kemizam šumske prostirke pod nekim šumskim kulturama na kršu. Šum. list CXV, (9-10): 407-414, Zagreb.

Hunting management I

ŠDU2003

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2

Lecturer
Prof. Marijan Grubešić, Ph.D.
Prof. Krešimir Krapinec, Ph.D.
Assistant Prof. Kristijan Tomljanović, Ph.D.

Associate teacher for exercises
Prof. Krešimir Krapinec, Ph.D.
Assistant Prof. Kristijan Tomljanović, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Student will be educated as future makers, operators and persons participating in supervision of hunting management bases, breeding programs and game protection programs. Detailed exploring of the hunting ground i.e. the habitat of game, elements of hunting ground and the criteria, which must be met by certain hunting grounds for certain game species. Procedure for establishment of habitat quality, establishment of hunting ground capacity for certain game species. Preservation of an optimum proportion between the genders and age structures among game as the basis for a lasting management and population stability. Increase planning and intervention in the population by Plan Act – LGO. Game breeding and protection measures contain elements of technical hunting ground arrangement, provision of game feed and monitoring of health condition in game. Apart from the economic game species, students will also get to know protected animal species, plans for their protection and revitalization of endangered species. The aim of this subject is to prepare the students for their future duties in terms of an integrated management of habitat and fauna, under the use of the technique and the technology for an optimum use of the area and the fauna, under application of measures for protection and preservation of habitats and animal species. Through exercises and teaching in the field students will directly get to know the manner for preparing and implementation of management plan acts, as well as habitat and animal species protection measures on the example of our national parks and nature parks.

Type of course:

Hunting management I (compulsory, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define wildlife habitat, hunting ground, and hunting grounds for certain game species (determining hunting productive areas, habitat quality for large and small game, determining the hunting capacity for each species of game).	Practice exercises, final exam.	A1, A3, B2
Presenting game management (optimum sex and age structure of game in the population, growth and recharge, dump, waste, development of large and small game stocks, planning the required amount of game food).	Practice exercises, final exam.	B2, C2
Comply with the technical arrangement of hunting grounds (hunting grounds - feeding tanks, dormitories, eating areas, food storage, dummies, observatories and checkers, ...).	Practice exercises, final exam.	B2, C2, D2
Establish protected species (protection and revitalization plans of endangered species, wildlife conservation programs, action plans, management plans).	Practice exercises, final exam.	B2, D1

General competences

Students will learn about hunting management plans, protected species and their habitat. It focuses on professional planning, management and oversight of the implementation of plans. Through the teaching, exercises and field teaching, the implementation of prescribed programs for the management of fauna and habitat will be presented.

Type of instruction

Lectures

At the lectures students learn about the management of wild game in open hunting grounds. Establishment of hunting grounds, hunting grounds, hunting grounds, hunting plans, etc.

Exercises

Exercises practically complement the thematic whole of lectures. The students independently create parts of the hunting management plan.

Field work

1. Counting large and small game.
2. Visit to the state open hunting ground Bjelolasica - hunting management.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures, exercises and field teaching. Maintenance of written, oral exams and consultations. Preparation and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,0
Exercises (E)	-	-	-	15	0	0,5
Field work	-	-	-	15	0	0,5
Exam (E)	100%	60-70%	Sufficient (2)	0	30	1,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		**60**	**30**	**3**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercise	Exercises are attended by groups. As part of the exercise, 15 practical exercises from the aforementioned thematic units are performed. At the beginning of the first exercise, students receive task templates, and. Exercises are a condition for accessing the exam.	according to the agreed term	-

Written exam	Exam can be attended by students who have completed and committed exercises. The students in the pre-printed printed exam answer the questions asked. Passage in writing is necessary for passing on the oral exam.	exam terms	-
Oral exam	The requirement for the entrance to the oral exam is at least 60% of the points collected on the written part of the exam. The final grade is obtained according to the formula (Ex100)/100	exam terms	-

Obligatory literature

1. Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str.
2. Andrašić, D., 1982: Objekti tehničkog uređenja lovišta i uzgajališta divljači, Zagreb,106 pp.
3. Andrašić, D., 1973: Uređivanje lovišta. Lovna privreda IV dio, Zagreb.
4. Grupa autora: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str.
5. Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str.
6. Tucak, Z., Florijančić, T., Grubešić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K., 2002: Lovstvo. Drugo prošireno izdanje. Uđbenik, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet Osijek, 405 str.
7. Zakonski i podzakonski akti vezani uz lovno gospodarenje, šumarstvo, zaštitu prirode i okoliša

Recommended literature

1. Pascal Durantel, P. 2007: Enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 607 str.
2. Pascal Durantel, P. 2007: Praktična enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 285 str.
3. Whitehed, G. K. (1993): The Whitehead Encyclopedia of Deer. Swan Hill Press, Shrewsbury, UK, 597 str.
4. Blüchel, K.G.: Die Jagd, 652 str.

Forest Tree Breeding

ŠDU 2004

ECTS 3

English language R1

E-learning R2

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Davorin Kajba, Ph.D.

Associate teacher for exercises
Professor Davorin Kajba, Ph.D.
Assistant Prof. Ida Katičić Bogdan, Ph.D.

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Students are introduced to general concepts of forest tree breeding, its importance within forestry, its goals and methods. Natural variation of forest trees, speciation, geographic variation, provenances, races, within provenance variation, full-sibs and half-sibs. Selection methods, mass selection, seed zones, seed stands. Individual selection (simple recurrent selection, general combining ability (GCA), specific combining ability (SCA), reciprocal recurrent selection). Hybridization and its use, intra- and interspecies hybridization, within species hybridization, backward hybridization. Genetic testing, quantitative traits inheritance in forest tree species, genetic parameters, estimate of heritability, genotype × environment interaction. Propagation and testing of plant material. Genetic components of continuous variation, selection and reproduction of experimental plant material, QTLs, marker assisted selection (MAS). Various types of breeding methods by selection, hybridization and mutation. Examples of geographic variation of forest trees, design of experiments in tree breeding, genetic considerations in forest seed production. Different types of seed orchards, genetic diversity and genetic resources conservation of indigenous tree species, introduction of exotic forest species within the frame of tree breeding efforts. Advances and perspectives in breeding of endangered indigenous as well as of exotic forest tree species.

Type of course:

Forest Tree Breeding (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Apply abiotic and physical factors that affect the natural selection of a particular tree species. Interpret the influence of seasonal climate change and plant phenology for economically significant species of forest trees. Evaluate shapes and measures of genetic variability of forest trees. Calculate the values of modification norms, ecotype and / or clonal variability.	Practise exercises, colloquia, knowledge test, final exam.	B6
Formulate the basic principles of differentiation of forest seed sources. Select the use of forestry reproductive material collecting equipment. Prepare and carry out selection of plus trees in a even age stand with objective selection criteria. Select the method of vegetative propagation of forest trees (autovegetatively and heterovegetatively multiplication).	Practise exercises, colloquia, knowledge test, final exam.	B6
Combination processes and methods of controlled hybridization. Classify types of sexuality in forest trees with examples. Introduce intra and interspecies hybridization with regard to the gender of the tree species. Evaluate inheritance and genetic gains in progeny and clonal tests.	Practise exercises, colloquia, knowledge test, final exam.	B6
Classify and review some type of genetic modification. Design and make a model for the breeding of conifers and hardwoods. Design and make a model of poplar and willow breeding.	Practise exercises, colloquia, knowledge test, final exam.	B6

General competences

Students acquire theoretical and practical knowledge of the principles and methods of breeding forest trees. Students are introduced to the goals of breeding (increase of wood mass, quality, resistance to biotic and abiotic factors, breeding for urban forestry and horticulture, clonal forestry techniques etc.). Breeding involves methods of selection, crossing, breeding of mutations, polyploidy, genetic engineering), and conservation of genetic diversity, all with examples of forest trees.

Type of instruction

Lectures

Exercises

Students learn practically in the exercises the variability and inheritance of qualitative and quantitative properties in forest trees.

Field work

1st day is held in the area of floodplain forests. The students are familiar with the results of molecular research and research of quantitative genetics, which are carried out in different types of forest trees.

They have also been demonstrated in experiments of provenance (quantitative properties, phenolic observations, etc.), with the aim of studying genetic variability and breeding. The researches in the progeny tests from seed regions from Croatia were demonstrated. Seed stands and their role in breeding and conservation of genetic diversity as well as the use of forest reproductive material in the changed ecological and climatic conditions have been demonstrated.
2nd day Field teaching is held in Čazma Forestry area. Schreiner criterion was selected for the selection of trees plus phenotypic selection, and they became acquainted with the process of establishing and maintaining clonal seed orchard of oak and narrow leaf ash. Biotechnical investigation, phenotypic observations and other properties related to intra-population variability research in clonal seed plantations are presented. The students were referred to the research results that were conducted through molecular research, genotyping of clones. They are acquainted with the use of forest reproductive material in "selected" and "tested" categories. The aim of the study was to study genetic variability and to preserve the evolutionary potential of different forestry wood species by the *ex situ* method, as well as the significance of clonal archives. As a part of the test, it was demonstrated genotype selection, that is, the goal of achieving genetic gain in improved clonal seed orchard. For the purpose of biomass production in short-rotation forestry, their work on the selection of willow clones has been shown.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards.	Sufficient (2)	30	0	1
		Extended lectures with less than 10% of acceptable disadvantages of the application of technical standards.	Good (3)			

		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards.	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards.	Excellent (5)			
Making excersies (E)	30%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards.	Sufficient (2)	15	15	1
		Extended lectures with less than 10% of acceptable disadvantages of the application of technical standards.	Good (3)			
		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards.	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards.	Excellent (5)			
Colloquium from the study of the Geographic Variability of Forest Trees and Breeding Selection (K1)	30%	60-70%	Sufficient (2)	2	13	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Breeding by mutations, polyploidy, genetic engineering with Breeding (K2)	30%	60-70%	Sufficient (2)	2	13	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Total	**100%**	**(Px10+Vx30 + K1x30+K2x30)/100**	**49**	**41**	**3**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	60%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx60+PEGx30+Ex5+HWx5)/100**				
*** students who do not pass the course through two partial exams during the semester take the final exam that is 60% of the grade and is the same as the partial exam - angiosperms; the remaining 5% is the grade of the exercises, 5% is the grade of the homework and 30% of the partial exam - gymnosperms**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours. Student activity is recorded.	semester (45 hours of direct lecturer)	
Making exercises	Exercises are attended by groups. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted in a probationary period (provided that the student does not leave the class more than allowed, that the average grade of all the lessons in the classroom is greater than enough.	15. week	
Colloquium from the method of studying the variability of qualitative and quantitative properties in forest trees (K1)	The first colloquium can be accessed by students who have a positive evaluation of the 1st Exercise and no less than 20% have abstained from teaching.		
Colloquium from the population structure and frequency of genes and genotypes, genetic	Colleges can be accessed by students who have passed the 1st Colloquium. The two colleges are scored with a total of 70 points, each colloquium with 35 points. A total of 42 of 70 points are required for the passage (60%).Students who get enough points from both hands		

equilibrium in forest tree populations (K2)	get a final score on the subject. The final grade is the average score from the exercise and the score by the points.		
Written exam	The written exam consists of six assignments. For the passage it is necessary to have 28 points out of a total of 47 points (60%).	exam terms	
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the university textbook) is checked. The final grade is obtained according to the formula		

Obligatory literature

1. D. Ballian, D. Kajba: OPLEMENJIVANJE ŠUMSKOG DRVEĆA I OČUVANJE NJEGOVE GENETSKE RAZNOLIKOSTI, Sarajevo-Zagreb, 2011, 299 str.
2. Vidaković, M., A. Krstinić: GENETIKA I OPLEMENJIVANJE ŠUMSKOG DRVEĆA, Liber, Zagreb, 1985, 505 str.
3. Kajba, D., D. Ballian: ŠUMARSKA GENETIKA, Zagreb-Sarajevo, 2007, 283 str.
4. Krstinić, A. i sur.: OPLEMENJIVANJE ŠUMSKOG DRVEĆA. U: Šume u Hrvatskoj. 1992, str. 109-121.
5. Borojević, K.: GENI I POPULACIJA. Forum. Novi Sad. 1986, 545 str.
6. Tucović, A, V. Isajev: PRAKTIKUM IZ GENETIKE SA OPLEMENJIVANJEM BILJAKA, Naučna klnjiga, Beograd, 1988., 340 str.
7. Kalafatić, M.: OSNOVE BIOLOŠKE EVOLUCIJE, HPD, 1998, 136 str.
8. Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.

Recommended literature

1. Eriksson, G., I. Ekberg, D. Clapham: AN INTRODUCTION TO FOREST GENETICS. SLU Repro, Uppsala. 2007, 185 str.
2. Namkoong, G., Kang, H. C., Brouard, J. S.: TREE BREEDING PRINCIPLES AND STRATEGIES, Springer Verlag, 1988, 345 str.
3. White, T. L., Adams, W. T., Neale, D. B., 2007: FOREST GENETICS, CABI Publishing, 682 str.
4. Kumar, S., M. Fladung: MOLECULAR GENETICS AND BREEDING OF FOREST TREES, Food Products Press, 436 str.
5. Falconer, D. S. & T.F.C. Mackay: INTRODUCTION TO QUANTITATIVE GENETICS. Longman Group Ltd., 1996, 464 str.
6. Müller-Starck, G., M. Ziehe: GENETIC VARIATION IN EUROPEAN POPULATIONS OF FOREST TREES, J.D. Sauerländer's Verlag, Frankfurt am Main, 1991, 271 str.
7. Richards, A.J.: PLANT BREEDING SYSTEMS, Second edition, Chapman & Hall, London, 1997, 539 str.
8. Zobel, B. J., Talbert, J.: APPLIED FOREST TREE IMPROVEMENT, John Wiley & Sons, 1984, 505 str.
9. Wright, J. W.: INTRODUCTION TO FOREST GENETICS, Academic Press, 1976, 463 str.
10. Hattemer, Hans H., Bergmann, F., Ziehe, M.: EINFÜHRUNG IN DIE GENETIK, J.D. Sauerländer's Verlag, Frankfurt am Main, 1993, 492 str.
11. Paule, L.: GENETIKA A ŠL'ACHTENIE LESNÝCH DREVÍN, Príroda a.s., Bratislava, 1992, 304 str.

Management and protection of forest soil

ŠDU2005

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Prof. Nikola Pernar, Ph.D.
Prof. Darko Bakšić, Ph.D.
Assistant Prof. Ivan Perković, Ph.D.

Associate teacher for exercises
Prof. Darko Bakšić, Ph.D.
Prof. Nikola Pernar, Ph.D.
Assistant Prof. Ivan Perković, Ph.D.

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

The curriculum of the course Management and protection of forest soil serves as the upgrading of soil knowledge that students acquire on the Faculty of Forestry within the framework of the curriculum of Soil science. It elaborates issues of soil protection in various fields of human activities.
The aim is to provide a student, after acquiring general knowledge of Soil Science, with a complete picture of soil role in the ecosystem, soil valorization in the ecosystem management, damage resources and possibilities and protection methods and opportunities.
The program is realized through lectures, practical part and field courses, and includes 6 basic units: Soil Characteristics and Functions, Soil Classification as a Precondition of its Protection, Soil Evaluation (soil survey, valorization), Changes in Soil and Soil Damages, Soil Improvement, Soil Protection. In the first part students get more detailed knowledge of soil characteristics and functions. This unit is to a particular degree the synthesis of the material of Soil Science, elaborated here for the purpose of better understanding the soil function. The second part elaborates bases of soil classification, as a precondition of sustainable soil management and elaborates soil systematic with emphasis on the international classification system. It includes a review of information soil system, information system establishment, soil inventory technique and creation and opportunities for using soil maps. Such knowledge is needed for soil evaluation (valorization, soil survey) in integral environmental management. The third part elaborates mapping, inventory and geography of soil. The

fourth unit introduces students to the methods of evaluation of the soil, focusing on the American method, FAO method and method applied in Croatia. The fifth unit acquaints students with changes in soil in relation to its initial condition. This unit defines terms such as harmful material and soil damage and provides systematic overview of various kinds and degrees of damage and their causal connection with various activities. The sixth unit elaborates issues of soil protection: legal framework; protection from various kinds of damages; soil monitoring as one of the important conditions of system and efficacious soil protection.

Type of course:

Management and protection of forest soil (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
The role of the soil. Critically evaluate the role of soil. Identify the importance of soil in forestry.	Partial examination, laboratory exercises, full examination.	A2
Soil classification system. Compare the soil to the national and WRB classification system. Comparative the properties of different type of soils. Evaluate the properties essential to the fertility and key properties of the soil.	Partial examination, laboratory exercises, full examination.	B2, B3, B9
Soil mapping. Application of soil mapping in forestry. Evaluate the nature of soil relationships in forest ecosystems in Croatia.	Partial examination, laboratory exercises, full examination.	A1, D1
Evaluate the soil. Select methods for increasing productivity of soil in forestry. Chemical soil melioration.	Partial examination, laboratory exercises, full examination.	B6, B13, D1
The role of soil in integral management of terrestrial ecosystems. Soil protection. Compare the geogenic and limit values in the soil. Critically evaluate the conversion of forest land due to the expected impacts on the soil.	Partial examination, laboratory exercises, full examination.	B9, C5, D1
Evaluate the influence of forest fire on the soil. Monitoring of forest soil. Organize forest monitoring. Compare the state of soil protection at a global, regional and national level. The implementation and regulations on the soil protection.	Partial examination, laboratory exercises, full examination.	B9, C5

General competences

The role of soil in a terrestrial, especially forest ecosystem. Valorization of soil in management of forest ecosystems. Assessment of potential soil degradation. Forest soil protection

Type of instruction

Lectures

The lectures are realized in blocks-hours in one of the major classroom. They are based on PP presentations and correspond to a material in the text-book.

Exercises

Exercises are the upgrading of knowledge adopted in lectures and there are platforms for understanding individual chapters, e especially from the aspect of nutrients in the soil, soil pollutants and soil consistency as a factor of its degradation. Exercises are performed in the Ecological-Pedologycal laboratory in small groups (8 students in group).

Field courses

Field course is maintained in the forests of the lowland area and on the karst. Soils of different fertility and various physiographic and genetic features are presented.

Working methods:

Teachers' obligations:

Teaching - lectures, exercises, field courses. Designing topics for seminar task, compiling knowledge tests and evaluating them. Observations of written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation on lectures, exercises and field courses; preparation of exercises report and preparation and presentation of seminar work (possibly). Partial and/or full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	10	1,3
Laboratory exercises (LE)	-	-	-	15	15	1
Field courses (FC)	-	-	-	8	1	0,3
Exam (E)	100 %	50-60 %	Sufficient (2)	4	37	1,4
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		**57**	**63**	**4**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	On the lectures is checked the students presence.The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	semester (45 hours of direct teaching)	-
Laboratory Exercises (LE)	Exercises are attended by groups. Four practical exercises are performed (soil nutrients, harmful substances, micro aggregate stability, consistency)	according syllabus and agreement with the students	In the case of a justified reason, the student draws up absence from the particular exercise term.
Field courses (FC)	Field course is performed as complex field course, and the terms are published at the beginning of the semester.	second half of the semester.	-
Partial exam (PE)	Students can take the exam in two parts (partial). The first part takes place after ~ 50% of theoretical teaching, and the term is agreed with the students. The exam consists of a written and oral part (the written part of the exam must be passed for oral instruction), and it is about 50% of the subjects provided by the theoretical program. Partial exams can be accessed by students who have no more than one absence from the lectures. Those students who take the first partial exam will also take the second part of the exam on some of the regular test terms by the end of the current academic year. The arithmetic mean of the two grades represents the grade of the exam that) gives the final grade.	agreement with the students in second half of the semester.	-
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade.	published test deadlines.	-

Obligatory literature

1. Pernar, N., 2017: Tlo; nastanak, značajke, gospodarenje. Šumarski fakultet, Zagreb, XVIII + 799 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Binkley, D. & R. F. Fisher, 2013: Ecology and Managenent of Forest Soils. John Wiley & Sons, Inc., 3rd edition, 363 p.

Ecological Monitoring

ŠDU2006

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Ivica Tikvić, Ph.D.
Associate Prof. Damir Ugarković, Ph.D.

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:

The course Ecological Monitoring includes an overview of the functioning of the main forest ecosystems in Croatia, the main disturbances to biological and ecological balance, monitoring conditions in virgin forests and forest reserves, assessments of tree vitality of the main types of forest tree species, air pollution and forest precipitation monitoring methods, dry and wet sedimentation, precipitation chemistry, monitoring pollution of flood waters and subterranean waters, determining the intensity of mycorrhizal development on the roots of the main tree species, monitoring and analysis of climate and microclimate, automatic systems of climactic monitoring, monitoring the influence of climatic factors on forest trees, ozone damage assessments, selection of bioindicators for assessing ozone damage, methods of monitoring the dynamics of flood and subterranean waters, hydrology of mountainous forest ecosystems, runoff, sinking and surfacing water, lyzimetric monitoring, phenological observation, monitoring leaf and generative phenophases of main forest tree species, monitoring the dynamics and intensity of seed yield, determining tree biomass, assessing canopy damage, lack of leaves or needles, changes in the colour of leaves or needles, dynamics of tree senescence, an overview of the main international ecological monitoring programs.

Type of course:

Ecological monitoring (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Identify tree species on the basis of morphological features, identify tree parts and shapes, and apply theoretical and practical knowledge of economically important indigenous and allochthon species of trees and shrubs.	Tests of knowledge, oral exam.	B1
Adopt the fundamental principles of protecting the forests of abiotic and biotic factors, especially from the fires, and apply the basic procedures and means to protect the forests.	Tests of knowledge, oral exam.	B3
Participate in the implementation of the forest management program.	Tests of knowledge, oral exam.	B4
Carry out works on forest inventory.	Tests of knowledge, oral exam.	B5
Collaborate on the development of ecological studies and spatial plans..	Tests of knowledge, oral exam.	B8

General competences

Complete training for the management of forest ecosystems in all respects. Methods and equipment for monitoring of ecological factors. Forest protection from abiotic and biotic factors. Preparation of environmental studies. The tasks of expert manager and supervisor in nature and environment protection.

Type of instruction

Lectures

Through lectures students are introduced to theoretical and practical knowledge from individual thematic units.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Laying the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS

Lectures (L) attendance	10%	100% - 5, 90% - 4, 80% - 3, 70% - 2	-	15	-	0,5
Partial exam (PE)	60%	50-62,5%	Sufficient (2)	4	25	1
		62,5-75%	Good (3)			
		75-87,5%	Very good (4)			
		87,5-100%	Excellent (5)			
Oral exam (OE)	30%	50-62,5%	Sufficient (2)	0,5	15,5	0,5
		62,5-75%	Good (3)			
		75-87,5%	Very good (4)			
		87,5-100%	Excellent (5)			
TOTAL	**100%**	**(Lx0,1)+(PEx0,6)+(OEx0,3)**		**19,5**	**40,5**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (15 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	exam terms	The student has the right three times to go to the exam.
Oral exam	Students who pass a written test and who receive passive grades from lectures attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage	exam terms	The student has the right three times to go to the exam.

	representation of each grade in the overall rating according to the formula: (Lx0,1)+(PEx0,6)+(OEx0,3)		

Obligatory literature

1. EKOLOŠKI LEKSIKON, Glavni urednik Oskar Springer, Zagreb: Barbat, Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, 2001., 361 str.
2. Vjekoslav Glavač, 1999. UVOD U GLOBALNU EKOLOGIJU, Državna uprava za zaštitu prirode i okoliša: Hrvatske šume. 207 str., Zagreb.
3. Mihovil Gračanin, Ljudevit Ilijanić, UVOD U EKOLOGIJU BILJA, Školska knjiga, Zagreb 1977.
4. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.

Recommended literature

1. Daniel B. Botkin, Edward A. Keller; : ENVIRONMENTAL SCIENCE EARTH AS A LIVING PLANET (1-649 str.)
2. Eugene P. Odum, 1971.: FUNDAMENTALS OF ECOLOGY (1-574 str.)
3. Robert E. Ricklefs, 1990.: ECOLOGY (1-885 str.)
4. BIOLOŠKA I KRAJOBRAZNA RAZNOLIKOST HRVATSKE, Državna uprava za zaštitu prirode i okoliša, Zagreb 1999, str. 151.
5. Richard T.T. Forman, Michel Godron, 1986: LANDSCAPE ECOLOGY. John Wiley and Sons, Inc. New York, p. 1-620.
6. BIODIVERSITY, E.O.Wilson, Editor, National Academy of Science, 1988, p. 521

Forest typology

ŠDU2007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Joso Vukelić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Definition and objectives of forest typology. Phytocenology in forest typology. Historical development. Typological schools in Europe (Russian, Ukrainian, Czech, German, Finnish, Swedish). Croatian forest typology. Basic components of typological research. Ecological-biological components. Geological-lithological material. Phytocenological component. Pedological component. Microclimatic component. Forest management component. Silvicultural component. Tending component. Economic component. Systematic units in forest typology (region, zone, type, subtype). Marking systematic units. Types of forests in the Mediterranean region. Forest types in the continental region (Dinaric, Pannonian). Examples of typological processing of forest ecosystems. Application of typology in forestry.
This course is based on the basics of the Croatian typological school of thought and uses the most up-to-date information and technological aids. The course also relies on the principles of naturalness, sustainable forest management and bio-diversity. The course is comprised of lectures using modern teaching aids.

Type of course:

Forest typology (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze the forest typology and the role of phytocenology (reasons for the establishment of the forest typology, the role of phytocenology in typology, the possibility of ecological characterization of	Seminar, final exam.	A3, B3, B9, D4, D5

habitats by floral composition, indicator species and scale).		
Interpret typological courses and schools (Scandinavian School, Russian School, Ukrainian School, courses in Central Europe).	Seminar, final exam.	A3, D4, D5
Present the Croatian forest typology (bases of definition of types, ecological-economic type, component of definition of area, zones and types, labeling of typological categories, typological research and mapping of forests of the Republic of Croatia).	Seminar, final exam.	A1, A3, B3, B14, D1, D4, D5
Evaluate typological classification (Natura 2000, EUNIS, Physis, national classification of habitats, determining habitat types, the application in management and conservation of forest habitats and communities).	Seminar, final exam.	A1, A3, B9, D1, D2, D4, D5

General competences

The objective of the course is to introduce students to the basic concepts of forest typology, i.e. to teach students to independently define and categorize forests and forest habitats into clearly distinctive entities (types) according to existing or potential productive abilities, for the easier and more rational management of forest ecosystems. Using the most up-to-date information, methods and aids adapted for each individual forest, this will form the foundation for modern silviculture, management and exploitation of forests.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS

Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	-
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100	exam terms	-

Obligatory literature

1. Bertović, S., V. Glavač, 1963: Tipologija šuma. Šumarska enciklopedija II, Zagreb.
2. Horvat, I. i sur., 1950: Priručnik za tipološko istraživanje i kartiranje vegetacije. Ministarstvo šumarstva FNRJ, 227 str.
3. Rauš, Đ., 1980: Šumarska fitocenologija (skripta) – drugo ispravljeno i dopunjeno izdanje. Šumarski fakultet Sveuč. u Zagrebu, Zagreb, 353 str.

4. Stefanović, V., 1963: Tipologija šuma. Univerzitet u Sarajevu, Sarajevo, 344 str.
5. Vukelić J. i sur. 2008: Šumska staništa i šumske zajednice u Hrvatskoj. Nacionalna ekološka mreža. DZZP, 263 str.

Recommended literature

1. Bertović, S., 1961: Istraživanje tipova šuma i šumskih staništa. Šum. list 85 (9-10): 374-389.
2. Cestar, D. i sur., 1966: Tipološko istraživanje i kartiranje šuma i šumskih staništa SR Hrvatske. Svezak I. Institut za šum. istraž. Šumarskog fakulteta Sveuč. u Zagrebu, 58 str.
3. Cestar i sur., 1986: Bukva i bukove šume Hrvatske. Radovi 69. Šumarski institut Jastrebarsko, 45 str.
4. Pogrebnjak, P.S., 1955: Osnovi lesnicke tipologii – 2. izd.. Kiev.
5. Zlatnik, A., 1976: Lesnicka fytocenologie. Statni zemedelske nakladatelstvi, Praha, 495 str.

Wildlife feeding

ŠDU2008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Krešimir Krapinec, Ph.D.
Prof. Marijan Grubešić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Contemporary hunting ground management includes a whole series of activities for habitat preservation (various international conventions), so as to ensure protection of species, habitat, but also a relevant trophy and physical structure in the population of single animal species. Therefore, this course of lectures intends to direct the students towards such manners of habitat management, aiming at upgrading of nutritional and legal factors, which will ensure a lasting fauna management.

Type of course:

Wildlife feeding (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Managing and autonomous making decision in wildlife/game management	Oral exam.	B4

General competences

Development of inductive and deductive abilities required for better knowledge of habitat potentials. Up-to-dateness in the work, systematism and effectiveness in data compilation on botanical or animal composition of nourishment and calculation of various measures applied for the improvement of

habitat circumstances. Identifying of similarities and differences in determining of vegetable species, used for the upgrading of habitat capacities.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Direct lessons. Keeping writing and oral exam, consultations, teaching material making.

Student's' obligations:

Regularity at teaching and active participation teaching. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0%			15	0	0,5
Exam (E)	100%	60-70%	Sufficient (2)	0	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Partial exam	-	-	
Written exam	Exceptionally (f.e. for students with speech disorder) .	exam terms	

Oral exam	Asks from different parts of course content.	exam terms	

Obligatory literature

1. Weiß, G. B., 1997: Anlage und Pflege von Wildäsungsflächen. Nimrod – Verlag, Suderburg., 320 p.
2. Černe, L.,1990: Ureditev lovišč za malo divjad; Lovska zveza Slovenije; Ljubljana; 70 pp.
3. Šoštarić-Pisačić, K., Kovačević, J., 1968: Travnjačka flora i njena poljoprivredna vrijednost; Nakladni zavod Znanje, Zagreb; 443 pp.
4. Mustapić, Z., i sur., 2004: Lovstvo. Hrvatski lovački savez, Zagreb, 597 p.

Recommended literature

1. Randal, D., Burggren, W., French, K., 1998: Eckert animal physiology: mechanisms and adaptations; W.H. Freeman and Company; New York; 824 pp.
2. Schwartz, M.W., 1997: Conservation in higly fragmentet landscapes; Chapman & Hall; New York; 436 pp.
3. Bookhout, T.A.,1996: Research and management techniques for wildlife and habitats; The Wildlife Society Bethesda; Maryland; 740 pp.
4. ***, 1986: Lehrbuch Jägerprüfung, Bänden 1-5, Paul Parey, Berlin und Hamburg, 1017 pp.

Hunting cinology

ŠDU2009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Marijan Grubešić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Historical development of dogs, by status and meaning of dogs through social development of man Development of cinological organizations, system, activity, legal regulations in cinology Manner for selection of quality hunting dogs, their physical defects and handicaps, by which they are eliminated from further breeding, problems of various diseases, to which hunting dogs are exposed, and manners of their prevention and suppression. Basic and advanced aids, which are nowadays used for training of hunting dogs and basic commands, which must be obeyed by the hunting dog, so as to be able to take part in the hunt in a useful and safe manner. Introduction of all groups of dogs proscribed by FCI, with minutely elaborated examinations and competitions, which must be taken by all hunting dogs as per the hunting breed they belong to. The whole subject is composed so as to make every future forester/hunter acquainted with individual hunting dog breeds, which will be used as per the terrain, where the hunt is taking place, and the game species hunted. The subject is based on contemporary knowledge of Croatian and world hunting cinologists and experts, aimed at the knowledge of hunting breeds. The whole teaching takes place aided by contemporary technology and guest appearances of the most renowned Croatian cinologists.

Type of course:

Hunting cinology (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Present hunting kinology - historical development and organization (development of kinology - organization of the World Kinologist Organization - FCI and Croatian Kinesiological Association - HKS).	Final exam.	A1, C4, D1
Identify anatomy and morphology of hunting dogs (Anatomy, disadvantages of body and teeth appearance, breeding of dogs, dog diseases, procurement, keeping and schooling of dogs).	Final exam.	A1, C4, D1
Present groups and standards, and tests of hunting dogs (groups of dogs by the standards of the FCI - Pointers, retrievers, dahhounds, ect.).	Final exam.	A1, C4, D2

General competences

Detailed preparation for the use of the knowledge in practice for selection, training, use and evaluation of hunting dogs.

Type of instruction

Lectures

Students will be introduced to the method of work of the kinological association, the genesis and division of hunting dogs, the basic elements of the dog's structure,

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Maintenance of oral exams and consultations. Preparation and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	15	1
		60-70%	Sufficient (2)			
		71-80%	Good (3)			

Exam (E)	100%	81-90%	Very good (4)	0	30	1
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+Ex100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Oral exam	Students are asked questions from different parts of the program content. (FEx100)/100	exam terms	-

Obligatory literature

1. Richter, I., 1986: Lovački psi uzgoj i školovanje. Nakladni zavod znanje, Zagreb.
2. Balać, J., Polak, M.D.: Lov, lovački psi i oružje. Alfa Zagreb 1991., Zagreb.

Recommended literature

1. Čeović, I.,: Lovstvo. Lovačka knjiga Zagreb, Zagreb, 1953.
2. Grupa autora: Velika ilustrovana enciklopedija lovstva Građevinska knjiga, Beograd,1987.

Mechanization in forest silviculture

ŠDU2010

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Assistant Prof. Zdravko Pandur, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The objective of the subject is to teach students about the basic features of machines and devices in forest silviculture. General demands regarding the use of machines in a forest are explained, then driving engines and characteristic groups of silvicultural machines. A special attention is given to the ecological evaluation of machines. Lectures include the introduction to the development, condition and classification of silvicultural machines according to their purpose: Machines in nursery production, Mechanization of seeding, Mechanized preparation of a habitat for natural rejuvenation and forestation, Machines for cleaning and care, Machines and devices in establishing forest cultures and plantations.

Type of course:

Mechanization in forest silviculture (selective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compare agricultural tractors in mechanized silvicultural works (technical features of tractors, classification, transmission, construction features, requirements of ISO and OECD standards for agricultural tractors).	Written exam.	B10
Analyze mechanized works in forest seed processing and nursery production of forest seedlings (machines for seed extraction and	Written exam.	B10

dewinging, machines and tools in nursery production of forest seedlings).		
Present mechanized works of habitat preparation, afforestation, tending of stands, forest cultures and plantations, short rotation coppice (machinery and tools in habitat preparation, machinery and devices in forest tending, machinery and devices for establishing and tending of forest cultures and plantations, specialized machinery and tools for short rotation coppice harvesting and storage of wood biomass).	Written exam.	B10

General competences

Students learn about the significant features of special silvicultural machines and the methods of adjustment of machines from big series originally intended for other branches of industry.

Type of instruction

Lectures

Lectures cover 5 methodical units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining lectures, consultations and exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Exam (E)	100%	60-70%	Sufficient (2)	0	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Students lay inly written exam. The students in the printed exam answer the questions asked. The written exam is evaluated and represents the final grade of the subject.	exam terms	-

Obligatory literature

1. CD s predavanjima u "Windows Power Point" prezentaciji te ispis istih.
2. S. Sever: Šumarski strojevi. Tehnička enciklopedija, LZ "Miroslav Krleža", svezak 12, Zagreb, 1992, s. 519-531.
3. Šumarska enciklopedija, LZ "Miroslav Krleža", svezak 1, 2, 3, poglavlja: a) Traktor, s. 78-80., b) Rasadnik, s. 119-130., g) Žičare, s. 651-659.
4. Izabrani stručni i znanstveni članci objavljeni u znanstvenim časopisima koji su na raspolaganju studentima u knjižnicama Šumarskoga fakulteta i Zavoda za šumarske tehnike i tehologije.

Recommended literature

1. Grupa autora: Mehanizacija poljoprivrede. Skripta agronomskog fakulteta, Zagreb, s. 85-95.
2. Stručni i znanstveni članci s međunarodnih savjetovanja s ergonomskom problematikom radova u šumarstvu prema izboru nastavnika (raspoloživi u knjižnici Zavoda za šumarske tehnike i tehnolgije).

Forest area measurement

ŠDU2011

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Assistant Prof. Ernest Goršić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

General course description:

Forest inventory process. Partial forest inventory. Inventory plan and types, measurement plots, field measurement. Diameter distribution in even-aged and uneven-aged stand. Height curves. Average stand trees. Stand basal area. Determining stand volume (ingrowth, mortality, cutting). Growth-yield tables. Normality. Data and forest measurement results control. Dendrochronology and dendrochronological methods. Total inventory. Types of measurement and measurement accuracy. Control measurement method, types of sampling plots. Methods of defining future and past increment. National forest inventory. Purpose of inventory. Inventory plan. Sampling plots and sampling types. Construction and implementation of single and two entra stand volume tables. Instruments and personnel. Calculation of measured data, inventory control. Urban inventory and inventory of scenic areas. Influence of multipurpose management on forest inventory. Inventory problems. Description inventory. Component inventory. Methods of measurement. Calculation and result presentation.

Type of course:

Forest area measurement (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Comparing types of inventories in forestry.	Final proof.	B2, B4, D2

Interpret the meaning of national forest inventories and methods of data collection during inventory conduction.	Final proof.	B2, B4, B9
Critically judge differences between results from national forest inventory and general management plan for different spatial levels.	Final proof.	A1, B9

General competences

Obtaining knowledge about informations which are gathered for different inventory purposes in forestry.

Type of instructions

Lectures

Working methods:

Teachers obligations:

Holding teaching lectures. Creating exam tests and performing the validation. Carrying out written and oral exams and consultations. Writing teaching material.

Students obligations:

Continuous attending and active engagement in lectures. Passing the exam.

Grade evaluation=Passing the exam

<table>
<tr><th>Evaluation elements</th><th>Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures (L)</td><td>-</td><td>-</td><td>-</td><td>15</td><td>0</td><td>0,5</td></tr>
<tr><td rowspan="4">Exam (E)</td><td rowspan="4">100%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="4">0</td><td rowspan="4">45</td><td rowspan="4">1,5</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td>TOTAL</td><td>100%</td><td colspan="2">(Ex100)/100</td><td>15</td><td>45</td><td>2</td></tr>
</table>

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student presence is recorded. Maximum lecture absence of 20% is tolerated.	semester (15 hours of classes)	-
Written exam (We)	The exam comprises of 10 questions. To pass the exam student needs to achieve minimum of 60% of exam points.	exam schedule defined on the beginning of semester	-
Oral exam (Oe)	Requirement for approaching an oral exam is passed written exam within timeframe of registrated exam date Theoretical knowledge with subject understanding of lectured classes is checked. Final grade is calculated according to following formula (Wex50+Oex50)/100		

Obligatory literature

1. Božić, M., Goršić, E.: Izmjera šumskih prostora, Prezentacije s predavanja
2. Pranjić, A., Lukić, N., 1997.: Izmjera šuma. Šumarski fakultet Sveučilišta u Zagrebu, 410 pp., Zagreb.

Recommended literature

1. Bitterlich, W., 1984: The Relascope Idea. CAB, pp.242, London
2. Loetsch, F., Zöhrer, F., Haller, K.E., 1973: Forest Inventory. pp.467, BLV München.
3. Šmelko, Š. & kolektiv, 2003: Meranie lesa a dreva. LVH SR, pp.239, Zvolen.
4. Zöhrer, F., 1980: Forstinventur, pp.202, Pareys, Hamburg
5. West, P.W., 2004: Tree and Forest Masurement. Springer V, pp.167, Berlin.

Quantitative methods for planning in forestry

ŠDU2012

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Ksenija Šegotić, Ph.D.

Grading
Sufficient (2) 50%
Good (3) 60%
Very good (4) 75%
Excellent (5) 90%

Course content:

Development of operations research. Mathematical models. Basic linear algebra. Systems of linear equations. Linear programming. Transportation and distribution problems. Investment problems. Multiple-criteria decision-making. Decision theory. Introduction to graph theory. Decision tree. Elements of econometrics.

Type of course:

Quantitative methods for planning in forestry (elective, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyzing and solving mathematical problems based on learned mathematical concepts and modeling situations outside a mathematical context.	Participating in class problems, seminar paper, exam.	A3
Connecting quantitative methods with engineering practice.	Participating in class problems, seminar paper, exam.	A3
Using linear algebra to calculate the matrix inverse.	Participating in class problems, seminar paper, exam.	A3
Solving a system of m linear equations with n unknowns.	Participating in class problems, seminar paper, exam.	A3

Solving a constrained maximization or minimization problem.	Participating in class problems, seminar paper, exam.	B4, B13, B14
Solving the transport problem.	Participating in class problems, seminar paper, exam.	B13, B14
Reccomending a multiple-criteria method when making decisions in forestry.	Participating in class problems, seminar paper, exam.	B4, B13, B14, C1, C4
Constructing a decision tree for a given problem.	Participating in class problems, seminar paper, exam.	B13, B14, C1, C4
Recognizing situation types when making decisions.	Participating in class problems, seminar paper, exam.	C1, C2, C4

General competences

Assigning mathematical objects to real world objects through examples from forestry. Formulating and solving mathematical models of practical problems. Mastering and applying some methods of operations research.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Teaching in class – lectures. Formulating practical problems. Creating and guiding practical seminar work. Organizing exams and office hours. Producing teaching materials.

Students' obligations:

Regular attendance and active participation in class. Practical seminar work. Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	13	9	0.75
Seminar paper (S)	50%	50-59%	Sufficient (2)	1	29	1
		60-74%	Good (3)			
		75-89%	Very good (4)			

		90-100%	Excellent (5)			
Oral exam (O)	50%	50-59%	Sufficient (2)	1	7	0.25
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
UKUPNO	**100%**	**S+O**		**15**	**45**	**2**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam* (FE)		50-59% 60-74% 75-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.25
UKUPNO	**100%**	**FE**				

***students who do not pass the course during the semester can take the exam during exam terms. The exam consists of a written and oral part. Students need to achieve at least 50% on the written part in order to take the oral part of the exam. The written part of the exam can be replaced with a seminar paper.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lecture attendance	Attendance is checked during class. Attendance and participation are necessary for obtaining the lecturer's signature, producing a seminar paper and taking exams.	semester (15 hours of direct lectures)	-
Seminar paper	Students apply methods taught in lectures to a practical problem that is presented in written form.	week 10	-
Oral exam	The exam includes topics from the seminar paper and related coursework.	week 15	Under extraordinary circumstances and with a valid excuse,the student can take the exam

			at a later date.
Written exam	The exam includes coursework from the entire semester. Students who obtained the lecturer's signature can take the exam.	exam terms	-
Oral exam	The exam includes coursework from the entire semester. Students who passed the written exam or handed in the seminar paper can take the oral exam. The final grade is obtained by combining the results of the written and oral exams.	exam terms	-

Obligatory literature

1. Kalpić, D., Mornar, V.: Operacijska istraživanja, DRIP, Zagreb, 1996.
2. Neralić, L..: Uvod u matematičko programiranje 1, Element, Zagreb, 2003.
3. Zadnik, L.: Operacijska raziskovanja, Biotehnološka fakulteta, Ljubljana, 1992.

Recommended literature

1. Elezović, N.: Linearna algebra, Element, Zagreb, 2003.
2. Vadnal, A.: Primjena matematičkih metoda u ekonomiji, Informator, Zagreb, 1980.
3. Winston Wayne, L.: Operatins Research, Duxbury Press, Belmont, California, 1994.

Forestry politics and legislation

ŠDU2013

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Ivan Martinić, Ph.D.
Assist. Prof. Matija Landekić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Fundamentals, principles, objectives and tasks of forestry policy. Role in sustainable development and global processes. Priorities of forestry policy in Croatia. European forestry legal framework. The state of the forest sector in Europe. EU organizations and institutions in forestry. Croatian forestry legal framework. National forestry policy and strategy in Croatia. The Forest Act, subordinate regulations with an emphasis on forestry inspection and relation to other laws. Relevant programs and processes in EU forestry. Convention on Biological and landscape diversity. AGENDA 21. NSAP. NEAP. Kyoto protocol. Ecological and social aspects of forestry. Role of forestry in preserving biodiversity. Protected areas. Social dimension of forestry. Concept and EU approach to Natura 2000. Implementation framework for Croatia forestry. Approach of implementation in forestry of Croatia. Forestry sector responsibilities in conservation of biodiversity in ecological network Natura 2000. Models and principles in forest certification. Organization of certification implementation in Croatia. Review of forestry policy instruments with a particular emphasis on role of state incentives, subsidies and grants. Motive and purpose of FLEGT action plan, RED and RED II., strategy of bioeconomy within domain of forest policy and legislation.

Type of course:

Forestry politics and legislation (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Present National forestry policy and strategy: importance, strategic areas, goals and priorities, implementation concept - carriers, timelines, financing (National forestry program goals and tasks, forestry policies in Croatia trough National environmental protection program (NEAP) Biodiversity (NSAP), Forestry measures, Forestry certification).	Knowledge test, final exam.	A1, A2, D3
Define organization of forestry administration in Croatia - ministry, regional offices, inspection service (key actors in forestry sector, forest law in Croatia, EU guidelines and national subordinate regulations).	Partial test, knowledge test, final exam.	A1, A2, D3
Analyse forestry policy in Croatia in EU context (Europe 2020 as a strategic framework for balanced EU development, EU cohesion policy, the principle of programming, the RH rural development program, principles and criteria project applications and allocation of funds by measures).	Knowledge test, final exam.	A1, A2, D3

General competences

Adopting principles and role of forestry policy in development of the forestry sector, but also in sustainable development and global processes. Acquiring knowledge about legal and social framework of forestry policy in Europe and Croatia for inclusion in relevant programs and processes (Natura 2000, certification, RED Directive etc.). Development of engineering skills in relation to forest sector commitments in contributing to sustainable development, in particular through the conservation of biodiversity and development of rural areas.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Compiling knowledge tests and evaluating them. Providing partial test, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Taking partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	0	0,5

Partial exam from Legislation (K2)	15%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	85%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(K2x15+FEx85)/100**		**15**	**45**	**2**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)		60-70%	Sufficient (2)			1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(K2x15+FEx85)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercise	The attendance is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Partial exam	Students in the pre-printed exam answer questions answered, round off accurate answers and supplement the words within the sentence. The colloquia is evaluated and participates in the final grade of the subject	10. week	Students who pass the partial exam can access the exam.
Written exam	Examinations can be attended by students who have exercises and a colloquy. The students in the pre-printed exam fit the questions asked, completing the correct	exam terms	-

	answers. The written exam is evaluated and participates in the final grade of the subject.		
Oral exam	Students who pass a written exam are asked questions from different parts of program content. Final grade of subject is obtained according to the formula. (K2x15+FEx85)/100		

Obligatory literature

1. Zbirka prezentacija iz predmeta Šumarska politika i zakonodavstvo za postojeću ak. god.
2. Sabadi, R.: Šumarska politika. Hrvatske šume p.o. Zagreb, Zagreb 1992.
3. Martinić, I.: Šumarska politika - gospodarenje šumama pred mnogim izazovima, Zbornik savjetovanja Šumarski fakultet Sveučilišta u Zagrebu i šumarski institut Jastrebarsko. Zagreb, 2002.
4. MZOE RH: Izrada radne verzije strategije prilagodbe klimatskim promjenama u Republici Hrvatskoj za razdoblje do 2040. s pogledom na 2070. (Zelena knjiga), Zagreb, 2017
5. ** Zakon o šumama (NN 68/18)
6. ** Šumarska politika i strategija RH (NN 42/03)

Recommended literature

1. Csaki, C., Tuck, L.: Rural Development Strategy, WorlBank, 2000
2. ** UN/FAO: Forest Management and Climate Change, Rim, 2012
3. ** FAO (2003) State of the World Forests 2003.UN FAO, Rim.

Regulations for forest management planning

ŠDU-2014

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Jura Čavlović, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

In the framework of the subject the following themes are addressed: importance of forest acts and regulations in forest planning and management; historical instructions for forest management planning; Legal decree on forests from year 1769; Direction for surveying, evaluation and tending of forest cultivation in proprietary municipalities of Croatian-Slavonic Border-land (1881); Direction for preparation of forest management plan (1903); Instructions for forest management planning of state forests (1903); Instructions for forest management planning of state forests (1931); Instructions for tree marking and prescribing cut in uneven-aged forests (1937); Temporary and general instructions for inventory and forest management planning of forests (1946/48); New system of uneven-aged forests management planning (1962); Modifications in the Regulations for forest management planning from 1968 to 1990 within the framework of forestry reorganization and amendments to the Forest Act; Regulations for forest management planning from 1994 and 1997; modifications and changes to the Regulations; analysis of the Regulation guidelines and the need for modifications to the guidelines, in line with the requirements of forest management and planning; Procedure for validity examining of the prepared management plans (program) and issue of approval to the prepared plan.

Type of course:

Regulations for forest management planning (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

To analyse, to present and to identify historic review of regulations for forest management planning (content characteristics of regulations, relevant determinations of historic regulations, development of regulations for forest management planning).	Seminar, knowledge tests, final exam.	B2
To analyse, to assess and to present importance of the regulations and its role on forest management planning (mutual differences between two regulations, influence of several determination on change of forest management planning system, procedures of approval of elaborated forest management plan).	Seminar, knowledge tests, final exam.	B2

General competences

Acquiring of knowledge about development of regulative relating on forest management planning during past (history), according to development of forestry profession and science, and human relations to forests. Acquiring of knowledge of actual regulation in relation on previous. Acquiring of skills for interpretation and understanding manner of application of the regulations in the procedures for elaboration and approval of forest management plans.

Type of education

Lectures

Lectures and seminars based on actual examples cover main topics of course.

Working methods:

Teachers' obligations:

Performing of primary education – lectures, exercises and field work; preparing of exercises, educational materials and knowledge tests; performing of consultations, partial and final exams.

Students' obligations:

Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
			Sufficient (2)			

Seminar (S)	20%		Good (3)	0	15	0.5
			Very good (4)			
			Excellent (5)			
Exam (E)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx20 + Ex80)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and seminars	Checking and evidence of students attendance. Student is allowed exculpatory to absent of maximal 15% hours of direct teaching (0% of exercises and 10% of lectures)	semester (15 hours of direct teaching)	-
Preparing of seminars	At beginning of semester to student assigns theme of seminar, which prepares during semester and at the end of semester present to student group and lecturer followed with discussion.	according to defined deadline	Exceptionally student is obliged to work of , in a case of exculpatory absent of several exercise.
Exam	Prerequisite for final exam is sufficient attendance on lectures, and preparation and presentation of seminar theme. Knowledge and understanding of topics within lectures and seminars are evaluate. The finish grade is get according to equation: (Ex80+Sx20)/100		

Obligatory literature

1. Separates of published Regulations in “Narodne novine” (N.N....)
2. Meštrović, Š., Fabijanić, G., 1995. Manual for forest management planning, Zagreb. Ministry of Agriculture and Forestry, Zagreb, p. 416.
3. Meštrović, Š., 1978. Regulation for elaboration of general forest management plan, forest management plans and programmes for forest improvement in a light of forestry science. Šum. list. 102(8-10), 352-364.

Recommended literature

1. Other relevant literature needed for preparation of seminar themes

Clonal forestry

ŠDU2015

ECTS 2

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Prof. Davorin Kajba, Ph.D.

Associate teacher for exercises
Prof. Davorin Kajba, Ph.D.
Assistant Prof. Ida Katičić Bogdan, Ph.D.

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Students are introduced to the generative and vegetative multiplication of forest trees, ontogenetic development in autovegetative multiplication and heterovegetative propagation, rejuvenilization, the advantages and disadvantages of clonal forestry. Monoclonal vs. multiclonal plantations of forest trees, optimum number of clones, clone distribution in cultures, interaction of clone × site (GEI), selection of clones for general and specific combinational ability and ideal genotype. Students get acquainted with clonal seed plantations, improved clonal seed plantations, and the second generation of clonal seed plantations, preserving genofle and clone archives, breeding poplar and canola. Identification of clones and field experiments, development of favorable clonal mixtures for individual habitats, mosaic schedules, genetic gain estimation in clonal assays depending on selectivity intensity is studied. Biology of species suitable for short rotation, energy potential of wood biomass, biomass production in short rotation coppice crops (SRF) is elaborated. The clone / site interaction and the spacing of plants, habitats, biotic and abiotic factors are studied. They recognize the ecological and physiological aspects (competition, regeneration dynamics, physiological stress, replenishment, etc.).
Students are introduced to forest cultures, mixed cultures, bioenergy plants, agro-forestry, plantations in watercourse protection (vegetation filters), sanitation of contaminated surfaces, sequestration of atmospheric carbon, use of waste water and precipitation for SRF. The micropropagation of forest trees and their variability, genetic engineering, molecular biology of forest species, conservation of the germplasm are handled. Legislation and legal regulations on the use of clonal material are introduced.

Type of course:

Clonal forestry (elected course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Propose the applicable vegetative propagation method for a particular tree species. To propose heterovegetative propagation techniques in the establishment of clonal seed orchards. Formulate a genetic variant of clones and transfer genetic covariantes. Evaluate juvenile-adult correlation and clonal aging.	Seminar, final exam	B6
Classify clonal material in genetic and physiological research. To predict the genetic parameters in clonal tests. Choose the culture of soft and noble leaflets, mixed cultures, and / or clonal archives. Analyze the existence of clone × site interaction (GEI) and perform clonal selection for general and specific adaptation and determine phenotype stability of clones. Evaluate the existence of clone interactions and plant spacing, the influence of biotic and abiotic factors on the production of wood stock.	Seminar, final exam	B6
Choose clonal cultures to protect waterways and polluted habitats (vegetation filters, phytoremediation, agroforestry). Integrate the use of clonal material as forest reproductive material with legislation and legal regulation	Seminar, final exam	B6

General competences

Students acquire knowledge about the methods of vegetative propagation (cloning) of forest trees and the use of clonal materials in forestry and the conservation of genetic resources. They are acquainted with the breeding clones and plantations, clonal seed orchards, clonal archives, material identification, short rotation forestry for biomass production and fitoremediation, and all in order to better understand the importance of cloning forest tree material.

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	-

Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100	exam terms	-

Obligatory literature

1. D. Ballian, D. Kajba: OPLEMENJIVANJE ŠUMSKOG DRVEĆA I OČUVANJE NJEGOVE GENETSKE RAZNOLIKOSTI, Sarajevo-Zagreb, 2011 (u tisku)
2. ***** BIOEN: program korištenja energije biomase, Energetski institut "Hrvoje Požar", 1998, str. 1-179.
3. ***** BIOEN: program korištenja energije biomase i otpada, Energetski institut "Hrvoje Požar", 2001, str. 1-144.
4. Borojević, K.: GENI I POPULACIJA, Forum, 1986, str.1-545.
5. Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, str. 1-398.
6. Vidaković, M., Krstinić, A.: GENETIKA I OPLEMENJIVANJE ŠUMSKOG DRVEĆA, Liber, Zagreb, 1985, str. 505.
7. Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.

Recommended literature

1. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, str. 277.
2. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, str. 240.
3. West, P.W.: GROWING PLANTATION FORESTS. Springer, 2006, 304 str.
4. Dickmann, D.I., Isebrands, J.G., Eckenwalder, J.E., Richardson, J.: POPLAR CULTURE IN NORTH AMERICA, NRC Research Press, Ottawa, 2001, str. 1-397.
5. El Bassam: ENERGY PLANT SPECIES, 1998, str. 1-356.
6. Falconer, D.S. & T.F.C. Mackay: INTRODUCTION TO QUANTITATIVE GENETICS. Longman Group Ltd, 1998, str. 1-459.
7. Stettler, R. F., Bradshaw, Jr., H. D., Heilman, P. E., Hinckley, T. M.: BIOLOGY OF POPULUS AND ITS IMPLICATIONS FOR MANAGEMENT AND CONSERVATION, NRC Research Press, Ottawa, 1996, str. 1-597.
8. Tamarin, R.H.: PRINCIPLES OF GENETICS. WCB Publishers, 1993, str. 1-674.

Biotechnology of forest trees

ŠDU2016

ECTS 2

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Prof. Davorin Kajba, Ph.D.

Associate teacher for exercises
Prof. Davorin Kajba, Ph.D.
Assistant Prof. Ida Katičić Bogdan, Ph.D.

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

The students become acquainted with the following contents: a) plant cell and tissue culture techniques (*in vitro*), cell culture suspensions, protoplast cultures, vegetative propagation in vitro, commercial replication, meristem culture, embryo and megagametophyte cultures, somatic embryogenesis, conservation of the plant genofle *in vitro* and with somaclonal variability; estimates of somaclonal variability (phenotypic, biochemical, cytological, molecular); b) application of biochemical and molecular genetic research in forest trees, biochemical and DNA markers, structure and genetic variability in forest trees, genetic mapping, genetic engineering and application of transgenic plants in forestry and urban forestry, properties subject to genetic engineering (pest resistance and pathogenic organisms, resistance to extreme ecological factors, reproductive ability, lignin fraction modification, biotechnology and biosecurity); c) storage of seeds, pollen and herb tissue, in vitro storage, medium storage (3 to 4 years) and for a longer period of time (cryopreservation), cryopreservation process (ultrasound temperature - 80º to -196ºC), dehydration and cell cultivation, acquaintance with plant growth substances (auksini, giberelini, cytokinin, ethylene, abcisic acid, etc.), seed bank and seed bank, and legislation related to forest reproductive material.

Type of course:

Clonal forestry (elected course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Suggest a technique of plant cell and tissue culture (in vitro) for each species of forest tree. Review the commercial use of in vitro propagation techniques. Organize conservation of plant genoflu in vitro (pollen preservation, preservation of DNA). Evaluate the possibility of somaclonal variability (phenotypic, biochemical, cytological, molecular).	Seminar, final exam	B6
Suggest a cryopreservation process. Classify the plant growth factor. Recommend storage of seeds, pollen and herbal tissue for conifers and leafworms. Organize seed plant and seed bank. Choose an option to find markers that indicate genetic variants. Formulate the study of the function and interaction of all genes in the genome.	Seminar, final exam	B6
Review the link between molecular markers and genetic variants. Present the method of transferring DNA to the plant cell (Agrobacterium tumefaciens, biolistics - genetic pistol). Review the possibilities of lignin modification and cellulose biosynthesis. Review the possibility of resistance to herbicides and insects.	Seminar, final exam	B6

General competences

Students acquire knowledge of plant and tissue culture techniques (in vitro), application of biochemical and molecular genetic research in forest trees, storage of seeds, pollen and plant tissue in the short and long term, roles of plant material collections, seed banks and banks and their role in breeding and preserving the genetic diversity of forest trees. Knowledge is gained from seed preservation, pollen and plant tissue, their endurance, reproduction and regeneration, estimation of genetic structure and genetic erosion, all in order to better understand the importance of preserving and breeding plant material in forest trees through biotechnology techniques, in accordance with regulatory legislation and biosafety.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	-
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula	exam terms	-

	(FEx80 + SPx20)/100		

Obligatory literature

1. Kajba, D., Ballian, D.: ŠUMARSKA GENETIKA, Zagreb-Sarajevo 2007, 283 str.
2. Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, str. 1-398.
3. Marić, V. i sur., 1991: BIOKEMIJSKO INŽENJERSTVO, Interna skripta, PBF, Zagreb.
4. Bajrović, K. i sur., 2005: UVOD U GENETIČKO INŽENJERSTVO I BIOTEHNOLOGIJU, Institut za genetičko inženjerstvo i tehnologiju, Sarajevo, 320 str.
5. Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.

Recommended literature

1. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, str. 277.
2. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, str. 240.
3. FAO, 1993, EX SITU STORAGE OF SEEDS POLLEN AND IN VITRO CULTURES OF PERENNIAL WOODY PLANT SPECIES. Forestry Paper 113, FAO, Rome.
4. Turner, P.C., McLennan, A.G., Bates., A.D., White, M.R.H., 1997: MOLECULAR BIOLOGY, Bios Scientific Publishers, Oxford.
5. Nicholl, D.S.T., 2002: AN INTRODUCTION TO GENETIC ENGINEERING, Cambridge University Press, Cambridge.
6. Rosillo-Calle, F.: THE BIOMASS ASSESSMENT HANDBOOK.BIOENERGY FOR SUSTAINABLE ENVIRONMENT.,Earthscan, London, 2007, 269 str.
7. EUFORGEN publikacije (www.euforgen.org).

Silviculture of special purpose forests

ŠDU3001

ECTS 5

English language R1

E-learning R

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Milan Oršanić, Ph.D.
Assistant Prof. Damir Drvodelić, Ph.D.

Associate teacher for exercises
Assistant Prof. Damir Drvodelić, Ph.D.
Assistant Prof. Vinko Paulić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course contents:

The subject is conceived to introduce students to all natural or artificial forest forms that do not handle classical forestry. Thus, all those that are exempt from regular management and where the economic role plays no crucial importance. Likewise, all those artificial plants whose aim is to protect human beings and human beings by increasing their quality of life in some space, or the production of raw materials used in recent times. The course assignments also introduce students to new trends in forest management with regard to forest landscape design, through visualization and design of new spaces. Find a balance between management and management in protected natural facilities.

Type of course:

Silviculture of special purpose forests (compulsory course, 3, semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Specifically forested forests, urban forests and arboriculture (raising forests of special purpose, restoration of special purpose forests, urban forestry functions, differences between urban forestry and arboriculture).	Practicum, Preliminary exam, Final exam	A2, B4
Compare the assessment of dangerous trees using different methods (identifying dangerous trees (basics of static trees, fracture profiles of different tree species) and protection measures.	Practicum, Preliminary exam, Final exam	B4, B8
Present the production of trees and large tree trunks (biological-ecological requirements of species, problems of large trees, extraction and packaging).	Practicum, Preliminary exam, Final exam	B15
Establish the establishment and care of a tree (choice of species, appearance, care).	Practicum, Preliminary exam, Final exam	B4, B15
Analyze the establishment and breeding of plantations in degraded habitats (establishment of plantations in arid and semiarid areas, selection of planting species in the Mediterranean area).	Practicum, Preliminary exam, Final exam	B4, B5, B6
Present the establishment and cultivation of special forestry plants (short-term plantations for the production of forest biomass, windshield belts, agro-forestry, Christmas trees).	Practicum, Preliminary exam, Final exam	B4, B5, B11, B15

General competences

During the lectures and exercises, the student acquires basic knowledge of the basic types of forests that are not solely for economic reasons. Students recognize the basic types of forests of special purpose and the types of work they are doing. In addition, students are acquainted with enduring management and natural close management.

Type of instruction

Lectures

Exercises

During semester seven different exercises are performed which are an upgrade to knowledge adopted in lectures.

Field work

Field work is planned for 2 days, according to the curriculum:
1. The management of forests in national parks (NP Plitvice Lakes or NP Risnjak).
2. The management of forests in nature parks (PP Medvednica)

Working methods:

Teachers' obligations:

Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, exercises and field sessions. A justified absence with a maximum of 20% of lectures and 10% of exercises is allowed. Creating and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,0
Exercises (E)	-	-	-	15	6	0,7
Field work (FW)	-	-	-	16	2	0,6
1. Partial exam (PE1)	50%	60-70%	Sufficient (2)	0	42	1,4
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2. Partial exam (PE2)	50%	60-70%	Sufficient (2)	0	39	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(P+V+TN+K1x50+K2x50)/100**		**61**	**89**	**5**

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS

Final exam* (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5	-	81	2,7
TOTAL	**100%**	**(ZIx100)/100**				

***** Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 100% of the final grade

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	The lectures are checked and the presence of students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours.	semester (30 hours of direct lectures)	-
Exercises (E)	Exercises are checked and students attend. Student may justifiably be absent with a maximum of 10% of direct teaching hours. At the end of the semester, the students submit their exercises based on the instruction given from the beginning of the course on the layout and content of the exercises.	after completing classes	-
Field work (FW)	On-site teaching is checked and the presence of students is recorded and no absences allowed. After completing each field course, the students are obliged to write and submit a report from the field teaching.	according to the field curriculum	-
1. Partial exam (PE1)	All students who have enrolled the subject for the first time in the current academic year can access the first queue. In the content of the 1st Column the first half of the tuition is entered. Colloquy is a written test with 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. It is necessary to collect more than 60% points for the passage to the colloquium.	8. week	There is a possibility of a correction deadline for the colloquium.
2. Partial exam (PE2)	2. Colleges can be accessed by students who have passed the 1st Colloquium. The second half of the semester enters the second half of the tuition. Colloquy is a written test with 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. It is necessary to collect more than 60% points for the passage to the colloquium. Students who get enough points from both hands get the final grade from the subject that is the arithmetic mean of the score from the first and second rounds.	15. week	There is a possibility of a correction deadline for the colloquium.
Written exam	Written exam consists of 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. For passage on a written exam, it is necessary to collect more than 60% of the points.	exam terms	-

Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. The final grade is obtained according to the formula (ZIx100)/100		-

Obligatory literature

1. Oršanić, M., 2005: Uzgajanje šuma posebne namjene. Predavanja za internu upotrebu. Šumarski fakultet, Zagreb.
2. Anić, I., 2004: Uzgajanje šuma I. Skripta za internu uporabu. Šumarski fakultet, Zagreb.

Recommended literature

1. Lucas, O., 1991: The Design of Forest Landscapes. Oxford university press.
2. Grey, G.W., 1996: The Urban Forestry: Comprehensive Management. New York.
3. Chapman, G. A., R. D. Wray, 1987: Christmas Trees for Pleasure and Profit. Rutgers University Press. Third Edition.
4. Miller, R. W., 1997: Urban forestry: Planing and Managing Urban Green Spaces, 2nd ed. Upper Saddle River, NJ: Prentice Hill.
5. Savill, P. E., J. Auclair, D. J. Falck, 1997: Plantation Silviculture in Europe. Oxford University Press.
6. Dobson, M., A. J. Moffat, 1993: The Potential for Woodland Establishment on Landfill sites. Department of the Enviroment. HMSO. London.

Economics of forest company

ŠDU3002

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Associate Prof. Stjepan Posavec, Ph.D.

Associate teacher for exercises
Karlo Beljan, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The name, definition, term of forest company economics. Creation, development of microeconomics and macroeconomics. Basic theories of forest management. Production theory, production function. Total, average and marginal costs. Diminishing returns. Structure of fixed and current assets in forestry. Measurement of business performance in forest companies. Accounting and financial balance sheet. Profit and loss account. Business indicators. Calculation, term and classification. Types and calculation methods (previous, on accruals basis, final calculation). Price structure in creation of specific calculations for characteristic productions and products in forestry. Calculation of costs. Costs calculation on the basis from their possibilities for division on the cost drivers. Specifics on costs calculation in forestry. Costs in production systems. Term and division of costs. Types of costs and their dinamycs. Break even calculation. Basic terms of breake even analyse. Break even diagrams for a part of the production systems in forestry. Control of direct costs in forestry. Control of fixed costs in forestry. Selling price controlling. Methodology of grading effectiveness of production and technology processes in forestry. Criteria for optimal economic choice of technology proces. The choice of economically optimal option of technology proces in forestry.

Type of course:

Economic of forest company (obligatory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyse capital and investments in forestry (meaning of the capital in forestry, fixed property and working capital in forestry, categories and importance of investments in forestry).	Excersise, final exam	C1
To present costs, calculation and cost management in forestry (costs in production processes, types and methodes of calculation, price structure in creation of specific calculation for characteristic productions and forest products).	Excersise, final exam	C3
To compare economic analyse of bussiness performance in forest company and business indicators (balance sheet, profit and loss account, cash flow, debt ratio, liquidity, activity, profitability, investment and market value).	Excersise, final exam	C3
To estimate specifics of planning processes and business plan (economic statements, influence of forest management planning on business results, functioning of investemnts and business plans in forest management, goals, contents and shape of the business plan).	Excersise, final exam	B1,C3
To compare economic policy insstruments and processes of strategic planning (monetary system, fiskal system, overseas relations and income policy, environmety analyses, added value chain analyse, controlling instruments).	Excersise, final exam	B1, C4

General competences

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:

Conduction of teaching programme – oral presentations, excercies and field trip case study. Creation of exams and their ranking. Conduction of written and oral exams and consultations. Creation of teaching materials.

Students' obligations:

Ordinarly participation and active participation in classes, excercises and field trip. Individual preparation and excercise submition. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (P)	10%	Minimal number of attendance in the class.	Sufficient (2)	30	0	1
			Good (3)			
			Very good (4)			
		Attendance and active participation in the teaching during semester.	Excellent (5)			
Excercizes (V)	30%		Sufficient (2)	15	30	1,5
			Good (3)			
			Very good (4)			
		Regular submission of excersize tasks without corrections.	Excellent (5)			
Field work	10%	60-70%	Sufficient (2)	8	7	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Written exam	50%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Total	**100%**	**(Px10+Vx30 + K1x30+K2x30)/100**		**53**	**67**	**4**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload	ECTS points

					outside the direct teaching
Final exam (FE)	50 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	30	1
TOTAL	**100%**	**(FExy0+Exy0)/100**			**4**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checking the attendance of students on lectures. Student can miss the lectures justifies more than 15% of exercises.	semester (45 hours of direct lecturer)	-
Partial exam	Excersies are individual. Students are receiveng excercise templates in the beginning of the course, and shape of the folder and files, which will be used for the individual tasks. Accuracy, precision and regularity of assignment are evaluating.	15. week	
Written exam	Students could attend exam with succesfully and correct finished exercises. Students on printed written exam work on three calculation exams. One positive exam has 10 points. Half of the correct exam gain 5 points. Grades for written exam are: 15-sufficient (2), 20- good (3), 25-very good (4), 30-excellent (5)	exam terms	
Oral exam	Students with positive written exam are questioned from different part of the course content. Final grade consists achieved percentage together from written and oral exam: Sufficient (2) 60%, Good (3) 71%, Very good (4) 81%, Excellent (5) 91%		

Obligatory literature

1. Figurić, M.: Uvod u ekonomiku šumskih resursa, Šumarski fakultet, Zagreb, 1998.
2. Figurić, M.: Menadžment troškova u drvno tehnološkim procesima, izabrana područja, Šumarski fakultet, Zagreb, 2003.

Recommended literature

1. Samuelson, P., Nordhaus, W.: EKONOMIKA, Mate, Zagreb, 1992, str. 1-800.

Hunting management II

ŠDU3003

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Marijan Grubešić, Ph.D.
Prof. Krešimir Krapinec, Ph.D.
Assistant Prof. Kristijan Tomljanović, Ph.D.

Associate teacher for exercises
Prof. Krešimir Krapinec, Ph.D.
Assistant Prof. Kristijan Tomljanović, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Game breeding in an enclosed area. Technical elements of an enclosed hunting and breeding ground, such as fence, structures in the fence and structures in the enclosed area intended for game and hunters. Game protection. Damages caused by game and damage prevention measures. Economic elements of game breeding, products obtained from game and presentation of game and hunting management in terms of marketing. Teaching will take place under the use of up-to-date teaching aids and the material recorded and prepared in domestic and foreign game breeding and hunting grounds. Through the teaching in the field, students will get to know open hunting grounds, enclosed breeding sites and pheasant farms directly.

Type of course:

Hunting management II (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program

		LO
Present game breeding in a fenced area (reasons, advantages and lack of intensive game breeding, facilities and equipment in wildlife farms).areas, habitat quality for large and small game, determining the hunting capacity for each species of game).	Practice exercises, final exam.	A1, B2
Identify the breeding technology of a certain species of game in a fenced area	Practice exercises, final exam.	A1, B2
Organize hygiene and health care in the breeding grounds (preventive, curative and remedial measures of health care, equipment, handling of game meat).	Practice exercises, final exam.	A1, C2
Review the economics and marketing of wild game breeding in a fenced area (economic justification, calculation of income and expenditure of game farms, marketing of farms, products and services).	Practice exercises, final exam.	B2, C2, D2
To predict the entry of wild game from breeding into open hunting grounds (procedure for entry of game from game farms into open hunting grounds - drift, preparation of habitat, reception site, discharge procedure, release time).	Practice exercises, final exam.	B2, C2, D2

General competences

Students will get to know the technology of game breeding in open hunting grounds and enclosed areas. The focus is on technical and economic elements of game breeding. Through teaching, exercises and teaching in the field, duties of a technologist in game breeding and protection will be presented.

Type of instruction

Lectures

In the lectures, students learn about the theory of raising large and small game farms. Diseases that occur in farms, risks, marketing and game products.

Exercises

Exercises practically complement the thematic whole of lectures. Students create parts of the breeding program and wildlife conservation programs.

Field work

1. Visit to the big game breeding farm.
2. Visit a small small game farm.

Teachers' obligations:

Maintaining original teaching - lectures, exercises and field teaching. Maintenance of written, oral exams and consultations. Preparation and preparation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,0
Exercises (E)	-	-	-	15	0	0,5
Field work	-	-	-	16	0	0,5
Exam (E)	100%	60-70%	Sufficient (2)	0	29	1,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+E+FW+Pex100)/100**		**61**	**29**	**3**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercise	Exercises are attended by groups. As part of the exercise, 15 practical exercises from the aforementioned thematic units are performed. At the beginning of the first exercise, students receive task templates, and. Exercises are a condition for accessing the exam.	according to the agreed term	-
Written exam	Exam can be attended by students who have completed and committed exercises. The students in the pre-printed printed exam answer the questions asked. Passage in writing is necessary for passing on the oral exam.	exam terms	-

Oral exam	The requirement for the entrance to the oral exam is at least 60% of the points collected on the written part of the exam. The final grade is obtained according to the formula (FEx100)/100	exam terms	-

Obligatory literature

1. Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str.
2. Andrašić, D., 1982: Objekti tehničkog uređenja lovišta i uzgajališta divljači, Zagreb,106 pp.
3. Andrašić, D., 1973: Uređivanje lovišta. Lovna privreda IV dio, Zagreb.
4. Group of authors: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str.
5. Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str.
6. Tucak, Z., Florijančić, T., Grubešić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K., 2002: Lovstvo. Drugo prošireno izdanje. Uđbenik, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet Osijek, 405 str.
7. Legislative and by-laws related to hunting, forestry, nature protection and the environment

Recommended literature

1. Pascal Durantel, P. 2007 : Enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 607 str.
2. Pascal Durantel, P. 2007: Praktična enciklopedija lovstva, Sveučilišna knjižnica Rijeka, 285 str.
3. Whitehed, G. K. (1993): The Whitehead Encyclopedia of Deer. Swan Hill Press, Shrewsbury, UK, 597 str.
4. Blüchel, K.G.: Die Jagd, 652 str.

Forestry Techniques and Technologies

ŠDU3004

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 3 days

Lecturer
Prof. Marijan Šušnjar, Ph.D.
Prof. Željko Zečić, Ph.D.
Assistant Prof. Hrvoje Nevečerel, Ph.D.

Associate teacher for exercises
Prof. Marijan Šušnjar, Ph.D.
Prof. Željko Zečić, Ph.D.
Assistant Prof. Hrvoje Nevečerel, Ph.D.
Assistant Prof. Zdravko Pandur, Ph.D.
Assistant Prof. Kruno Lepoglavec, Ph.D.
Assistant Prof. Dinko Vusić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The task of the subject is to inform students about theoretical and practical knowledge about forestry techniques and technologies in wood logging, opening of forests by primary and secondary forest roads and technical and exploitational features of machines and devices used in wood logging and building of forest roads. In this way, the students will expand their ideas about the integrating factors of complex management and forest resource management. The subject is structured in such a way that the knowledge acquired from mentioned areas is expanded during the educational process, this time oriented towards interaction effects. Students learn about the forest road infrastructure as one of the basic preconditions of the rational forest management. Basic procedure stages of establishing the optimum forest road network are defined on the terrain: planning, designing, building and maintenance. Rules and professional placement of horizontal (situational) and height (vertical) development of a forest road route are shown. The functional approach to forest opening with

defining the criteria of optimality evaluation and procedures of economic, technical-technological, environmentally-ecological, sociological-aesthetic and comprehensive optimisation is described. GIS is introduced as the base for making the best possible decisions in forest opening and GPS as a device for establishing a forest road cadastre. After having met the components of forest machines, their driving engines, the lectures include morphological and other analyses of the individual group of machines, like devices for cutting and processing (motor chainsaws), equipment of mechanised loading and unloading (forest cranes and forest winches), special forest vehicles (adapted agricultural tractors, skidders, forwarders, forest lorries). Special emphasis is given to the analysis of dynamic load of a vehicle and the method of transfer of force from a wheel to the soil – Basic mechanics of motor vehicles: resistance of a vehicle movement, sliding, pitch resistance, resistance in vehicle acceleration, air resistance, calculation of tensile force from the available tensile force, real maximum tensile force, basis of the system wheel-soil, forest soil and realisation of tensile force.
Classes consist of lectures, calculations and measurement exercises, seminars and field trips with the use of contemporary didactical aids and support of computer and multimedia technology. Field trips are organized on testing grounds with the highest practical achievements.

Type of course:

Forestry Techniques and Technologies (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Recommend machines for tree felling and processing and timber transport (chainsaw, harvester, skidder, adapted farming tractor, forwarder, forest trucks for timber transport, cableways).	Exercises, Colloquium, Final exam	B10
Present timber harvesting works, development of standardization and rationalization of timber harvesting (timber harvesting systems and sub-systems, works required for the production of a particular forest product, standardization of forest products by processing methods, skidding or forwarding technology, new technical and technological method of timber harvesting, standardizing of harvesting works by applying work and time studies, rationalization of works).	Exercises, Colloquium, Final exam	B10
Investigate the construction and maintenance of forest roads in the lowland area and on sloping terrains (the procedures for establishing an optimal network of forest roads in the field are considered through the issues of construction and maintenance in the lowland area and on sloping terrain, the analysis of the existing primary and secondary forest traffic infrastructure network).	Exercises, Colloquium, Final exam	B10
Present a modern approach to optimizing the network of forest roads - revitalization of land (justifiability of return on land, land revitalization,	Exercises, Colloquium, Final exam	B10

so-called reforestation, existing techniques and technologies for land revitalization).

General competences

The objective of the subject is to enable students of Silviculture and Forest Management Planning with Wildlife Management with the activity of wood logging to obtain integrated forestry knowledge for making competent decisions about complex procedures in forest renovation, cultivation and arrangement and hunting management.

Type of instruction

Lectures

Lectures cover 3 methodical units according to the teaching plan.

Exercises

Exercises are performed in the form of measurement and calculation. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is scheduled for 3 days according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining original teaching: lectures, exercises and field teaching. Organization of field trips. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Field work				24		0,75

Exercises (E)	30%	60-70%	Sufficient (2)	30	36	2,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	70%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex30 + PEx70)/100**		**84**	**66**	**5**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Final exam (FE)	70 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
UKUPNO	**100%**	**(FEx70+Ex30)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures, exercise and field work	The attendance is checked and the attendance of the students is recorded. Filed work and measuring exercises are obligatory. A student may justifiably be absent with a maximum of 15% of other types of direct teaching hours (lecturers and calculation exercises).	semester (60 hours of direct lecturer)	-
Exercises preparation	Exercises are attended by groups. At the beginning of the first exercise, students will receive templates with exercise assignments, as well as the appearance of the collage, jumper, and list of suggestions in which they	in accordance with the agreed terms	

	will respond to the set tasks in printed form. The accuracy, regularity and regularity (time-honored exercises) are evaluated.		
Partial exam (PE1)	Partial exam can be accessed by students who proper attended direct teaching hours. 60% points must be collected for the exam pass. Students who have passed partial exam receive a final grade from a subject. The final grade is calculated according to formula: Vx30+Kx70/100	15. week	
Written exam	Examinations can be attended by students who have completed exercises and field teaching but failed on partial exams. Also, students who are not satisfied with the final grade on the basis of passed partial exams can access the written exam. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade is calculated according to formula: Ex30+PEx70/100	exam terms	

Obligatory literature

1. CD with lectures in "Windows Power Point" presentations with printed vesrion.
2. B. Kraut: Strojarski priručnik. Tehnička knjiga Zagreb, 1988, s. 53-74, 133-222, 255-287, 313-482.
3. S. Sever: Šumarski strojevi. Tehnička enciklopedija, LZ “Miroslav Krleža”, svezak 12, Zagreb, 1992, s. 519-531.
4. Šumarska enciklopedija, LZ “Miroslav Krleža”, svezak 1, 2, 3, poglavlja: a) Harvester, s. 50-51., b) Procesor, s. 78-80., c) Skider, s. 208-210., d) Koranje, s. 278-281., e) Traktor, s. 78-80., f) Rasadnik, s. 119-130., g) Žičare, s. 651-659.
5. Anon., 1966: Šumarsko-tehnički priručnik. Nakladni zavod Znanje, Zagreb, 1-568.
6. Benić, R., 1987: Transport, šumski. Šumarska enciklopedija 3, JLZ "Miroslav Krleža" Zagreb, 519 - 520.
7. Conway, S., 1986: Logging practices, Principles of timber harvesting systems. Miller Freeman Publications, 1-432.
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11. Krpan, A.P.B., Zečić, Ž., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1-98.
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16. Slunjski, E. 1995: Strojevi u građevinarstvu, Hrvatsko društvo građevinskih inženjera, Zagreb, s. 1-250.
17. Winkler, N. 1998: Environmentally Sound Road Construction in Mountainous Terrain, Food and Agriculture Organization of the United Nations, Rome, p. 1-54.
18. Cornell, J., Mills, K. 2000: Forest Road Management Guidebook, Oregon Department of Forestry, p. 1-32.
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20. Selected profesional and scientific papers published in scientific journals which are available for studnets in the libraries of Faculyt of Foresty and Forest Engineering Institute.

Recommended literature

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2. Pičman, D., Pentek, T. 1996: Prilog poznavanju uporabe strojeva za stabilizaciju šumskih prometnica vapnom, Mehanizacija šumarstva 21 (2), Zagreb, Hrvatska, s. 87-96.
3. Pičman, D., Pentek, T. 1996: Uporaba RRP sredstva za stabilizaciju tla pri gradnji šumskih prometnica, Šumarski list vol. 120 (11-12), Zagreb, Hrvatska, s. 469-476.
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5. Pičman, D., Pentek, T. 1997: Različite mogućnosti primjene geosintetika kao metode stabilizacije tla pri gradnji šumskih cesta, Šumarski list vol. 121 (7-8), Zagreb, Hrvatska, s., 383-389.
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10. Šušnjar M., Horvat D., Kristić, A., Pandur, Z., 2008: Morphological analysis of forest tractor assemblies. Croatian Journal of Forest Engineering 29 (1): 41-51.
11. Krpan A. P. B., Zečić, Ž., Stankić, I., 2007.: Biomasa nekih domaćih vrsta šumskog drveća (Biomasse of some local forest tree species). Znanstveno savjetovanje HAZU Zagreb, Poljoprivreda i šumarstvo kao proizvođači obnovljivih izvora energije, Zagreb, 2007. Zbornik radova, str. 75-87.
12. Zečić, Ž., Stankić, I., Vusić, D., Bosner, A., Jakšić, D., 2009: Iskorištenje obujma i vrijednost drvnih sortimentna posušenih stabala jele obične (Abies alba Mill.) (Volume utilization and value of timber assortmets of dried silver fir (Abies alba Mill.) trees). Šumarski list 133 (1/2): 27 - 37.

13. Tikvić, I., Zečić, Ž., Ugarković, D., Posarić, D., 2009.: Oštećenost stabala i kakvoća drvnih sortimenata hrasta lužnjaka na spačvanskom području (Damage of forest trees and quolity of timber assortments of pedunculate oak on spačva area). Šumarski list 133 (5/6): 237 - 248.
14. Prka, M., Zečić, Ž., Krpan A. P. B., Vusić, D.: 2009: Characteristics and share of beech false heartwood in felling sites of Central Croatia (Značaj i udio neprave srži bukve u brdskim sječinama središnje Hrvatske). Croatian Journal of Forest Engineering 30 Issue 1, pp. 37 - 49, Zagreb
15. Zečić, Ž., Vusić, D., 2009.: Računalne norme privlačenja drva traktorima (RANOP). Konačno izvješće projekta "Ususstavljenje normi i normativa" (Final report project "Syistematization of time standards and normative provisions". Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, prosinac 2009., str. 1 - 13.
16. Zečić, Ž., Vusić, D., Prka, M., Klepac, S., 2010.: Utjecaj nagiba traktorskog puta na proizvodnost traktora Timberjack 240C pri privlačenju drvnih sortimenata u prebornim šumama (Influence of skidding road slope on productivity of skidding timber assortments with tractor Timberjack 240C in selective forests). Šumarski list, 134 (3/4), pp. 103 - 114, Zagreb.

Spatial analysis and valorization

ŠDU3005

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Renata Pernar, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The lectures include the following thematic wholes: Introduction to spatial analyses; Sources, formats and possibilities for exchange of geodata with other systems; Use of different data types for spatial analyses and valorization; Importance of thematic data; Concepts for saving of thematic data; Establishment, use, maintenance and amendment of databases; Connection of thematic and geometrical data; Methods for interpolation of thematic variables and their spatial division; Preparing of DEM and connection of thematic data with DEM; Generation of new variables based on DEM; Spatial analysis (zoning, searching, thematic overlaps, extraction of contents, autocorrelation, connection of surfaces and contents); Quantification of spatial elements.
Quantification of spatial elements for the manners of land use, land cover and habitats; Generation of variables for implementation of fragmentary statistics (polygon surface and volume, lengths of lined objects, number of polygons on one surface unit, number of lined elements on a given area, integration and distance between polygons of the same type, analyses of neighboring polygons, …).

Type of course:

Spatial analysis and valorization (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of spatial data. Distinguish ordinary from spatial information. Describe models and sources of spatial data. Comment on the types and form of spatial data.	Comprehensive exam	D4

Pronounce the definition of digital relief model and digital orthophoto. Describe and explain ways of making and editing data at creating DRM. Present the creation of a DRM and explain its significance in forestry. Compare ways of DRM visualization.	Comprehensive exam	A1, B2, B9, B15, D4
Compare and describe the analysis of vector and raster data. Analyze isolated polygons with aim of determining the homogeneity and / or heterogeneity of the studied area from the aspect of silviculture, forest management, forest protection, ...	Comprehensive exam	A1, B2, B9, B15, D4
Analyze quantification of spatial elements of land use, land cover and habitat. Explain the significance of spatial analysis and valorization of spatial elements.	Comprehensive exam	A1, B2, B9, B15, D4

General competences

The task of this subject is to make students acquainted with types and models of spatial data, sources and ways for data compiling for spatial analyses and space valorization, as well as with basic procedures and possibilities for application of spatial analyses and space valorizations.

Type of instruction

Lectures

Lectures are performed with computer presentations. Within the course, along with regular attendance of lectures students during the semester creates seminar.

Working methods:

Teachers' obligations:

Maintaining elective classes – lectures. Designing topics for seminar papers, compiling knowledge tests and evaluating them. Maintaining oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, production and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5

Comprehensive exam (CE)	100%	60-70%	Sufficient (2)	7,5	37,5	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(CEx100)/100**		**22,5**	**37,5**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (15 hours of direct lecturer)	The student work off for absence from the individual lectures term.
Regular examination deadlines	All students who have fulfilled their teaching obligations have the right to attend a regular exam period. The knowledge of the entire program (realized through theoretical lectures) is checked on the exam.	published examination deadlines	-

Obligatory literature

1. Pernar, R. (1996): Primjena rezultata interpretacije aerosnimaka i GIS-a za planiranje u šumarstvu, Zagreb, 156 str.
2. Kušan (ed.) (1994): Nove tehnike izmjere i kartografije, Zagreb.
3. Pernar, R.: Prezentacije s predavanja

Recommended literature

1. Göpfert, W., 1991: Raumbezogene Informationssysteme, Karlsruhe, 318 str.
2. Furlan-Zimmermann, N., Salaj, M., 1999: Krajolik: sadržajna i metodska podloga krajobrazne osnove Hrvatske, Ministarstvo prostornog uređenja, graditeljstva i stanovanja, 185 str.

Preparation and Measurement of Hunting Trophies

ŠDU3006

ECTS 2

English language R2

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Krešimir Krapinec, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The aim of the mentioned subject is to qualify the student for finalization in hunting management, in line with global and European standards and ever more strict regulations regarding the circulation of wild animals (not only game). During the curriculum, students will be qualified to address and to evaluate parts of animals and hunting trophies, as per the legal regulations. After he has attended and passed the course of lectures, the student acquires the right to evaluate hunting trophies officially.

Type of course:

Preparation and Measurement of Hunting Trophies (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Managing and autonomous making decision in wildlife/game management	Oral exam	B4

General competences

Development of inductive and deductive abilities required for better knowledge of the elements related to addressing and evaluation of trophies and the analysis of effectiveness and correctly conducted game kill. Up-to-dateness in the work, systematism and effectiveness in data compilation, and keeping files on trophies. Capability for application of acquired information in resolving of

practical issues encountered by a modern game evaluator and taxidermist. One lecture will be held by a taxidermist, who will instruct the students on manners, tools and chemicals used in animal stuffing.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Direct lessons. Keeping writing and oral exam, consultations, teaching material making.

Student's' obligations:

Regularity at teaching and active participation teaching. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0%			15	0	0,5
Exam (E)	100%	60-70%	Sufficient (2)	0	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam, according to Croatian Hunting Act.	exam terms	
Oral exam	Asks from different parts of course content.	exam terms	

Obligatory literature

1. Varićak, V., 1997: Ocjenjivanje lovačkih trofeja; Euroteam d.o.o.; Zagreb; 176 pp
2. Frković, A., 1989: Lovačke trofeje, obrada, ocjenjivanje i vrednovanje – europska divljač; Lovački savez Hrvatske za uzgoj, zaštitu i lov divljači, Zagreb; 239 pp.
3. Važeći zakoni i pravilnici

Recommended literature

1. ***, 1950: The standard book of hunting and shoting, New York, 564 pp.
2. Kellermann, K., 1995: Trophäen- und Tierpräparation. Jahr Top Special, 192 pp.

Post-Fire Restoration

ŠDU3007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Željko Španjol, Ph.D.
Assistant Prof. Roman Rosavec, Ph.D.

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The purpose of the course is to familiarize students with issues of forest fires in the Republic of Croatia and to acquaint themselves with the problem of restoration of the surface after the fire. The continuation includes a number of factors relevant to the mentioned issues, such as: types of forest fires, causes of fire, frequency of forest fire occurrences, impact of habitat conditions (geological structure, relief, soil, vegetation, etc.), methods of restoration of fired areas.

Type of course:

Post-Fire Restoration (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the basic features and characteristics of the fire. Identifying areas where fires occur more frequently. Grading of forest fuel.	Final exam	B8
Understanding fire-fighting activities. Analyzing the ways and forms of risk assessment. Evaluation of the model for assessing the vulnerability.	Final exam	B8
Understanding qualitative and quantitative forms of damage. Analyze types suitable for reconstruction. Evaluation of the restoration methods.	Final exam	B6

General competences

Interpretation of the restoration of the affected area by fire. Ways of managing with fire affected areas. Analyze methods of restoration of fire affected areas.

Type of instruction

Lectures

Working methods:

Teachers obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written exams, oral exams and consultations. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				11	0	0,3
Seminar (S)	20%	50-70%	Sufficient (2)	2	10	0,4
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	40%	50-70%	Sufficient (2)	1	20	0,7
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam		50-70%	Sufficient (2)			
		71-80%	Good (3)			

(P2)	40%	81-90%	Very good (4)	1	20	0,7
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx20 + P1x40 + P2x40)/100**		**15**	**50**	**2**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		42	1,4
TOTAL	**100%**	**(Fex80+Sx20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (15 hours of direct lecturer)	
Seminar	Seminar papers are produced in accordance with assigned topics related to the teaching units.		
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam.
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	exam terms	
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: (Fex80+Sx20)/100		

Obligatory literature

1. Bertović, S. i dr. (1987): Osnove zaštite šuma od požara, Zagreb

Recommended literature

1. Rosavec, R., 2010: Odnos čimbenika klime i zapaljivosti nekih mediteranskih vrsta kod šumskih požara. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.
2. Vučetić, M, Španjol, Ž. & Barčić, D. (2002): «Prirodna obilježja i potencijalna opasnost od šumskih požara». Zbornik radova s međunarodnog, znanstvenog i stručnog savjetovanja «Sigurnost u okolišu i graditeljstvu», 9-11.5.2002. Šibenik.
3. Bilandžija, J. (1992): Prirodno opterećenje sastojina alepskog, primorskog i crnog bora šumskim gorivima. Radovi, vol. 27, br. 2: 105-113, Šumarski institut, Jastrebarsko.
4. Bilandžija, J. & Lindić V. (1993): Utjecaj strukture šumskog goriva na vjerojatnost pojave i razvoja požara u sastojinama alepskog bora. Radovi, vol. 28, br. 1-2: 215-224, Šumarski institut, Jastrebarsko.
5. Bilandžija, J. (1995): Struktura goriva, vjerojatnost pojave i razvoj požara u sastojinama primorskog i crnog bora na Biokovu. Prirodoslovna istraživanja Biokovskog područja, Ekološke monografije 4, Zbornik radova sa Kongresa, 293-297, HED, Zagreb.
6. Španjol Ž. (1996): Prilog poznavanju šumskih požara u sastojinama alepskog bora (*Pinus halepensis* Mill.). Unapređenje proizvodnje biomase šumskih ekosustava, Šumarski fakultet Sveučilišta u Zagrebu. Šumarski institut Jastrebarsko, Knjiga 1: 391-412, Zagreb.

Ecology of Forest Tree Species

ŠDU3008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Ivica Tikvić, Ph.D.
Associate Prof. Damir Ugarković, Ph.D.

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:

The course Ecology of Forest Tree Species covers the ecological and biological ties between the main forest tree species, the habitat conditions required for tree development, natural ecological and other characteristics, an overview of the climate, relief, geology and soils in Croatia, demands of forest tree species for light, temperature, water, relationships between chemical and mechanical factors, morphological constitution of forest tree species, dependence of germination, growth and development of the below-ground and above-ground components and seed yield on ecological conditions, negative impact of biotic factors on the development and survival of forest trees, negative impacts of abiotic factors on forest trees, drought and high temperatures, frost and snow, ice and low temperatures, floods, wind, pollution, insects, mushrooms and higher plants, animals. Ecological relationships of common beech, English oak, sessile oak, narrow-leaved ash, black alder, downy oak, evergreen oak, European chestnut, elm, linden and maple in Croatia. Ecological relationships between common fir, common spruce, aleppo pine and black pine in Croatia. Ecological relationships between alochthonous tree species, green Douglas fir, American white pine, European larch, Scotch pine, sea pine, Atlas cedar, plantain, hackberry, white cedar and cypress.

Type of course:

Ecology of forest tree species (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Identify tree species on the basis of morphological features, identify tree parts and shapes, and apply theoretical and practical knowledge of economically important indigenous and alohton species of trees and shrubs.	Tests of knowledge, oral exam.	B1
Conduct biological and technical works on park and green landscaping.	Tests of knowledge, oral exam.	B4
Conduct professional field work on plant protection in urban areas.	Tests of knowledge, oral exam.	B7
Conduct environmental monitoring.	Tests of knowledge, oral exam.	C1

General competences

Complete qualifications for management of forest ecosystems in every sense. Keeping all jobs in forestry. Prepared for professional and scientific training through various educational forms and postgraduate studies.

Type of instruction

Lectures

Through lectures students are introduced to theoretical and practical knowledge from individual thematic units.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Laying the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L) attendance	10%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	15	0	0.5

Partial exam (PE)	60%	50%-62.5%	Sufficient (2)	4	26	1
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam (OE)	30%	50%-62.5%	Sufficient (2)	1	14	0.5
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lx0,1)+(PEx0,6)+(OEx0,3)**		**20**	**40**	**2**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (15 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	exam terms	The student has the right three times to go to the exam.
Oral exame	Students who pass a written test and who receive passive grades from lectures attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: (Lx0,1)+(PEx0,6)+(OEx0,3)	exam terms	The student has the right three times to go to the exam.

Obligatory literature

1. Matić, S., Prpić, B. POŠUMLJAVANJE, Savez inženjera i tehničara šumarstva i drvne industrije Hrvatske, 1-79., Zagreb 1983.
2. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.
3. OBIČNA JELA U HRVATSKOJ, 2001., Akademija šumarskih znanosti, Hrvatske šume ,p.o. Zagreb, ISBN 953-98571-0-4, str. 5-895.
4. OBIČNA BUKVA U HRVATSKOJ, 2003., Akademija šumarskih znanosti, Hrvatske šume, d.o.o., Grad Zagreb, Gradski ured za poljoprivredu i šumarstvo, ISBN 953-98571-1-2, str.5-855.
5. HRAST LUŽNJAK U HRVATSKOJ, 1996, HAZU, Hrvatske šume, p.o. Zagreb, ISBN 953-154-079-9, str. 9-559.

Recommended literature

1. M. Vidaković, 1993., Četinjače. Grafički zavod Hrvatske, «Hrvatske šume» Zagreb, str. 741.
2. J. Herman, 1971., Šumarska dendrologija. Stanbiro, Zagreb, str. 470.

Management by selection system and subalpine forest ecosystems

ŠDU3009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Assistant Prof. Damir Drvodelić, Ph.D.
prof. Joso Vukelić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The aim of the subject is to acquaint the students with the functioning of the subalpine ecosystem. The subalpine ecosystem covers a relatively small area in Croatia, but it is of utmost significance. These ecosystems are very unstable, so that all kinds of interventions leave irreparable damages. Special attention will be paid to ecology and vegetation of these communities, the way of their functioning and regeneration. Management by selection system is one of the natural ways of forest management. Due to its many advantages, an increasing number of experts support management by selection. In Croatia, management by selection has a long and significant tradition, so that it makes sense to make detailed study of this management method the subject matter of this course.

Type of course:

Management by selection system and subalpine forest ecosystems (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (IU)	Evaluation methods	Connection with the study program IU
Explain the division of the subalpine ecosystem and the forest community. Conduct the renovation of subalpine forest communities. Apply knowledge of ecology and stability of subalpine forest communities.	Final exam.	B1, B2, B3

Apply knowledge of selection system management methods, especially in subalpine forest ecosystems.	Final exam.	B2, B3
To perfect the existing and introduce new techniques of selection system management. Apply knowledge of selection system management of beech stands and other types of trees.	Final exam.	B15

General competences

Explain the division, ecology and forest community of the subalpine belt. Explain the regeneration and stability of subalpine forest communities. Make forestry programs and basics of management. Apply methods of selection system management to the main types of subalpine ecosystems.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original lessons – lectures. Maintenance of written and oral exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Laying the final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	15	1,0
Seminar (S)	-	-	-	0	15	0,5
Final exam (FE)	100%	60-70%	sufficient (2)	0	15	0,5
		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(FEx100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	The lectures are checked and the presence of students is recorded. Students may be excluded with a maximum of 20% of direct teaching hours.	semester (15 hours of direct teaching)	-
Seminar (S)	Writing of seminar work from problems of selection system management in subalpine forest ecosystems.	-	-
Written exam (WE)	After completing a lecture, students take a written exam. The final grade of the subject is obtained according to the formula (FEx100)/100	according to the test schedule	-

Obligatory literature

1. Matić, S., I. Anić, M. Oršanić, 2001: Uzgojni postupci u prebornim šumama. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 407–460, Zagreb.
2. Matić, S., B. Prpić, I. Anić, M. Oršanić, 2001: Uzgojni postupci u jelovim šumama oštećenima propadanjem. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 461–478, Zagreb.
3. Matić, S., 1994: Šume visokih gora i planina dinarskog područja. U: Đ. Rauš (ur.), Silvae nostrae Croatiae, Ministarstvo poljoprivrede i šumarstva Republike Hrvatske, 145-153, Zagreb.
4. Vukelić, J., Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.

Recommended literature

1. Schutz, J. P., 2001: Der Plenterwald, und weitere Formen strukturierter und gemischter Walder. Paul Parey.
2. Ott, E., 1997: Gebirgsnadelwalder. Haupt Verlag.

Population outbreaks and monitoring of forest insects

ŠDU3010

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Boris Hrašovec, Ph.D.
Assistant Prof. Milivoj Franjević, Ph.D.

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The phenomenon of mass outbreaks of forest insects and their impact on energy flows in the ecosystem is studied in this course. Also, the means of population density estimation and accession of some forest pest species is practiced and taught in the course. Monitoring programs for the most important forest defoliators and xylophages is explained in the detail. Students are given the crucial facts about the populations fluctuations (both quantitative and qualitative). Special emphasis is given on some recorded cases of massive insect outbreak in the near history in Croatia or neighboring countries together with the critical analysis of the possible causes and analysis of the outbreak dynamics.

Type of course:

Population outbreaks and monitoring of forest insects (elective, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the dynamic processes that rule in the insect populations, identify the dominant mechanisms that govern and interpret the circumstances that lead to overburdening and collapsing populations on the other side.	Seminar, final exam.	B4, B8, C6
Differentiate and classify different population-gradation types according to their grading properties	Seminar, final exam.	B4, B8, C6

and predict the grading process on the basis of recognized patterns.		
To explain concrete historical examples of forest insect gradation based on the circumstances that led to them.	Seminar, final exam.	B4, B8, C6
Link recent and potential future gradations with biotic and abiotic factors that are crucial to their emergence.	Seminar, final exam.	B4, B8, C6
Calculate the actual and relative density of a specific forest insect population using the data collected through the monitoring system.	Seminar, final exam.	B4, B8, C6
To know and evaluate the risks of the outbreak of the most important forest insect pests on the basis of the analyzed input parameters and patterns that define the population dynamics of the analyzed pests.	Seminar, final exam.	B4, B8, C6

General competences

Identify the dynamic processes that rule in the insect populations, identify the dominant mechanisms that govern and interpret the circumstances that lead to overburdening and collapsing populations on the other. Link recent and potential future gradations with biotic and abiotic factors that are crucial to their emergence. Calculate the actual and relative density of the population of a specific forest insect using the data collected through the monitoring system. To know and evaluate the risks from the outbreak of the most significant forest insect pests graded on the basis of the analyzed input parameters and patterns that define the population dynamics of the analyzed pests. To select, plan, design and field implement the most appropriate method of monitoring the population of a forest insect pest. Quantify and analyze the density of forest insect population in time and space and compare the status of populations of the same insects in different habitats at the level of Croatia but also in the environment.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students	ECTS

					workload outside the direct teaching	
Lectures (L)	10%			15	0	1
Seminar (S)	50%	Student through the seminar handles the default problem / topic.	Sufficient (2)	0	20	0,67
			Good (3)			
			Very good (4)			
			Excellent (5)			
Final exam (FE)	50%	65-74%	Sufficient (2)	0	25	0,83
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
TOTAL	**100%**	**(S1x50 + Fex50)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours	semester (15 hours of direct lecturer)	-
Seminar (S)	In the form of a seminar presentation / presentation, the student demonstrates the knowledge learned from the forestry insect codes and their monitoring system (according to the program). Structured exposes the problem of the default pest.	the second third semester	No compensation.
Final exam	Students who exhibit and evaluate their seminar and fulfill their student obligations (attendance) get the right to go to final exam Final grade is the result of a combination of a seminar evaluation and an oral final exam. On the final exam can equally come out and a student who did not give up seminar.	regular and extraordinary examination deadlines	

Obligatory literature

1. Kovačević, Ž., 1950: Primijenjena entomologija, I knjiga: Opći dio. Nakladni zavod Hrvatske, 217 str.
2. Androić, M., 1965: Aviokemijska metoda zaštite šuma. Poslovno udruženje šumsko-privrednih organizacija, Zagreb, 128.
3. Hrašovec, B. & M. Harapin, 1999: Dijagnozno-prognozne metode i gradacije značajnijih štetnih kukaca u šumama Hrvatske. Šumarski list 5–6: 183–193.

Recommended literature

1. Berryman, A.A., 1986: Forest Insects – Principles and Practice of Population Management. Plenum Press, New York and London, 273 str.

2. Berryman, A.A., 1988: Dynamics of Forest Insect Populations – Patterns, Causes, Implications. Plenum Press, New York and London, 603 str.
3. Schowalter, T.D., 2000: Insect Ecology – An Ecosystem Approach. Academis Press, USA, 483 str.
4. Speight, M.R., M.D. Hunter & A.D. Watt, 1999: Ecology of Insects – Concepts and Applications. Blackwell Science Ltd., 350 str.

Statistical methods and models

ŠDU3011

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Anamarija Jazbec, Ph.D.

Grading
The average score of four self-made and presented exercises.

Course content:

Concept of inferential statistics. Sample distribution. Standard error. Hypothesis testing. Decision errors. ANOVA (analysis of variance), conditions and assumptions. Repeated measure ANOVA. Fixed and random effects. Design of experiment. Random block design. Factorial design. Correlation. Linear regression. The least squares method. Estimating and evaluation of parameters. Univariate and multivariate models. Model building methods (Forward, stepwise, backward). Testing the Model Adequacy. Modelling of interactions. Growth models.

Type of course:

Statistical methods and models (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Create, analyze and interpret the contingency table - ch2 test. Calculate and test the statistical significance of correlation (Pearson correlation) with the help of computer support. Identify and compare more than two Population means (ANOVA) with the help of computer support. Perform and interpret univariate linear regression with the help of computer support. Perform analysis and interpret the results of multivariate linear regression with the help of computer support.	Presentation of self-solving exercises	A2

General competences

Collect, statistically analysed, display collected data. Discuss and make conclusions based on the already analysed data.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Preforming original lessons - lectures, exercises. Preforming Partial, Written and Oral Exams and Consultations. Creating teaching materials. Correcting Exercises.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Self-solving and preapering exercises for presentation outside regular classes.

Methods of grading

<table>
<tr><th>Evaluation elements</th><th>Maximum points or Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures</td><td>-</td><td></td><td>-</td><td>15</td><td>15</td><td>1</td></tr>
<tr><td>Self-solving exercises</td><td rowspan="2">100%</td><td rowspan="2">Each of the four tasks that are correctly solved is evaluated with a mark from 2 to 5.</td><td>-</td><td>0</td><td>29</td><td rowspan="2">1</td></tr>
<tr><td>Presentation of exercises</td><td></td><td>1</td><td>0</td></tr>
<tr><td>UKUPNO</td><td>100%</td><td colspan="2"></td><td>16</td><td>44</td><td>2</td></tr>
</table>

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance of students is checked. Student may miss 2 hours.	semester (15 hours of direct lecturer)	-
Presentation of exercises	The student independently solved four excercises and presents them orally. The average mark of the all exercises	during the semester	

	is the mark f the course. All exercises must be positively evaluated.	or exam terms	

Obligatory literature

1. Jazbec A. Teaching materials in pdf format.
2. Jazbec A. 2009: Osnove statistike, 2 ed. Šumarski fakultet, Zagreb

Recommended literature

1. Sokal RR, Rohlf FJ. (1995) Biometry. Freeman and Company. New York.
2. Prodan, M., 1961: Forstliche Biometrie. pp.432, BLV München
3. Pranjić, A., 1986: Šumarska biometrika, Šumarski fakultet, pp.204, Zagreb
4. Bahovec V, Erjavec N ur. 2015: Statistika, Element, Zagreb

Floodplain forests

ŠDU3012

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Igor Anić, Ph.D.
Assistant Prof. Stjepan Mikac, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

This course is based on the following concept: lowland forest – floodplain forest – riparian forest. The following topics are studied and analysed: the range of the floodplain forests in Europe and Croatia; the environmental significance of floodplain forests and the history of its relation with man; main factors influencing today's status of floodplain forests; geomorphology of alluvial region and the fluvial processes, with a review of soils; the tree species of floodplain forests, with a review of vegetation, and the dynamics of floodplain forests. The production of floodplain forests; economic, environmental and social value, as well as their biological diversity are also studied. Further studies and analyses are carried out on the following: morphology of forest stands; history of floodplain forest management in different European countries, and the history of floodplain forests in Croatia; silviculture of hardwood broadleaf floodplain forest stands; silviculture of softwood broadleaf floodplain forest stands; silvicultural procedures under conditions of changed water regimes; the adjustment of silvicultural procedures to the floodplain forest dynamics; the impacts of engineering developments upon floodplain forests illustrated by such cases in some European countries and in Croatia, and concept of conservation and revitalisation of floodplain forests illustrated by cases in some European countries (case studies).

Type of course:

Floodplain forests (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the geomorphology of floodplain and habitat for floodplain forest (lowland forests, floodplain forest, riparian forest, floodplain area, floodplain site, floodplain geomorphology and fluvial processes).	Final exam.	B5
Define geography, morphology and dynamics of floodplain forests (distribution, types, biodiversity and flood forest dynamics).	Final exam.	B5
Recommend the management of floodplain forests (production, economic, ecological and social values, silvicultural procedures).	Final exam.	B5
Present threats and revitalization of flood forest (impact of intervention in environment for floodplain forest, conservation and revitalization of floodplain forests).	Final exam.	B5

General competences

The tasks of this subject is to inform the students on the floodplain forest ecosystems in terms of their distribution today and in the past, their structure and morphology, the impacts exerted upon them, management methods, and spatial and time dynamics. Considering the significance of floodplain forest ecosystems and their proportion in the Republic of Croatia, a special attention has been paid to the methods of stand management of the floodplain region, for the purpose of conserving their biodiversity, stability and productivity. The methodology of revitalisation of the endangered stands will be analysed in case studies, particularly in the instances of water regime changes caused by infrastructural developments in the floodplain forest environment.
The obtained knowledge will qualify the future forestry experts for acting in all situations during their work in the region of floodplain forests both in Croatia and abroad. The tuition is organised through lectures, using modern teaching devices and the analyses of real cases in the practice of floodplain forest management of the European forest ecosystems.

Type of instruction

Lectures
Lectures cover 15 units according to the teaching plan.

Exercises

Working methods:

Teachers obligations:

Maintaining original teaching: lectures. Consultation, written exams, oral exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Final exam (FE)	100%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(FEx100)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	exam terms	-
Oral exame	Students who pass a written exam are asking questions from different parts of the program content.	exam terms	-

Obligatory literature

1. Vukelić, J. (gl. ur.), 2005: Poplavne šume u Hrvatskoj. Akademija šumarskih znanosti, Zagreb.
2. Klimo, E., H. Hager (ur.), 2001: The floodplain forests in Europe – current situation and perspectives. European Forest Institute, Brill, 267 str., Leiden – Boston – Koeln.
3. Penka, M., M. Vyskot, E. Klimo, F. Vašiček, 1985: Floodplain forest Ecosystem. Academia, knjiga I, 466 str., Praha.
4. Penka, M., M. Vyskot, E. Klimo, F. Vašiček, 1991: Floodplain forest Ecosystem. Academia, knjiga II, 629 str., Praha.

Recommended literature

1. Anić, I., 2001: Uspijevanje i pomlađivanje sastojina poljskog jasena (*Fraxinus angustifolia* Vahl) u Posavini. Disertacija, Šumarski fakultet, 197 str., Zagreb.
2. Baričević, D., 1999: Ekološko-vegetacijske promjene u šumama hrasta lužnjaka na području g.j. Žutica. Šum. list CXXIII(1/2): 17 – 28, Zagreb.
3. Bušić, G., 1998: Proizvodnost fluvisola varaždinske podravine u odonsu na uspijevanje bijele topole (*Populus alba* L.). Magistarski rad. Šumarski fakultet, 131 str., Zagreb.
4. Dekanić, I., 1962: Utjecaj podzemne vode na pridolazak i uspijevanje šumskog drveća u posavskim šumama kod Lipovljana. Glas. šum. pokuse 15: 5 – 118, Zagreb.
5. Matić, S., I. Anić, M. Oršanić, 1998: Utjecaj promjena stanišnih prilika na strukturu, razvoj i proizvodnju nizinskih šumskih ekosustava. U: B. Prpić, H. Jakovac (ur.), Međunarodna konferencija održivo gospodarsko korištenje nizinskih rijeka i zaštita prirode i okoliša-zbornik radova, 83 – 93, Zagreb.
6. Matić, S. M. Oršanić, I. Anić, 1996: Istraživanja obnove i njege šuma na području pokupskog bazena. Radovi 31(1/2): 111 – 124, Jastrebarsko.
7. Oberdorfer, E., 1953: Der europaeische Auenwald. Beitr. nat. Foresch. Suddwetsdeutsch. 12: 23 – 70.
8. Prpić, B., 1974: Ekološko-biološke značajke šuma jugoistočne Slavonije. U: M. Vidaković, S. Horvatinović, D. Švagelj (ur.), Zbornik o stotoj obljetnici šumarstva jugoistočne Slavonije, JAZU, str. 65 – 77, Vinkovci–Slavonski brod.
9. Rauš, Đ., 1976: Vegetacija ritskih šuma dijela Podunavlja od Aljmaša do Iloka. Glasnik za šumske pokuse 19: 5–75, Zagreb.
10. Rauš, Đ., 1975: Vegetacijski i sinekološki odnosi šuma u bazenu Spačva. Glas. šum. pokuse 18: 225 – 346, Zagreb.

Bioenergy plantations and phytoremediation

ŠDU3013

ECTS 2

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Prof. Davorin Kajba, Ph.D.

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Students are familiar with the species of forest trees suitable for short rotation crops, with energy potential and wood biomass production in Short Rotation Forestry (SRF). The clone / site interaction and the spacing of planting, as well as the influence of habitat, biotic and abiotic factors. Monoclonal vs. multiclonal cultures of forest trees, optimum number of clones in the SRF, distribution of clones in bioenergy cultures, interaction of clone × site (GEI). The ecological and physiological aspects of the SRF (competition, dynamics of regeneration, regeneration, physiological stress, replenishment etc.), Cultures and plantations of forest trees, mixed crops, bioenergetic plants, agroforestry, plantations in watercourse protection, vegetation filters, remediation of contaminated surfaces (phytoremediation), carbon sequestration, the use of wastewaters and recovery deposits in the CLC. Principle of the effect of fodder mediation (phytoextraction, rhizofiltration, phytostation, phytodegradation, rhodium degradation, phytovolatilization). Biodiversity and Environmental Protection Contribution to Crop Cultures in Short Phases and Fertilization (Greenhouse Gases, Energy Balance, Biomass Conversion in Energy, Use of Cocoa in Reducing Pollution, Biomass Characteristics as Fuel, Improvement of Soil Properties, etc.), Socio-Economic Position a legislative environment for biomass production and phytoremediation.

Type of course:

Bioenergy plantations and phytoremediation (elected course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Students are familiar with the types of forest trees suitable for short rotation crops, with energy potential and wood biomass production in Short Rotation Forestry (SRF). The clone / site interaction and the spacing of planting, as well as the influence of habitat, biotic and abiotic factors. Monoclonal vs. multiclonal cultures of forest trees, optimum number of clones in the SRF, distribution of clones in bioenergy cultures, interaction of clone × habitat (GEI)	Seminar, final exam	B5
The ecological and physiological aspects of the SRF (competition, dynamics of regeneration, regeneration, physiological stress, replenishment etc.), Cultures and plantations of forest trees, mixed crops, bioenergetic plants, agroforestry, plantations in watercourse protection, vegetation filters, remediation of contaminated surfaces (phytoremediation) , carbon sequestration, the use of wastewaters and recovery deposits in the CLC. Principle of the effect of fodder mediation (phytoextraction, rhizofiltration, phytostation, phytodegradation, rhodium degradation, phytovolatilization).	Seminar, final exam	B5
Biodiversity and Environmental Protection Contribution to Short Rotation Forestry and Fertilization (Greenhouse Gases, Energy Balance, Biomass Conversion in Energy, Use of Cocoa in Reducing Pollution, Biomass Characteristics as Fuel, Improvement of Soil Properties, etc.), Socio-Economic Position a legislative environment for biomass production and phytoremediation.	Seminar, final exam	B5

General competences

Students acquire knowledge of energy potential and wood biomass production in short rotation forestry, as well as on the principles of remediation. They also learn about the importance of environmental protection contributions in breeding of SRF and phytoremediation.

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	-
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed	exam terms	-

	exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100		

Obligatory literature

1. ***** BIOEN:program korištenja energije biomase, Energetski institut "Hrvoje Požar", 1998, str. 1-179.
2. ***** BIOEN:program korištenja energije biomase i otpada, Energetski institut "Hrvoje Požar", 2001, str. 1-144.
3. Rosillo-Calle, F.: THE BIOMASS ASSESSMENT HANDBOOK.BIOENERGY FOR SUSTAINABLE ENVIRONMENT.,Earthscan, London, 2007, 269 str.
4. Vidaković, M., Krstinić, A.: GENETIKA I OPLEMENJIVANJE ŠUMSKOG DRVEĆA, Liber, Zagreb, 1985.
5. ****** :BIOMASS & BIOENERGY, Pergamon, Elsevier Science Ltd.
6. ****** :FOREST MANAGEMENT FOR BIOENERGY, The Finnish Forest Research Institute, 1997, str. 1-127
7. El Bassam, ENERGY PLANT SPECIES, 1998, str. 1-356.
8. Journal of Phytoremediation
9. http.//www.rtdf.org/phytobib.htm

Recommended literature

1. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, str. 277.
2. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, str. 240.
3. Dickmann, D.I., Isebrands, J.G., Eckenwalder, J.E., Richardson, J.: POPLAR CULTURE IN NORTH AMERICA, NRC Research Press, Ottawa, 2001, str. 1-397.
4. Stettler, R. F., Bradshaw, Jr., H. D., Heilman, P. E., Hinckley, T. M.: BIOLOGY OF POPULUS AND ITS IMPLICATIONS FOR MANAGEMENT AND CONSERVATION, NRC Research Press, Ottawa, 1996, str. 1-597.

Recovery of degraded terrains

ŠDU3014

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Nikola Pernar, Ph.D.
Prof. Igor Anić, Ph.D.
Prof. Goran Durn, Ph.D.

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

Program is realized through lectures and includes following basic units: Concept of degraded terrain – factors, processes and indicators of degradation; Recovery of terrain – starting point, opportunities, obligations; Recovery of eroded terrains; Recovery of depots; Recovery of surface mineral raw material pit; Recovery of area of construction projects; Recovery of contaminated soil and substrate. The first part will get students more acquainted with the concept and definition of degraded area and with factors, processes and indicators of degradation, with special emphasis on soil. Furthermore, starting points in the recovery of terrain connected to the character and proportion of deviations in relation to natural state and opportunities of recovery of such deviations are considered. After that, legal obligations for recovery of terrain or habitat niches (for example soil) should be analyzed as well as directions that originate from conventions and international declarations relating primarily to soil recovery. The third, basic part of the program, elaborates recovery processes and methods of degraded terrain. The greatest impact in degradation is most often manifested on soil characteristic. Therefore the program in this part focuses primarily to rehabilitation of environmental function of the soil

Type of course:

Recovery of degraded terrains (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

Identify the most important forms of terrain degradation. Valorize the influence of soil degradation. Present the most important forms of terrains recovery. Soil damage classification.	Full examination.	A2
To predict the development of erosion processes. Recommend appropriate preventative anti-erosion measures. Establish measures for recovery of eroded terrain.	Full examination.	B4
Evaluation degradation processes as a result of petroleum mining. Surface remediation project or land degraded by petroleum mining. Valorize the recovery implementation with technical and biological measures.	Full examination.	B4, B7
The landfill classification. Optimal method for recovery a landfill.	Full examination.	B4, B7
Assess the nature of forestry degradation Recommend the way of biological recovery of fire site. Recovery forest habitats degraded by water regime disturbance.	Full examination.	B4, B7

General competences

The curriculum from the course Recovery of Degraded Terrains aims to offer students the possibility of acquiring knowledge and skills in the recovery of area that suffered the reduction of functions or utilization opportunities caused by natural or anthropogenic factors. This acquires competences: Prevention of degradation processes and Collaboration and implementation recovery of degraded terrains.

Type of instruction

Lectures

The lectures are realized in blocks-hours in one of the major classroom. They are based on PP presentations and correspond to a material in the text-book.

Teachers' obligations:

Teaching – lectures. Observations of written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation on lectures. Full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS

Lectures (L)	-	-	-	15	3	0,6
Exam (E)	100 %	50-60 %	Sufficient (2)	2	40	1,4
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			**17**	**43**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	On the lectures is checked the students presence.The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	semester (15 hours of direct teaching)	-
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade.	published test deadlines	-

Obligatory literature

1. Pernar, N., D. Bakšić, I. Perković, 2019: Sanacija degradiranog tla (predavanja, interni materijal) 120 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Kisić, I., 2012: Sanacija onečišćenog tla. Agronomski fakultet Sveučilišta u Zagrebu. 271 p.
2. Osman, K. T., 2014: Soil Degradation, Conservation and Remediation. Springer, 237 p.

History of forestry

ŠDU3015

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. Igor Anić, Ph.D.
Assistant Prof. Stjepan Mikac, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

This course is carried out through the following teaching units: concept and tasks; definition, meaning and role of forests and forestry; review of geography, statistics, and ownership structure of Croatian forests; history of Croatian forestry until 15th century with a special comment on the influence of Roman, and later Venetian cultures; first most significant written documents; forest-management relations from 15th century until 1805, with an emphasis on the forming of property municipalities and land communities; establishment, activity and significance of the Royal Supervision of karst afforestation in the region of the Military District – The Inspectorate for afforestation of karst, stony land, and wild water control; Croatian forestry 1945 – 1990; Croatian forestry since 1990; history of forestry *per* region (Dalmatia, Istria, Lika, Gorski Kotar, Central and North Croatia, Slavonia, Baranja); forest laws and their significance for the development of forestry in this country; historical development of forestry education in Croatia: Forest Management School in Križevci, Forestry Academy, Faculty of Agriculture and Forestry, Forestry faculty, secondary forestry schools; development of forestry science; forestry institutions and societies, and their significance for the development of the branch; the most significant forestry personalities of the past; analysis of the basic literature on the history of Croatian forestry.

Type of course:

History of forestry (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Construct appropriate time intervals from the history of man - to - tree relationships. Link Visual and Mathematical Data Presented in Maps, Tables, Charts, and Other Graphic Views Explaining and Illustrating Information on Geography, Statistics, and Forest Ownership Structure in Croatia. Formulate a view on the significance of forests for the development of civilization, especially in the Mediterranean area. Evaluate the provisions of the oldest statutes of our coastal towns where the relationship between the tree and the forest and their consequences is regulated.	Seminar, final exam.	A2
Critically evaluate the influence of the Venetian Republic on the state of the forest in our coast. Valorize the influence of French authorities at the time of the Illyrian provinces on forestry. Compile the timing of constructing events in the development of forestry from 1814 to 1945. To evaluate the meaning of the activities of the Royal Inspectorate for the afforestation of the grazing of the Krajina area - Inspectorate for the afforestation of cliffs, bays and landscaping for the development of forests, forestry and forestry.	Seminar, final exam.	A2
Build a timeline in the design of events in the development of forestry starting from the end of the Second World War to the independence of the Republic of Croatia. To build the stand on the development of forestry after the independence of the Republic of Croatia by analyzing the factors involved. Critically evaluate the impact of forest law provisions on forestry.	Seminar, final exam.	A2
Create a timeline with the years of the most important events from Croatian forest history. Evaluate the significance of forestry educational institutions for the development of forestry in Croatia. Assess the cause-and-effect relationship between the state of forests and the development of higher education forestry. Evaluate the main professional and scientific discussions on which some of today's forest management methods are based.	Seminar, final exam.	A2

General competences

The course is conceived on the analysis of the interaction between man and forest throughout the history. It contains lectures including the analyses of literature, documents, maps, sketches and photography. By mastering the programme of this subject, students will learn about the development of forestry profession, education and science in Croatia. They will become acquainted with the basic specialist literature and the manner of its analysis, and will learn to find out how the individual specialist and scientific ways and methods, legislative solutions, and historical circumstances have contributed to the present status of Croatian forests. They will thus learn about the short-term and

long-term impacts of the natural and technical forest management approach upon forest status. The tuition is organised through lectures, including a visit to the Croatian Forestry Society.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams, oral exams. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	30%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex70 + SPx30)/100**		**15**	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper	The student prepares seminary work on the topic of forestry history. The quality of the seminar work is evaluated.	15. week	
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	exam terms	
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	exam terms	

Obligatory literature

1. Ivančević, V., 2003: 125. obljetnica osnutka «Kraljevskog nadzorništva za pošumljenje krasa krajiškog područja – Inspektorata za pošumljavanje krševa, goleti i uređenja bujica» u Senju, naše najstarije šumarske krške organizacije, 1878 – 2003. godine. Šumarski list, pos. izd., CXXVII: 3 – 22, Zagreb.
2. Kauders, A., S. Frančišković, 1983: Hrvatska, povijest šumarstva. Šumarska enciklopedija 2: 81 – 86, Zagreb.
3. Matić, S. (ur.), 1998: Sveučilišna šumarska nastava u Hrvatskoj 1898 – 1998, knjiga druga. Šumarski fakultet, 709 str., Zagreb.
4. Meštrović, Š. (ur.), 1998: Sveučilišna šumarska nastava u Hrvatskoj 1898 – 1998, knjiga prva. Šumarski fakultet, 194 str., Zagreb.
5. Piškorić, O., J. Vukelić, 1992: Pregled povijesti hrvatskih šuma i šumarstva. U: Đ. Rauš, J. Dundović (ur.), Šume u Hrvatskoj, Šumarski fakultet i Hrvatske šume p. o. Zagreb, 273 – 290, Zagreb.
6. Prpić, B., S. Matić, O. Piškorić, M. Stojković, I. Maričević, H. Jakovac, 1996: Hrvatsko šumarsko društvo 1846 – 1996. Hrvatsko šumarsko društvo, 451 str., Zagreb.
7. Rauš, Đ., 1973: Šume Slavonije i Baranje od Matije Antuna Relkovića do danas. JAZU, Radovi Centra za organizaciju znanstvenoistraživačkog rada u Vinkovcima 2: 107 – 166, Zagreb.

Recommended literature

1. Delort, R., F. Walter, 2002: Povijest europskog okoliša. Barbat te Ministarstvo zaštite okoliša i prostornog uređenja RH, 300 str., Zagreb.
2. Jedlowski, D., 1975: Venecija i šumarstvo Dalmacije od 15. do 18. stoljeća. Disertacija, Split.
3. Klepac, D., 1997: Iz šumarske povijesti Gorskoga kotara u sadašnjost. Hrvatske šume, 236 str., Zagreb.
4. Klepac, D., 1996: Stare šume hrasta lužnjaka i njihov doprinos razvoju Hrvatske. Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj. HAZU i Hrvatske šume, p.o. Zagreb,13 – 26, Zagreb.
5. Matić, S., 1990: Šume i šumarstvo Hrvatske – jučer, danas, sutra. Glasnik za šumske pokuse 26: 35–56, Zagreb.

Integrated forest protection

ŠDU4001

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Prof. Boris Hrašovec, Ph.D.

Associate teacher for exercises
Assistant Prof. Milivoj Franjević, Ph.D.
Assistant Prof. Marko Vucelja, Ph.D.
Jelena Kranjec Orlović, Ph.D.

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Forest protection is a comprehensive unit which primarily relies on the forest entomology, forest phytopathology, forest growing, but also on all other disciplines. Its integrity results from it. The task of the subject is to show students the connection and interdependence of certain disciplines in the common solution of protective tasks. For this purpose, the influence and protection of forests from the harmful influence of abiotic factors will be examined (extremely high and low temperatures, wind, water, air and soil pollution). Apart from that, weeds in forests and nurseries, on one side as harmful and on the other as useful plants (in certain conditions) are dealt with. Relying on the knowledge of biology of harmful insects and pathogen fungi, integrated protection methods are indicated, as well as the knowledge and application of plant protection products. Damages caused by wild game and small rodents are particularly dealt with, as well as methods of protection from them. Regarding forest fires, the forest economic factor will be greatly dealt with as preventions of forest fire occurrence and models of evaluation of the danger of forest fire occurrence.

Type of course:

Integrated forest protection (compulsory, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To counteract harmful biotic and abiotic factors - determination, diagnosis of health status and planning of control strategy (importance and role, preventive and curative measures of active protection, identification of most common plant diseases, identification of fungal fungi, symptoms of attack pests and symptoms of damage caused by abiotic factors and other zoobytic harmful factors).	Seminar work, final exam.	B4, B8, C6
Present an assessment of the intensity of attack of harmful biotic factors and Quantifying the density of their populations and implementing repressive protection measures - aviomethods in forest protection (methods of determining the number and density of the population (abundance) of individual pests and plant diseases, technologies used recently in the protection of forests from the air).	Seminar work, final exam.	B4, B8, C6
Valorize integrated protection in lowland regular oak forests, forests of common beech and oak trees, and forts of forests beans and fir (valorization of the role of some well-known harmful biotic factors as well as those most recently discovered, as well as climatic conditions and anthropogenic interventions, on the basis of a comprehensive analysis, consider options and opportunities to undertake preventive and repressive measures of integrated protection).	Seminar work, final exam.	B4, B8, C6
Present integrated protection in Mediterranean forests and their degradation stages (the greatest attention is paid to the analysis of appearance, dynamics of spread, detrimental effects and fire prevention capabilities open space, also considers the importance of some specific organisms that occasionally appear in this area as a dominant detrimental factor for forest stands).	Seminar work, final exam.	B4, B8, C6
To propose integrated protection in nurseries, forest cultures and intensive plantations of special purpose (there are considered increased risks and actual danger of increased occurrence of numerous harmful factors of biotic and abiotic nature, as well as protection measures - mechanical, physical, chemical, biotechnical, biological).	Seminar work, final exam.	B4, B8, C6
Connect invasive pests and the consequences of their entry to implementation. Integrated forest protection measure (pest control system, plant protection quarantine and plant control system and the most efficient methods prevention and curative (monitoring, early eradication, dissolution slowdown) in context of known measures and procedures of integrated forest protection).	Seminar work, final exam.	B4, B8, C6
Predict the organization and monitoring system of biotic and abiotic harmful factors - reporting forecasting jobs in integrated forest protection (the most commonly used monitoring methods, their advantages and disadvantages	Seminar work, final exam.	B4, B8, C6

are compared).		
Present insects as molest ants and causes allergic reactions to the forest and urban space.	Seminar work, final exam.	B4, B8, C6
Analyze invasive quarantine insect species and their correlation with urban space.	Seminar work, final exam.	B4, B8, C6

General competences

To counteract harmful biotic and abiotic factors - determination, diagnosis of health status and planning of the control strategy (importance and role, preventative and curative measures of active protection, identification the most common herbal diseases, the identification of fungal fungi, the symptoms of the attack pests and symptoms of damage caused by abiotic factors and others zoobiotic detrimental factors). Present an assessment of the intensity of attack of harmful biotic factors and quantification of the density of their populations and the implementation of repressive measures protection - aviometode in forest protection (methods of determining the number and density population (abundance) of individual pests and plant diseases, technologies that used recently in the protection of forests from the air). Valorize integrated protection in lowland regular oak forests, forests of common beech and oak trees, and forts of fire, spruce and beech uneven aged (valorization of the role of some well-known harmful bioticas well as those most recently discovered, and climatic conditions, and anthropogenic interventions, based on comprehensive analysis are considered options and opportunities to take preventive and repressive measures integrated protection). Present integrated protection in Mediterranean forests and their degradation stages (the greatest attention is paid to the analysis of appearance, the dynamics of propagation, the detrimental effect and the possibilities of open space fire prevention, also considers the importance of some specific organisms that are also occurring occasionally in this area as a dominant detriment factor for forest stands). Suggest the best approach and selection of integrated protection methods based on ecological and economic indicators. Propose Integrated Protection in Nurseries, Forest Cultures and intensive plantations of special purpose (considering the increased risks and the real danger of the increased occurrence of many harmful bio - and biotic factors abiotic nature, and protection measures - mechanical, physical, chemical, biotechnical, biological). Connect the invasive pests and the consequences of their entry to implementation Integrated forest protection measure (pest control system, plant protection quarantine and plant control system and the most efficient methods prevention and curative (monitoring, early eradication, dissolution slowdown) in context of known measures and procedures of integrated forest protection). Predict the organization and monitoring system of biotic and abiotic damages factors - forecast forecasting jobs in integrated forest protection (the most commonly used methods are monitored by their monitoring advantages and disadvantages).

Type of instruction

Lectures

Exercises

Field lectures

Working methods:

Teachers' obligations:

Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	0%	-	-	30	0	1
Seminar (S1)	30%	Student through the seminar handles the default problem / topic.	50-64% sufficient (2) 65-74% good (3) 75-84% very good (4) 85-100% excellent (5)	0	40	1,5
Final exam (FE)	70%	65-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	80	2,5
UKUPNO	**100%**	**(Ex0 + S1x30 + FEx70)/100**		**60**	**120**	**6**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	Exceptionally, only in the case of a teacher's disability (field courses at other courses).
Partial exam	Exercises are attended by groups. As part of the exercise, 15 thematic units are conducted through 15 exercises. At the beginning of the first exercise, students are provided	at the end of each exercise, in	No compensation.

	with information on how to conduct the exercise and their content. During the implementation of each exercise, the accuracy and understanding of the content of the exercise is verified, verbally by examining individual students and verifying each exercise individually without assigning a grade.	the teaching room	
Seminar	As a seminar presentation / presentation, the student demonstrates the learned knowledge of solving a problem in the context of integrated forest protection (according to the performance program). Structured exposes the problem through diagnosis, analysis and proposal of solutions-taking protective measures (preventive and curative)	the second third of semester	No compensation.
Oral exam	Students who exhibit and evaluate their seminar and fulfill their student obligations (attendance at the lectures and field teaching) are entitled to attend the final exam The final grade of the course is the result of a combination of a seminar evaluation and an oral final exam. The final written exam can not be equally accessible to a student who did not give up the seminar.	regular and extraordinary examination deadlines	

Obligatory literature

1. Matić, S., B. Prpić, J. Gračan, I. Anić, J. Dundović (ur.), Obična bukva (Fagus sylvatica L.) u Hrvatskoj. Akademija šumarskih znanosti, 855 str., Zagreb, 537-548.
2. Vukelić, J. (ur.), Poplavne šume u Hrvatskoj. Akademija šumarskih znanosti, 456 str., Zagreb, 379-389.
3. Matić, S. (ur.), Šume hrvatskog Sredozemlja. Akademija šumarskih znanosti, 740 str., Zagreb, 556-572.
4. Prpić B., J. Vukelić, J. Gračan, J. Dundović (ur.), Obična jela (Abies alba Mill.) u Hrvatskoj. Akademija šumarskih znanosti i "Hrvatske šume", 895 str., Zagreb, 579-589.

Recommended literature

1. Grupa autora: 1977: Upute za kontrolu nekih značajnih šumskih štetnika u dijagnostičko-prognostičke svrhe na području SR Hrvatske. Radovi, 31, 65 str.
2. Grupa autora, 1996: Skrb za hrvatske šume od 1846. do 1996. Knjiga 2, Hrvatsko šumarsko društvo Zagreb, 430 str.
3. Grupa autora, 2001: Znanost u potrajnom gospodarenju hrvatskim šumama. Šumarski fakultet Sveučilišta u Zagrebu, Šumarski institut Jastrebarsko, Hrvatske šume, p.o. Zagreb, 636. str.
4. Kišpatić, J., 1991: Šumarska fitopatologija. Sveučilišna naklada Zagreb, 356 str.
5. Uščuplić, M., 1996: Patologija šumskog i ukrasnog drveća. Šumarski fakultet Sarajevo, 366 str.
6. Vajda, Z., 1973: Nauka o zaštiti šuma. Školska knjiga Zagreb, 482 str.
7. Altenkirsh, W., Majunke, C., Ohnesorge, B., 2002: Waldschutz auf ökologischer Grundlage. Eugen Ulmer Verlag, Stuttgart, Deutschland. ISBN 3-8001-3684-8, 434 str.

Forest management planning

ŠDU4002

ECTS 6

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work 4 days

Lecturer
Prof. Jura Čavlović, Ph.D.
Assist. Prof. Krunoslav Teslak, Ph.D.

Associate teacher for exercises
Assist. Prof. Krunoslav Teslak, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Within the framework of the lectures, substantiated by laboratory work and field work, the subject included the following main teaching wholes: description of forest management system in Croatia and comparison with some European countries; levels of forest management and types of forest management plans; structure of management plans (management book, numerical and graphical attachments to management plan); preparation (renewing or revision) of management plan, preparatory works for forest management, planning, preparation and implementation of field works for description and surveying of elements in the site and stand structure; establishment of area structures in line with the categories of forest and forestland, cadastre municipalities and lots, compartments and sub-compartments, stand abstraction, border surveying and recording of newly abstracted stands; actual current growing stock and current annual increment at the level of sub-compartments, management class, management unit, comparison with previous inventories, structure by thickness and age classes and tree species, methods of forest inventory, intensities of inventory, reliability and exactness of inventory, norms and costs of inventory, definition and descriptions of management classes, management goals and manners by management classes, regulations of silviculture treatments; forest normality, comparison of actual and normal structure at the level of stand (even-aged, uneven-aged), actual and normal age-class structure of management class, so far development of age-class structure, projections of future development of age-class structure, explanations, actual and normal thickness structure (uneven-aged forests), development analysis of thickness structure; harvest plan (cut) prescribing at the level of even-aged (O-2) and uneven-aged

stands (O-3) and at the level of management class (O-6, O-7 and O-8), structure of prescribed cut, felling plan, different methods for establishment of harvest plan (prescribing cut) in even-aged and uneven-aged forests, other regulations (forest protection, construction of forest roads, fauna management, hunting management and use of secondary forest products); preparing of economic and financial plans, income structure, costs structure of silviculture treatments, construction of forest roads and forest utilization, keeping records and implementation monitoring of forest management regulations.

Type of course:

Forest management planning (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyse and to explain process planning and decisions (model structure of planning process, decision making model in forestry planning).	Computational and computer exercises, partial exams, knowledge tests, final.	B7
To analyse and to present past management and development of forest resources (impact of natural and anthropogenic factors, usage of relevant data source, impact of management on age-class/diameter-class development, review of realized cut and management activities).	Computational and computer exercises, partial exams, knowledge tests, final.	B2
To assess, to measure, to calculate and to present actual state of forest resources (social-economic-technological factors, elements of site and stand structure, stand border and area, derived structure elements, age-class and diameter-class forest structure, relation between actual and theoretical age-class/diameter class structure).	Computational and computer exercises, partial exams, knowledge tests, final.	B2, B7
To explain, to project and to valuate elements of prognosis and planning of future forest resources management (types of prognosis and simulation methods of future development, defining of forest management objectives, tending and regeneration influence on forest development, projection of stand selection structure and influence of changes of age-class distribution).	Computational and computer exercises, partial exams, knowledge tests, final.	B2, B7, C4
To calculate and to plan amount and structure of cut and other management activities (thinning cut on stand and forest level, regeneration cut on stand and forest level, selection cut on stand and forest level).	Computational and computer exercises, partial exams, knowledge tests, final.	B2, B7, C5

General competences

Acquiring of skills for inventory, collecting, processing and analyses of data and assessment of actual state on stand and forest level. Acquiring of knowledge about main phases of planning process and components of forest management plans. Acquiring of skills for planning of quantitative and qualitative management activities on the stand and forest level.

Type of education

Lectures

Exercises

Within computational and computer exercises (3 computational, 5 computer) two projects are elaborate which cover main topics of course based on actual examples, as upgrade on knowledge acquired on lectures.

Working methods:

Teachers' obligations:

Performing of primary education – lectures, exercises and field work; preparing of exercises, educational materials and knowledge tests; performing of consultations, partial and final exams.

Students' obligations:

Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Exercises (E)	20%	Partially uncluttered, large correction and on time.	Sufficient (2)	45	15	2
		Uncluttered, large correction and on time.	Good (3)			
		Uncluttered, small correction and on time.	Very good (4)			
		Uncluttered, correct and on time.	Excellent (5)			
Field education (FE)	-	-	-	30		1
Partial exam 1 (PE1)	40%	60-70%	Sufficient (2)	2	28	1
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
Partial exam 2 (PE2)	40%	60-70%	Sufficient (2)	2	28	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PE1x40-PE2x40)/100**		**109**	**71**	**6**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS points**
Final exam (FE)	80 %	60-70%	Sufficient (2)	4	56	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	Checking and evidence of students attendance. Student is allowed exculpatory to absent of maximal 15% hours of direct teaching (10% of exercises and 20% of lectures).	semester (75 hours of direct teaching)	-
Field work	Checking and evidence of students attendance and their activity. Field teaching is fully obligatory.	semester (15 hours of direct teaching)	Exceptionally, in a case of exculpatory absent student is obliged to prepare seminar or to pass partial exam related on topics of field teaching.
Preparing of exercises	Exercises are performing in groups up to 20 students, depending on total enrolled students. Within computational and computer exercises (3 computational, 5 computer) two projects exercises are elaborate. At beginning of semester,	according to defined deadline	Exceptionally student is obliged to work of , in a case of

	students get instructions for preparing of files and covers for exercises, and templates which include explanation of topics and actual examples for each exercise. Evaluation include correct, uncluttered and regularity of preparing and delivery of exercise. Exam include.		exculpatory absent of several exercise.
Written exam	Attendance to exam is allowed to student who regularly get done and complete all exercises and field teaching. Written exam is possible to pass by two partial exams, at the middle and end of semester, or on exam dates scheduled after semester. Student get in advance prepared knowledge test, which include 10 questions (5 questions are in essay form which can include graphs, and 5 question relate on solving of problem examples). Exam include testing and evaluation of knowledge and skills gained on lectures, exercises and field teaching. Attendance to the second partial exam is allowed to student who passed the first partial exam. Written exam is evaluate and contribute in final grade of the course.	defined deadlines of partial exams during semester, schedule of exam dates	
Oral exam	Prerequisite for oral exam is sufficient grade achieved on written part of partial exam or exam within scheduled exam date. Theoretical knowledge (from book) and understanding of teaching topics within exercises and field teaching are evaluate. The finish grade is get according to equation: (WIx40+OIx40+Ex20)/100		

Obligatory literature

1. Čavlović, J., 2005: Šumsko gospodarsko planiranje, Presentation, 207 slides
2. Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 322 str.
3. Klepac, D., 1965: Uređivanje šuma, Znanje, Zagreb.

Recommended literature

1. Loetsch, F., Zöhrer, F., Haller, K.E., 1973: Forest Inventory. pp.467, BLV München
2. Zöhrer, F., 1980: Forstinventur, pp.202, Pareys, Hamburg
3. Davis, L.S. & Johnson, K.N.: Forest Management. Mc Graw-Hill Book Company, New York, 1987.
4. Forest management plan of different forest management units.

Graduate study
C. FORESTRY, STUDY TECHNIQUES, TECHNOLOGIES AND MANAGEMENT IN FORESTRY

Forestry is the profession, science and art of managing and protecting forest ecosystems for the long-term benefit of society, the environment, and economy. Students at the graduate level are trained in the management of forest ecosystems from a biological-ecological, technological and economic aspect. The study is based on upgrading and improving the basic knowledge in the field of forestry acquired in undergraduate studies with directing students to highly professional work in all aspects of forestry organizations and forest enterprises, and student involvement in scientific research and guidance on further education at the doctoral and specialist studies. Students gain the necessary knowledge and skills to solve the most complex tasks in forestry and for coping with the constant technological change, innovation and knowledge. Graduate study in forestry is designed so that students are led in a logical sequence from the basic biological and technical disciplines, through disciplines in which they are introduced to the components of forest ecosystems and to the techniques of forest management, to those that embrace the knowledge of forest and forest land management. Through optional and optional compulsory subjects from a list submitted in the study program, students have the opportunity to broaden their knowledge. Through fieldwork students acquire necessary practical experience they are acquainted with the practical application of acquired knowledge. Students acquire conditions for performing the most complex jobs in forestry and for continuation of education in doctoral and specialist studies by individual making of master thesis. Defending the master thesis is requirement for study conclusion.
Master Engineering of forestry with the knowledge gained by the completion of graduate study Forestry - Techniques, Technology, and Management in Forestry are completely qualified for organization and realization of timber harvesting works, forest opening, designing of forest road network and tasks and assignments in forestry entrepreneurship in the aim of sustainable management of forests and forest land.

DESCRIPTION OF THE PROGRAM
List of compulsory and elective courses

YEAR I.

Code	Name of the course	L*	E	FW	ECTS
	1st semester				
DŠT1001	TIMBER HARVESTING II	3	2	3	7
DŠT1002	MECHANIZATION OF WOOD LOGGING	3	2	3	7
DŠT1003	MANAGEMENT AND ENTREPRENEURSHIP IN FORESTRY	2	2	2	6
DŠT1004	FORESTRY POLITICS AND LEGISLATION	2	0	0	4
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
	Total:	13	6	8	30
	Elective courses				
DŠT1005	TORRENT MANAGEMENT	1	0	0	
DŠT1007	PHYSICAL AND MECHANICAL PROPERTIES OF WOOD	1	0	0	
DŠT1008	WORK HUMANIZATION IN FORESTRY	1	0	0	
DŠT1009	ORGANIZATIONAL CULTURE	1	0	0	
	2nd semester				
DŠT2001	FOREST ACCESSIBILITY	2	2	2	6
DŠT2002	FOREST PRODUCTS	2	1	2	4
DŠT2003	INTEGRATED FOREST PROTECTION	2	1	2	4
DŠT2004	SILVICULTURE	2	2	3	5
	DIPLOMA THESIS INTRODUCTION I				5
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
	Total:	11	6	9	30
	Elective courses				
DŠT2005	FOREST PRODUCTS TRADE	1	0	0	
DŠT2006	ERGONOMICS OF FOREST MACHINES	1	0	0	
DŠT2007	MECHANICAL TECHNOLOGIES OF WOOD PROCESSING	1	0	0	
DŠT2008	FOREST FIRES	1	0	0	
DŠT2009	FOREST FIRE-PREVENTION INFRASTRUCTURE	1	0	0	

* L – lectures (hours/week); E – exercises (hours/week); FW – field work (days/semester)

YEAR II.

Code	Name of the course	L*	E	FW	ECTS
	3rd semester				
DŠT3001	FOREST ROAD DESIGN	2	2	4	6
DŠT3002	ECONOMICS OF FOREST COMPANY	2	1	1	5
DŠT3003	MARKETING IN FORESTRY	2	1	0	3
DŠT3004	DIGITAL CARTOGRAPHY IN FORESTRY	2	1	0	3
	DIPLOMA THESIS INTRODUCTION II				7
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
	Total:	13	6	8	30
	Elective courses				
DŠT3005	TECHNOLOGIES OF FOREST ROAD CONSTRUCTION	1	0	0	
DŠT3006	EVALUATION OF FOREST RESOURCES	1	0	0	
DŠT3007	FOREST BIOMASS FOR ENERGY	1	0	0	
DŠT3008	PLANNING OF TECHNOLOGICAL OPERATIONS	1	0	0	
DŠT3009	INNOVATIONS IN FORESTRY	1	0	0	
	4th semester				
DŠT4001	ENVIRONMENTALLY SOUND TECHNOLOGIES	2	2	3	4
DŠT4002	PRODUCTION ORGANIZATION IN FORESTRY	2	2	3	5
DŠT4003	FOREST MANAGEMENT	2	1	2	3
	DIPLOMA THESIS				18
	Total:	6	5	8	30

* L – lectures (hours/week); E – exercises (hours/week); FW – field work (days/semester)

List of learning outcomes for the Graduate study Forestry, Study Techniques, Technologies and Management in Forestry

A) general engineering competence
- A1: independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways
- A2: explain position and trends of forestry profession in the country and worldwide
- A3: apply simpler methods of operation research

B) focused engineering competence
- B1: organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical
- B2: implement forest management programs
- B3: manage and make independent professional (business) decisions form the field of timber harvesting, forest opening, designing of forest road network and forestry entrepreneurship
- B4: organise and perform forest planning works
- B5: manage protection of forests from abiotic and biotic factors, and organise procedures in protection of forests
- B6: recommend and choose forest machines, techniques and standard technologies used in forestry above all in timber harvesting from natural forests, even-aged and unevenaged stands, culture, plantation, and energy forests
- B7: select and choose mechanical means based on cost analysis and other criteria
- B8: measure and evaluate quality parameters of timber assortments and interpret their size and meaning
- B9: apply scientific insights on wood as renewable material and optimise usage of wood by applying harvesting technologies of forest residual
- B10: apply knowledge related to forest main and secondary forest products and their shipment from the place of production to the market via forest soil, skid trails and the network of forest and public roads
- B11: apply knowledge related to marketing of forest main and secondary forest products
- B12: apply knowledge related to the methods for preparing and planning technical works in forestry
- B13: manage forest, human resource, and technical potential during performance of forest works
- B14: apply knowledge related to the methods, techniques, and technology of opening of forests, i.e. designing and constructing a network of forest roads
- B15: design a network of forest roads
- B16: develop current technologies as well as implement new technologies

C) organizational engineering competence
- C1: plan, organise and works of organization of production in forestry
- C2: organise and conduct sale of timber assortments and timber products on domestic and worldwide market
- C3: organise and manage work safety in forestry
- C4: plan and calculate production, calculate basic indicators of successful business, compose basic financial reports, recognise and analyse types of costs
- C5: manage the most complex tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship
- C6: manage tasks of county and national institutions competent for forestry; inspection services

D) developing engineering competence
- D1: conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry
- D2: conduct courses in professional secondary and other similar schools

- D3: conduct businesses and tasks in publicist writing and media connected with forestry
- D4: professionally and scientifically upgrade through different educational ways and postgraduate study
- D5: gather, process and interpret reference sources and prepare simpler written professional or scientific paper

The connection between the learning outcomes of the course and the learning outcomes of the program

Courses' code	General engineering competence			Focused engineering competence																Organizational engineering competence						Developing engineering competence				
	A1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5
DŠT1001			+	+		+			+	+					+	+							+							+
DŠT1002									+			+																		
DŠT1003	+																							+		+				
DŠT1004	+	+																										+		
DŠT1005		+														+			+											
DŠT1007		+		+	+																									
DŠT1008	+	+																				+								
DŠT1009																+				+				+						
DŠT2001						+									+		+													
DŠT2002	+										+		+								+									
DŠT2003					+			+	+										+											
DŠT2004					+			+																						
DŠT2005	+			+																	+			+						
DŠT2006									+													+								
DŠT2007		+		+	+																									
DŠT2008							+				+														+					
DŠT2009											+		+					+												
DŠT3001				+			+	+																						
DŠT3002				+																+		+	+							
DŠT3003														+						+	+									
DŠT3004	+														+				+										+	
DŠT3005										+							+													
DŠT3006		+		+										+									+							
DŠT3007						+			+		+								+											
DŠT3008				+		+			+	+					+					+										
DŠT3009																+				+				+						
DŠT4001		+							+								+		+											
DŠT4002			+	+																+				+						+
DŠT4003	+				+		+													+						+	+		+	

Timber Harvesting II

DŠT1001

ECTS 7

English language R1

E-learning R1

Teaching hours 99
Lectures 45
Exercises 30
Field work 24

Lecturer
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.

Associate teacher for exercises
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.
Assist. Prof. Andreja Đuka, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject is structurally divided into several rounded segments, so the problem of felling and processing, primary transport and distance transport are separately elaborated but also in the interaction under conditions of modern timber harvesting technologies. Emphasis is given to the ecological basis of the exploitation of forests. The work and time study (standardization) in the exploitation of forests is the basis of planning, preparation of work and production control and payment of completed works. Costs of timber harvesting are elaborated as well as appropriate laws, regulations and instructions. Through exercises and seminars productivity and cost models are analyzed and the profitability thresholds determined for the use of technical resources and felling, processing and transport technologies as well as for the optimum road density.
The course is structured in such a way as to provide the facilitator with theoretical and practical knowledge, which can independently solve practical problems of greater complexity, or continue education in doctoral studies and work in forestry science.

Type of course:

Timber Harvesting II (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the laws of timber harvesting efficiency (influential factors, ways of carrying out works in forestry, mechanization laws in timber harvesting, interaction with stand and exploitation factors, performance and labor productivity, standardization and labor costs, methods of direct cost calculation).	Exercises, Partial exam, Final Exam	A3, B1, B3, B6, B7, C4
Interpret the development of techniques and technologies in timber harvesting (development of equipment and methods of work, discontinuous evolution theory, system optimization, tree felling theory, tree bucking by the selected method).	Exercises, Partial exam, Final Exam	B6, B7, D5
Present timber harvesting system (system elements and timber harvesting subsystems, component interaction, and visualization of the system).	Exercises, Partial exam, Final Exam	B12, B13
Valorize partially mechanized timber harvesting systems (buck-to-quality, tree-length, half-tree-length method, firewood production).	Exercises, Partial exam, Final Exam	B12, B13, C4
Present mechanized timber harvesting systems (cut-to-length and full tree method, centralized timber yards and roundwood processing, combined method, harvesting residue and wood chips harvesting, mechanized harvesting systems in SRC, mechanized processing of chopped firewood).	Exercises, Partial exam, Final Exam	B12, B13

General competencies

Mastering the general and specific knowledge that enables competent planning, performance, supervision and independent decision-making in the complex areas of forestry exploitation, the development of timber harvesting technology and the acquisition of the basis of scientific research.

Type of instruction

Lectures

Exercises

Field work
Stationary field work refers to tree volume and value estimation techniques, tree felling and processing, standardization of forest products, utilization of trees in felling and processing, waste and waste structure, bark, time study in felling and processing, productivity of chainsaw bucking. After the theoretical cabinet preparation, the students are directly involved in the felling and processing of trees (each group 5 trees), under the supervision of the teachers, performing independently selected practical work (except for work with the chainsaw) and all the measurements necessary to find out the essence of the problem of mastering knowledge related to the said works. Field work is also carried out through one-day excursions, the main objective of which is to learn about the latest operational achievements in the field of machine technology and forest utilization technology.

Working methods:
Teachers' obligations:
Presenting original lessons - lectures, exercises, field work. Compiling knowledge tests and evaluating them. Providing partial exams, written, oral exams and consultations. Creating teaching materials.
Students' obligations:
Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45		1.5
Field work				24		1
Exercises (E)	10%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	20	0.75
		Neat, with bigger corrections and on time	Good (3)			
		Neat, with minor corrections and on time	Very good (4)			
		Neat, accurate and timely	Excellent (5)			
Partial exam (PE)	15%	60-70%	Sufficient (2)		20	0.75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Exam (WE)	25%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (OE)	50%	60-70%	Sufficient (2)		40	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10+PEx15+WEx25+OEx50)/100**		99	110	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	75%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			3
TOTAL	**100%**	**(FEx75+Ex10+PEx15)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures and exercises	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from a maximum of 20% of the lectures and 10% of the exercises.	semester (45 hours of direct teaching)	-
Field work	The attendance is checked and the attendance of the students is recorded.	in accordance with the agreed terms	

Evaluation elements	Description	Deadline	Compensation
Exercises preparation	Exercises are attended in groups. At the beginning of the first exercise, students will get task templates, as well as the outlook of the file, the paperback and the list of suggestions in which they will fill in the results. The accuracy and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student can compensate the absence of the individual exercise
Partial exam	The colloquium is evaluated and participates in the final evaluation of the subject.	10^{th} week	-
Written exam	Examinations can be attended by students who have completed exercises. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program content. The final grade is calculated according to formula: **(Ex10+PEx15+WEx25+OEx50)/100**	Exam terms	

Obligatory literature

1. Zečić, Ž., Vusić, D., Presentations (Script).
2. Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.
3. Conway, S., 1986: Logging practices, Principles of timber harvesting systems. Miller Freeman Publications, 1-432.
4. Krpan, A.P.B., Zečić, Ž.., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1-98.
5. Krpan, A.P.B, 1992: Iskorišćivanje šuma (Forest exploitation). Monografija „Šume u Hrvatskoj“, Šumarski fakultet Sveučilišta u Zagrebu i „Hrvatske šume“ p.o. Zagreb, 153 – 170.

Recommended literature

1. Ugrenović, A., Benić, R., 1957: Eksploatacija šuma. Grafički zavod Hrvatske, 1 – 481.
2. Taboršak, D., 1987: Studij rada. Tehnička knjiga Zagreb, 1 – 214.
3. Anon., 1966: Šumarsko-tehnički priručnik. Nakladni zavod Znanje, Zagreb, 1-568.
4. Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219
5. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/ Boston/Lancaster, 1 – 371.
6. Recent publications in domestic and foreign professional and scientific journals (CROJFE, Mehanizacija šumarstva, Šumarski list, Drvna industrija, Glasnik za šumske pokuse, FTI, Holzzentralbllat, FERIC, ...).

Mechanization of Wood Logging

DŠT1002

ECTS 7

English language R1

E-learning R1

Teaching hours 99
Lectures 45
Exercises 30
Field work: 24

Lecturer
Assist. Prof. Zdravko Pandur, PhD.
Prof. Marijan Šušnjar, PhD.

Associate teacher for exercises
Assist. Prof. Zdravko Pandur, PhD.
Prof. Marijan Šušnjar, PhD.
Marin Bačić, MSc.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students learn in details about the development, bases and classification of the most important forest machines for mechanisation of wood logging, principles of their building and their most important energetic, ecological and ergonomic features. After having met the components of forest machines, their driving engines, the lectures include morphological and other analyses of the individual group of machines, like devices for cutting and processing (motor chain saws), equipment of mechanised loading and unloading (forest cranes and forest winches), special forest vehicles (adapted agricultural tractors, skidders, forwarders, forest trucks). Special emphasis is given to the analysis of dynamic burden of a vehicle and the method of transfer of force from a wheel to the soil – Basic mechanics of motor vehicles: resistance of vehicle movement, slipping, pitch resistance, resistance in vehicle acceleration, air resistance, calculation of drawbar pull, basis of the system wheel-soil, forest soil and realisation of drawbar pull. Students also learn about the machines for logging and using forest biomass as an energy source.

Type of course:

Mechanization of Wood Logging (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compare machines for tree felling and processing – motor chainsaws (history development, parts and elements, chainsaw use in Croatia, energy and environmental suitability of 2-stroke engines, chain (construction and maintenance), ergonomic features, guidelines of development, morphological analysis of chainsaw).	Exercises, Final exam	B6
Recommend machines for tree felling and processing – Harvesters (basic technical features, types, morphological, ergonomic, energy and environmental characteristics of harvester).	Exercises, Final exam	B6
Recommend forest vehicles for timber logging – Skidders, Forwarders (construction, types of skidders and forwarders, technical features, principle of Diesel engine, environmental suitability, morphological features).	Exercises, Final exam	B6
Present machines for timber transport – tractor assemblies (adapted farming tractor, adaptation for forest work, farming tractor equipped with forest winch, tractor with semi-trailer and crane).	Exercises, Final exam	B6
Present other machines of mechanised timber logging (forest trucks for timber transport, forest cableways, forest biomass chippers).	Exercises, Final exam	B9

General competencies

Apart from the basic knowledge of measured values, students learn in details about the methods of measuring mechanical sizes of forest machines. After having learned basic components of forest machines, their basic analysis, students learn about the ways of technical (e.g. by morphological analysis), energetic, ecological and ergonomic evaluation of their suitability. A special attention is given to the oil ecologic quality for lubrication of motor chainsaws and oils of hydraulic systems and exhaust of driving engines with internal combustion. The knowledge on energetic and ecological aspects of force transmission from wheel to the soil is a part of this subject's program.

Type of instruction

Lectures

Lectures cover 6 methodical units according to the teaching plan.

Exercises

Exercises are performed in the form of measurement and calculation. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 3 days according to the teaching plan.

Working methods:
Teachers' obligations:
Maintaining original teaching: lectures, exercises and field teaching. Organization of field trips. Consultation, written exams and oral exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

<table>
<tr><th>Evaluation elements</th><th>Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students' workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures (L)</td><td>-</td><td>-</td><td>-</td><td>45</td><td></td><td>1.5</td></tr>
<tr><td>Field work</td><td></td><td></td><td></td><td>24</td><td></td><td>0.75</td></tr>
<tr><td rowspan="4">Exercises (E) and writing of reports from filed work</td><td rowspan="4">20%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="4">30</td><td rowspan="4">36</td><td rowspan="4">2.25</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td rowspan="4">Final exam (FE)</td><td rowspan="4">80%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="4"></td><td rowspan="4">75</td><td rowspan="4">2.5</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td>TOTAL</td><td>100%</td><td colspan="2">(Ex20+FEx80)/100</td><td>99</td><td>111</td><td>7</td></tr>
</table>

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2.5
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercises and field work	The attendance is checked and the attendance of the students is recorded. Filed work and measuring exercises are obligatory. A student may justifiably be absent with a maximum of 20% of other types of direct teaching hours (lecturers and calculation exercises).	semester (99 hours of direct lecturer)	-
Exercises preparation	Exercises are attended by groups. 4 measuring tasks are performed within the exercise. Students become acquainted with measurement methods, independently perform measurements and process data. At the beginning of the first exercise, students will receive templates with exercise assignments, as well as the appearance of the collage, jumper, and list of suggestions in which they will respond to the set tasks in printed form. The accuracy, regularity and regularity (time-honored exercises) are evaluated.	in accordance with the agreed terms	
Written exam	Examinations can be attended by students who have completed exercises and field teaching. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program content. The final grade is calculated according to formula: **(Ex20+FEx80)/100**	Exam terms	

Obligatory literature

1. CD with lectures in „Windows Power Point" presentations with printed vesrion.
2. B. Kraut: Strojarski priručnik. Tehnička knjiga Zagreb, 1988, s. 53-74, 133-222, 255-287, 313-482.
3. S. Sever: Šumarski strojevi. Tehnička enciklopedija, LZ „Miroslav Krleža", svezak 12, Zagreb, 1992, s. 519-531.

4. Šumarska enciklopedija, LZ „Miroslav Krleža“, svezak 1, 2, 3, poglavlja: a) Harvester, s. 50-51., b) Procesor, s. 78-80., c) Skider, s. 208-210., d) Koranje, s. 278-281., e) Traktor, s. 78-80., f) Rasadnik, s. 119-130., g) Žičare, s. 651-659.
5. Božićević J.: Temelji automatike 2, Mjerni pretvornici i mjerenje. Školska knjiga, Zagreb, 1985, s. 1-226
6. Brezinšćak M.: Mjerenje u tehnici i znanosti. Tehnička knjiga, Zagreb, 1971.
7. Selected profesional and scientific papers published in scientific journals which are available for studnets in the libraries of Faculyt of Foresty and Forest Engineering Institute.

Recommended literature

1. Bekker, M., G., 1956: Theory of land locomotion, The University of Michigan Press, 1 – 499.
2. Bekker, M., G., 1960: Off-the-road locomotion, The University of Michigan Press, 1 – 215.
3. Bekker, M., G., 1969: Introduction to Terrain-Vehicle Systems, prijevod Mašinostroenije 1973., 1– 20.
4. C. E. Malmberg: The off-road vechicle. (Volume 1) Atlanta, USA, Montreal, Canada, 1989., s.1-573.
5. C. E. Malmberg: The off-road vechicle. (Volume 2) Atlanta, USA, Montreal, Canada, 1989., s.1-463.
6. Conway, S., 1976: Logging practices., Principles of timber harvesting systems. Miller Freeman Publications, 1 – 432.
7. MacDonald, A.J., 1999: Harvesting Systems and Equipment in British Columbia. FERIC, Handbook No. HB-12, 1 – 197.
8. Owende, P. M. O., Lyons, J., Haarlaa, R., Peltola, A., Spinelli, R., Molano, J., Ward, S. M., 2002: Operations protocol for Eco-efficient Wood Harvesting on Sensitive Sites. Project ECOWOOD, Funded under the EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 – 74.
9. Saarilahti, M., 2002A: Soil interaction model. Project deliverable D2 (Work package No. 1) of the Development of a Protocol for Ecoefficient Wood Harvesting on Sensitive Sites (ECOWOOD). EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 – 87.
10. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/Boston/Lancaster, 1 – 371.
11. Professional and scientific papers from international conferences deal with forest work mechanization according to the choice of lecturer (available in the library of Forest Engineering Institute).

Management and Entrepreneurship in Forestry

DŠT1003

ECTS 6

English language R1

E-learning R1

Teaching hours 76
Lectures 30
Exercises 30
Field work 16

Lecturer
Prof. Ivan Martinić, PhD.
Prof. Mario Šporčić, PhD.

Associate teacher for exercises
Assist. Prof. Matija Landekić, PhD.
Matija Bakarić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction: management - the concept, definition and features of modern management. Basic management functions - planning, decision making, organizing, staff and control. Basics on project: definition, role, significance and characteristics of projects. Types, elements, concept and goals. Main actors in project: people, resources, time. Project development: identification of problem, project idea, input strategy, dedicated and object goals, project results. Actors and stakeholders in the preparation development of projects; stakeholders forum, key stakeholders, project partners. Basic of team work - fundamental characteristics, advantages and disadvantages of team work, differences between traditional and team approach to work. Forms and stages in team development: team formation, team matching, team functioning, team improvement. Planning and decision making in team. Common decision methods. Evaluating associates in team. Leading styles, internal communication and motivation models. Financial and non-financial forms of motivation. Project life cycle - start-up, stabilization, maturity, restart or disappearance. Project management: organizational models, project tactics, time management, human resource management, risk management, project development tracking. Economics of projects: structure of revenues and expenditures, sources of financing, acceptable costs. Performance evaluation and project economics. Overall assessment of project impacts (economic, environmental and social impacts), key financial performance indicators. Controlling, monitoring and reporting in the project. Entrepreneurship - concept and goals of entrepreneurship. Principles of entrepreneurship: discovering and creating favorable opportunities, market orientation of entrepreneurs. Importance of innovation and technology transfer. Characteristics of entrepreneurship in Croatia. Legislative framework of entrepreneurship. Classification

of entrepreneurs according to EU Directive 2013/34. Entrepreneurial climate: legislative, fiscal and social aspect. Entrepreneurial areas and opportunities in forestry: improvement of existing products and services, new products, new services. Assessment of sustainability and feasibility studies. Entrepreneurial strategies according to P. Drucker - features and conditions for implementing a particular strategy. The most common business strategies in forestry: cost reduction, price increases, price reductions, changes in focusing activities, expansion in existing segments, expansion to other (related) sectors / industry, inventiveness and innovation. Business strategies for strengthening the competitiveness of the forestry sector in the Republic of Croatia: Direct competitiveness enhancement tools: ecological efficiency, ISO quality systems and environmental management, occupational safety and health systems OHSAS 18001. Corporate Social Responsibility (CSR). Measures for the forest sector from the Rural Development Program of the Republic of Croatia for the period 2014-2020. Competitiveness enhancing instruments: cohesion policy, EU programs, structural and investment funds; thematic areas and criteria for project submission and allocation of funds.

Type of course:

Management and Entrepreneurship in Forestry (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret a concept, features and basic functions of modern management and explain functioning of the team in project management.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Explain the roles of individual actors and project phases in project management and illustrate project life cycle.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Apply group decision-making techniques to finding ways to achieve project goals.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Carry out team assessors and create models of financial and non-financial motivation.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Carry out an analysis of the entrepreneurial climate and see the favorable entrepreneurial opportunities in the forestry sector	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Select an appropriate entrepreneurial strategy and create a list of indicators for evaluation of a specific entrepreneurial venture.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Describe elements for overall (economic, environmental and social) assessment of the project	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1
Analyse elements of business strategy for strengthening competitiveness of forestry sector and identify the areas of possible submission in entrepreneurial projects in framework of EU operational programs.	seminar, practice exercises, partial exam, knowledge test, final exam	A1, C5, D1

General competencies
Ability to independently perform professional activities related to different areas of activity of business entities in commercial and public forestry sector.
Management of skills for preparation and implementation programs and operational plans of business entities in forestry.

Type of instruction

Lectures

Exercises
Within the auditorial (10) and methodical (4) exercises, 14 units are provided, which include analytical reviews, critical explanations, and individual computational tasks related to operational tasks in certain management functions. Exercises are upgrading of knowledge adopted in lectures and field teaching.

Field work
Within the field work (2 days), students visit companies and events where business strategies and various aspects of entrepreneurial activities related to the forestry sector are problematized.

Working methods:

Teacher's obligations:
Maintaining original teaching – lectures, exercises, field work. Compiling group seminars, partial exams, knowledge tests and evaluating them. Maintenance of partial exams, written and oral exams and consultation. Creating teaching materials.
Student's obligations:
Regular attendance and active participation in lectures, exercises and field work. Taking group seminar, partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1.5
Exercises (E)	30%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	30	1.5
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Field work (FW)	10%	Present, participates passively	Sufficient (2)	24	0	1
		Presents, cares closely and participates	Good (3)			
		Presented, includes questions and comments	Very good (4)			
		Presented, suggests concrete suggestions related to the theme of teaching	Excellent (5)			
Final exam (FE)	60%	60-70%	Sufficient (2)	-	60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex30+FWx10+FEx60)/100**		84	90	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(Ex30+FWx10+FEx60)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked, and the attendance of students is recorded. A student may justifiably be absent with a maximum of 15% direct teaching hours.	semester (60 hours of direct lecturer)	-
Making exercise	14 practical exercises are performed within the exercise. Before starting each individual exercise, students will receive materials related to exercise issues and task templates. Accuracy, neatness and regularity is evaluated (exercise submitted on time).	15. week	
Field work	Within the field course (2 days) is visited an entrepreneurial company oriented to expert services in forestry. Get acquainted with organization, business, and transformation and adaptation of the company to operate on the domestic and EU markets. The second course of field teaching is organized through meeting with successful managers and entrepreneurs in forestry, with the emphasis on developing business careers by acquiring the skills and competencies that are crucial for success in entrepreneurship and managerial work. The level of participation and contribution to the discussion regarding the teaching is evaluated.	Exam terms	
Oral exam	Students who pass a written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **(Ex30+FWx10+FEx60)/100**		

Obligatory literature

1. Buble, M.: Osnove menadžmenta, Sinergija nakladništvo, Zagreb, 2006.
2. Martinić, I.: Zbirka prezentacija „Menadžment i poduzetništvo u šumarstvu“ (za tekuću a.g.), Šumarski fakultet Sveučilišta u Zagrebu
3. Škrtić, M. Vouk, R.: Osnove poduzetništva i menadžmenta, Katma Zagreb, 2006

Recommended literature

1. Martinić, I.: Upravljanje zaštićenim područjima prirode – planiranje, razvoj i održivost, Šumarski fakultet u Zagrebu, Zagreb 2010
2. Srića, V.: Inventivni menedžer u 100 lekcija. Kako postati i ostati pobjednik. Delfin/Znanje, Zagreb, 2003
3. Škrtić, M., Poduzetništvo, Sinergija, Zagreb, 2006

Forestry Politics and Legislation

DŠT1004

ECTS 4

English language R1

E-learning R1

Teaching hours 30
Lectures 30
Exercises 0
Field work 0

Lecturer
Prof. Ivan Martinić, PhD.
Assist. Prof. Matija Landekić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Bases, principles and role of forestry policy in sustainable development and global processes. Review of legal and social framework in forestry policy and forestry sector organization in Europe and Republic of Croatia (transition and global processes - restitution, privatization, market liberalization, certification etc.). Significance of relevant EU forest programs (Forest Principles, the Ministerial Conference on the Protection of European forests) relationship to the Convention on Biological and Landscape Diversity (CBD), Agenda 21, Kyoto Protocol and others. Review the framework of Croatian Forestry Policy in the light of NSAP and NEA with EU directives guidelines related to the forestry sector. The forestry sector's commitment to biodiversity conservation and the establishment and maintenance of the ecological network and Natura 2000 program. Impact of climate change on forests and adjustment measures. The Kyoto Protocol and the Paris agreement. The principles of forest management in the Republic of Croatia and priorities of forestry policy in Republic of Croatia. Financing public functions of forests. Analysis of the National Forestry Policy and Strategy in Republic of Croatia (2003), organizational models of state forest management and private forest ownership. Legislation related to forestry policy: The Forest Act, subordinate regulations with an emphasis on forestry inspection and relation to other laws. Review and analysis of state administrative institutions in forestry - MA CR, forestry administration, education and research in forestry, international cooperation and cooperation. An overview of forestry financial instruments, with a special accent on the role of state incentives subsidies and grants. Motive, purpose and goal of the FLEGT action plan, RED and RED II. Directives, strategy of bio-economics within the domain of forest policy and legislation.

Type of course:

Forestry Politics and Legislation (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse global programs and forest policy documents (Forest Principles, Ministerial Conferences on European Forest Protection, Convention of Biological and Landscape Diversity, UN Framework Convention on Climate Change and the Kyoto Protocol, Europe 2020 Strategy, EU Forestry Strategy, Natura 2000 Ecological Network CR).	Knowledge test, final exam	A1, A2, D3
Present National Forestry Policy and Strategy: importance, strategic areas, goals and priorities, implementation concept - carriers, timelines, financing (National forestry program goals and tasks, Forestry Policies in Republic of Croatia in the light of National environmental protection program (NEAP), Biodiversity (NSAP), Forestry Measures, Forestry Certification).	Knowledge test, final exam	A1, A2, D3
Define organization of forestry administration in Republic of Croatia - Ministry, regional offices, inspection services (key actors in the forest sector, Forest Law in the Republic of Croatia, EU Guidelines and National subordinate regulations).	Partial test, knowledge test, final exam	A1, A2, D3
Analyse forestry policy in Republic of Croatia with view on EU context (Europe 2020 as a Strategic Framework for Equitable EU Development, EU Cohesion Policy, Programming Principle, Rural Development Program of Croatia, Principles and Criteria for project applications and allocation of funds by measures).	Knowledge test, final exam	A1, A2, D3

General competencies

Adopting principles and role of forestry policy in development of the forestry sector, but also in sustainable development and global processes. Acquiring knowledge about legal and social framework of forestry policy in Europe and Croatia for inclusion in relevant programs and processes (Natura 2000, certification, RED directive etc.). Development of engineering skills in relation to forest sector commitments in contributing to sustainable development, in particular through the conservation of biodiversity and development of rural areas.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Compiling knowledge tests and evaluating them. Providing partial test, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures. Taking partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)				30	0	2
Partial exam from Legislation (K)	15%	60-70%	Sufficient (2)	1	30	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (E)	85%	60-70%	Sufficient (2)		50	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Kx15+Ex85)/100**		31	80	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(Kx15+FEx85)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked, and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (30 hours of direct lecturer)	-
Partial exam	Students in the pre-printed exam answer questions answered, round off accurate answers and supplement the words within the sentence. The partial exam is evaluated and participates in the final grade of the subject,	10. week	Students who pass the exam can access the exam
Written exam	Examinations can be attended by students who attended the lectures and passed the partial exam. The students in the pre-printed exam fit the questions asked, completing the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are questioned from different parts of program content by a lecturer. Final grade of subject is obtained according to the formula: **(Kx15+FEx85)/100**		

Obligatory literature

1. Collection of presentations from the subject „Forestry politics and legislation“ (for existing academic year)
2. Sabadi, R.: Šumarska politika. Hrvatske šume p.o. Zagreb, Zagreb 1992.
3. Martinić, I.: Šumarska politika - gospodarenje šumama pred mnogim izazovima, Zbornik savjetovanja Šumarski fakultet Sveučilišta u Zagrebu i šumarski institut Jastrebarsko. Zagreb, 2002.
4. MZOE RH: Izrada radne verzije strategije prilagodbe klimatskim promjenama u Republici Hrvatskoj za razdoblje do 2040. s pogledom na 2070. (Zelena knjiga), Zagreb, 2017
5. ** Zakon o šumama (NN 68/18)
6. ** Šumarska politika i strategija RH (NN 42/03)

Recommended literature

1. Csaki, C., Tuck, L.: Rural Development Strategy, WorlBank, 2000
2. ** UN/FAO: Forest Management and Climate Change, Rim, 2012
3. ** FAO (2003) State of the World Forests 2003.UN FAO, Rim.

Torrent Management

DŠT1005

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Assist. Prof. Hrvoje Nevečerel, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject Torrent managemnet will inform students about the basic terms and definitions of technical foundations and biological methods, i.e. technical-biological rehabilitation measures in a drainage basin. Basic terms from hydraulics, hydrostatics and hydrodynamics are dealt with. Students learn about individual hydrometric measures, data processing and hydrogram construction.
The task of the subject is to teach students about the types of drainage basins, erosions and torrent flows, problematics of torrent control of a drainage basin and erosion areas, with the use of confirmed technical, biological and biologically-technical methods and control systems.

Type of course:

Torrent Management (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Apply to hydro engineering (water management areas and branches and water management systems and solutions, hydrology components, hydrometrics, hydraulics, hydrometeorology and basin characteristics - size, shape, decline, altitude relationships, river basin processes etc.).	Colloquium, Final exam	B13

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse soil erosion (elements of erosion, factors affecting erosion formation and complex deformation of terrain due to erosion).	Colloquium, Final exam	A2
Present the streams (general characteristics of torrential and torrential regulation, buoy flow classification, buoyancy determination, geomorphologic calming downs, equations and projected torrents, principles and systems for river basin regulation planning, and active and passive flood planning).	Colloquium, Final exam	B16

General competencies
The basic objective and task of this subject, through theoretical and practical base, is to inform students about knowledge and skills necessary for completing individual simple tasks in a drainage basin on a forest land, i.e. in a forest.

Type of instruction

Lectures
Lectures cover 3 methodical units according to the teaching plan.

Working methods:
Teachers' obligations:
Providing lectures, consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0.5
Written exam (WE)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Students lay inly written exam. The students in the printed exam answer the questions asked. The written exam is evaluated and represents the final grade of the subject.	Exam terms	-

Obligatory literature

1. Čavlek, E. 1992: Osnove hidrologije, Geodetski fakultet u Zagrebu, s. Zagreb, 1-145.
2. Grupa autora, 1980: Bujice (bujični tokovi), Šumarska enciklopedija, JAZU, Zagreb, s. 205-220.
3. Pičman, D. 2002: Uređivanje bujica i vodogradnje (interna skripta), I dio - Osnove hidrotehnike, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, s. 1-54.
4. Srebrenović, D. 1979: Hidrologija, Tehnička enciklopedija, JAZU, Zagreb, s. 396-416.

Recommended literature

1. Scientific and professional papers on the subject matter of domestic and foreign authors published in journals and conference proceedings.
2. Gjurović, M. 1967: Regulacija rijeka, Tehnička knjiga Zagreb, s. 15-86, 115-136, 177-181, 187-221, 265-331.
3. Vuković, Ž. 1994: Osnove hidrotehnike, prvi dio, Akvamarine, Zagreb, s. 1-252.

Physical and Mechanical Properties of Wood

DŠT1007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Tomislav Sinković, PhD.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Knowledge about commercial wood species. Segments and form of tree. Factors, forms and modification of tree. Chemical structure of wood and its influence on wood properties. The wood structure and its influence on wood properties. Properties of wood sections. Sapwood and heartwood. Process of heartwood forming. Theories. Classification. Earlywood, latewood and percentage of latewood. Closeness of grain. Macroscopic properties of domestic commercial wood species. Color and lustre of wood. Odour of wood. Texture of wood. Density and specific gravity of wood. Distribution of density inside the wood and tree. Wood and water, types of water in wood. The method of determining of moisture content. Fiber saturation point. Maximum moisture content of wood. Shrinkage and swelling. Anisotropy of shrinkage and swelling. Thermal properties of wood. Specific heat. Electrical properties of wood. Distribution of physical properties in tree and between trees of same species. Hooks law, modulus of elasticity, Poisson ratios, plasticity and creep. Static bending, tensile strength, compression strength, impact test, torsion strength, shearing strength, hardness and abrasion resistance. The wood structure and its influence on mechanical properties of wood. The influenced factors on mechanical properties of wood. Distribution of mechanical properties in tree and between trees of same species. Defects of wood. Classification. Natural defects, reaction wood, compression and tension wood, cross grain, variations in log form and shakes.

Type of course:

Physical and Mechanical Properties of Wood (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination and evaluation of macroscopic characteristics of wood in application of conditional characteristics of trees.	Written and oral exam	A2, B1, B2
Determination and evaluation of physical properties of wood in the application of conditional characteristics of trees.	Written and oral exam	A2, B1, B2
Determination and evaluation of mechanical properties of wood in application of conditional characteristics of trees.	Written and oral exam	A2, B1, B2
Determination and valuation of wood defects in application of conditional characteristics of trees.	Written and oral exam	A2, B1, B2
Evaluation and comparative analysis of macroscopic characteristics, physical and mechanical properties of timber derived from certain stands on the usability of wood for the manufacture of wood products.	Written and oral exam	A2, B1, B2

General competencies
The student gains knowledge about commercial wood species. Segments and form of tree. Distribution of macroscopic and physical properties in tree and between trees same species. Distribution of mechanical properties in tree and between trees same species. Defects and abnormalities of wood.

Type of instruction

Lectures
Lectures on theoretical bases prepare the students to acquire basic knowledge about macroscopic characteristics, physical and mechanical properties of wood. Defects of wood conditioned by the growth factors of the tree and their impact on the applicability of wood in future use.

Working methods:
Teachers' obligations:
Maintaining original lessons – lectures. Providing exams and consultation. Creating teaching materials.
Students' obligations:
To attend the lectures. To attend exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0.5

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Exam (E)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (15 hours of direct lectures)	-
Written and oral exam	The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Horvat, I. i sur.: Osnove nauke o drvu, Zagreb, 1985, str. 1-89.
2. Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.

Recommended literature

1. Kollmann, F.R, Cote, W.A.Jr.: Solid wood, New York, 1968, str. 1-592.
2. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Work Humanization in Forestry

DŠT1008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Assist. Prof. Matija Landekić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The term, objective, multidisciplinary character, areas and tasks of work humanization in forestry. Ergonomic aspect of forestry work with emphasis on forest workloads, impact of work environment and adaptation of working technologies and human resources. Design and humanization of forestry operations with examples of good practice (types, carriers, financing, management, mechanisms of motivation, etc.). The organizational and social aspect of work humanization in forestry and examples of health measures and hygiene standards in forestry production. Categorization of personal protective equipment, quality in relation to specific jobs and working conditions, certification procedure and compliance statement. The role of ergonomic design and cognitive ergonomics in the production of working tools and personal protective equipment. Analysis of the principles and models of forest work design in order to humanize it with the most frequent forestry jobs. The level of safety and humanization of forestry work with nonprofessional workers. Examples of good practice of forest owner training. European safety standards and certification processes in forestry. The role of the national center for forest work. Through practical examples, the implementation of legislative, technical, health, organizational and educational measures with the aim of shaping and humanizing work in forestry (international recommendations and domestic regulations). Work impact and experience of mental workload in forestry practice. Prevention measures and workplace design mechanisms.

Type of course:

Work Humanization in Forestry (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze a work humanization in forestry (aim and area of humanization in forestry, workplace design procedures, forest safety guides, examples of good practice, work ability index and psychological loads in forestry practice).	knowledge test, final exam	A1, A2, C3
Present work environment, ergonomic design, PPE certification (working environment conditions for forestry; allowed, warning and harmful values; risk assessment and risk reduction measures; ergonomic design and cognitive ergonomics; basic health and safety requirements of the PPE and certification process).	knowledge test, final exam	A1, A2, C3
Define EU certification processes in the field of forestry work (development of training standards and training content for safe and humane work in forestry with the idea of establishing a center for forestry work in Croatia; humanization and safety of nonprofessional work).	knowledge test, final exam	A1, A2, C3

General competencies

Expert knowledge about the complex process of improving work humanization in forestry. Ability to evaluate ergonomic advantage in forestry work and adopt skills (principles, methods) for designing safer and more efficient work in terms of choice of measures, their holders and funding. Expert knowledge regarding the possibilities for improvement of work through the application of international reach of related systems of work organization, management and payment models, the group and individual motivation at work.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original teaching - Lectures. Compiling knowledge tests and evaluating them. Maintenance of written and oral exams and consultation. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
Exam (E)	100%	60-70%	Sufficient (2)	0	45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance of the students is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Exams can be attended by students who have fulfilled the requirement of attending lectures. Students on the previously designed printed exam answer questions, rounds out the correct answers, supplement the key terms within sentences. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	

Evaluation elements	Description	Deadline	Compensation
Oral exam	Students who pass a written exam are questioned from different parts of the program content by a lecturer. The final grade of the subject is obtained according to the formula **FEx100/100**		

Obligatory literature

1. Collection of presentations from the subject „Work humanization in forestry“ (for existing academic year)
2. Landekić, M., Martinić, I., Bakarić, M., Šporčić, M., 2013: Work Ability Index of Forestry Machine Operators and some Ergonomic Aspects of their Work. Croatian journal of forest engineering. 34 (2); 241-254
3. Landekić, M., Martinić, I., Lovrić, M., Šporčić, M., 2011: Assessment of Stress Level of Forestry Experts with Academic Education. Collegium antropologicum. 35 (2011) , 4; 1185-1192
4. Lipoglavšek, M.: Humanizacija dela v gozdarstvu. Biotehnička fakulteta Ljubljana, s. 1-214., Ljubljana, 1998.

Recommended literature

1. Martinić, I., 1994: Ocjena fizičkog opterećenja radnika na privlačenju drva. Meh. šumar. 19 (3): 151-160
2. Martinić, I., Landekić, M., Šporčić, M., Lovrić, M., 2011: Hrvatsko šumarstvo na pragu EU – koliko smo spremni na području sigurnosti pri šumskom radu?. Croatian journal of forest engineering. 32 (2011) , 1; 431-441
3. Safety and health in forestry work - An ILO Code of practice. ILO, Geneva1998, str. 1-166
4. (razni autori) Zbornik savjetovanja „Životni i radni uvjeti proizvodnih radnika u šumarstvu i njihov utjecaj na zdravstveno stanje i socioekonomski položaj“, Rovinj. Objavljeno u: Radovi 25/1, šumarski institut Jastrebarsko, 1990
5. ILO – Ergonomics in Forestry: The Chilean case (ed. E. Apud, S. Valdes), 1995

Organizational Culture

DŠT1009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Mario Šporčić, PhD.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Organizational culture, also known in the literature as a corporate culture or company culture, is one of the key factors of business and development of economic organizations in all areas, including forestry. Relationship towards innovation and progress, relationship to expectations of the customers i.e. clients or their own workers, the attitude toward the preservation of the human environment and respect for nature, the desire that way of business makes life easier and a more beautiful are all indicators of organizational culture. That what constitutes the way in which company operates, what shows a scale of values in a company or, in other words, a set of factors defining life philosophy and specific style of an enterprise can be considered as the organizational culture of that enterprise.
In interactive work with students, the following content will be elaborated: concept and definition of organizational culture, elements of organizational culture, role and function of organizational culture, developing organizational culture, models and types of organizational culture, maintenance and change of organizational culture, relation between culture and management styles, research models, impact on the organizational efficiency, examples of organizational culture etc.
Students will recognize the importance of organizational culture as a factor that defines the majority of what is being done and how it's being done, expressing the purpose, mission and business strategy of organizations, and by which organizations differ from each other.

Type of course:

Organizational Culture (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Formulate organizational culture in the context of environment and conditions in forestry (elements and functions of organizational culture, organizational climate and culture, classification and typology, design and maintenance of organizational culture, role and importance in forestry, influence of environment and ICT on organizational culture of enterprise, ethical components and contemporary trends in organizational culture, research and features of organizational culture in forestry).	Written exam	C1
Present the measurement and management of organizational culture (methods and models of research, influence of managers on organizational culture, most known theories and models of leadership, subculture and change of organizational culture in the company).	Written exam	B13
Evaluate organizational culture and organization effectiveness (impact of organizational culture on the success and efficiency of business systems, relationship between organizational culture and business strategy, examples of good practice, ie organizational culture of successful domestic and foreign companies).	Written exam	C5

General competencies
Students will become familiar with organizational culture as a factor of success and efficiency of the business system (in forestry). The aim is to master the minimal knowledge and skills of creating an organizational climate and managing the organizational culture in the company.

Type of instruction

Lectures
Lectures include 4 methodological units, according to the teaching plan.

Working methods:
Teachers' obligations:
Giving lectures, consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)				15		0.5
Exam (WE)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is checked and recorded. The student can justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	The students in the prepared printed exam answer the questions asked and solve the problem tasks. The written exam is evaluated and makes the final grade of the subject. The final grade is obtained according to the formula **(FEx100)/100**	Exam terms	

Obligatory literature

1. Žugaj, M., Bojanić-Glavica, B., Brčić, R., Šehanović, J.: Organizacijska kultura. TIVA Tiskara Varaždin, 2004.
2. Sušanj, Z.: Organizacijska klima i kultura. Naklada Slap, Jastrebarsko, 2005.

Recommended literature

1. Žugaj, M., Šehanović, J., Cingula M.: Organizacija. TIVA Tiskara Varaždin, 2004.
2. Peter F. Drucker: Upravljanje u budućem društvu. M.E.P. Consult, Zagreb, 2006.
3. Stephen P. Robbins: Bitni elementi organizacijskog ponašanja. MATE d.o.o., Zagreb, 1996.
4. Šporčić, M., Landekić, M., Lovrić, M., Bogdan, S., Šegotić, K., 2010: Višekriterijsko odlučivanje kao podrška u gospodarenju šumama – modeli i iskustva. Šumarski list 134 (5-6): 275-286.
5. Landekić, M., Šporčić, M., Martinić, I.,Lovrić, M., 2010: Effort-reward imbalance of the forestry experts in Croatia. Proceedings of the 43rd International Symposium FORMEC 2010 „Forest engineering: meeting the needs of the society and the environment“, Padova - Italy, 11.-14. July 2010.

Forest Accessibility

DŠT2001

ECTS credits 6

English R2

E-learning R1

Teaching hours 76
Lectures 30
Exercises 30
Field work 16

Lecturer
Prof. Tibor Pentek, PhD.
Prof. Tomislav Poršinsky, PhD.
Assist. Prof. Ivica Papa, PhD.

Associate teacher for exercises
Assist. Prof. Ivica Papa, PhD.
Assist. Prof. Andreja Đuka, PhD.
David Janeš, MSc.

Grading
Fair (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The aim of this course is to transfer the knowledge to students on the first phase of establishing a forest road network – planning. The emphasis is placed on the importance of planning of primary and secondary forest roads for rational forestry management with a survey of the historical development of forest accessibility in Croatia and the world. Different systems of primary and secondary forest accessibility are defined. The course defines classical accessibility, relative openness and target forest accessibility as well as the average timber extraction distance. Students get acquainted with optimal forest accessibility and different calculation models for its calculation. The course presents a functional approach to forest accessibility with economic, technical-technological, environmental-ecological, sociological and aesthetic and overall optimization. Geographical information system (GIS) is introduced and defined as the basis for making the best forest accessibility decisions. Students are acquainted with the global positioning system (GPS) and its application in the development of forest road registers. Detailed description is given of methodological studies of primary and secondary forest accessibility, determining precisely the phases and methods of work. Information is given on computer models of forest accessibility and computer simulations of individual solutions.

Type of course:

Forest Accessibility (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze strategic and tactical planning of forest roads (types of plans and planning – strategic, tactical and operational planning, strategic and tactical planning of forest roads, study of primary forest accessibility (level of management unit), study of secondary forest accessibility (level of a group of departments), upgrading and optimization of primary and secondary forest road infrastructure).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B12
Present the mean timber extraction distance and forest area accessibility (central and parallel extraction, values of correction factors of specific relief areas, actual and target mean timber extraction distance, advantages and deficiencies of the parameter mean timber extraction distance, primary and secondary forest accessibility, efficiency coefficient, advantages and deficiencies of the parameter forest accessibility, optimal forest accessibility and models of its calculation).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B3
Assess forest road density, as well as primary and secondary forest accessibility of different relief areas (register of primary and secondary forest road infrastructure, criteria for estimating optimal primary forest road infrastructure, economic, technical-technological, environment (ecological-aesthetic) criteria of optimization, primary and secondary forest accessibility for timber harvesting by skidding (lowland forests, hilly and mountainous forests), primary and secondary forest accessibility on sloped terrain for timber forwarding).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B14
Present the classification of the actual network of primary forest roads, criteria for estimating the optimum conditions (methodology study of primary forest accessibility, determination of the actual geometric (Euclidian) distance of timber extraction, criteria for estimating the optimum conditions and classification into priority levels).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B14

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the optimization of the primary forest road network - horizontal and vertical (analysis of selected possible routs of future forest roads and achieving the target primary classical accessibility, optimization of newly planned routes of forest roads in view of vertical development of individual forest road routes, development of the register of upgraded network of primary forest traffic infrastructure, analysis of quantity and quality of upgraded network of primary forest traffic infrastructure).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B14
Present methodological study of secondary forest accessibility (design and establishment of GIS on such area, analysis of the actual work on secondary forest traffic infrastructure, selection of possible routes and analysis of future secondary forest roads, optimization of newly planned network of secondary forest roads, construction of planned routes).	Practical exercises in specialized classroom, midterm exams, knowledge test, final exam	B14

General competencies

The basic objective and aim of this course is to acquaint students with the planning phase of forest roads. Students acquire theoretical and practical knowledge and skills needed to address the issue of providing forest accessibility by primary and secondary forest roads with the aim of optimizing forest traffic infrastructure and eventually reducing construction, maintenance and harvesting costs.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Exercises

Practical exercises in design consist of fifteen computer sessions performed in ArcGIS program with the aim of establishing optimal forest road network on the example of a specific management unit. The exercises build on the knowledge acquired in lectures.

Field work

In field classes, students have the task to collect spatial data with GPS on specific objects in the forest area, which, due to their characteristics, present three basic types of spatial data (point, line and polygon). These data are subsequently processed by suitable computer programs.

Obligations:

Teachers' obligations:

Teaching activities - lectures, practical exercises and field classes. Organization of field classes, office hours, midterm exams and written and oral exams. Preparation of teaching materials.

Students' obligations:
Regularly attend and actively participate in lectures, practical exercises and field classes. Take midterm exams, or written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures	-	-	-	30		1
Completion of exercises and assignments for field classes (E)	20 %	Partly disordered and incomprehensible, with major corrections and within time	Fair (2)	46	30	2
		Neat, readable, with major corrections and in time	Good (3)			
		Neat, legible, with minor corrections and in time	Very good (4)			
		Neat, legible, accurate and within time	Excellent (5)			
Midterm exam I, II (PE)	(80) %	60-70 %	Fair (2)	0	40	1.5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
Exam (WE)	80 %	60-70 %	Fair (2)	0	40	1.5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
TOTAL	**100 %**	**(Ex20+PE2x40)/100**		76	110	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam* (FE)		60-70 % 71-80 % 81-90 % 91-100 %	Fair (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100 %**	**(FEx80+Ex20)/100**				
*** students who do not pass the midterm exams during the semester shall take the final exam that makes up for 80 % of the grade, the remaining 20 % being, the grade for practical exercises**						

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Elements for assessment	Description	Term	Compensation for absence
Lectures+ practical exercised	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	Semester (60 hours of direct teaching)	-
Performance of practical exercises	Students attend practical exercises in groups. A total of 15 design exercises are carried out using a suitable GIS computer program. At the beginning of the first practical exercise, students get the appearance of the file, folder and template sheet. Based on a specific management unit, they establish a forest road network of optimal density. The files with the completed exercises are submitted for review, and assessment is given for accuracy, quality of analyzed forest accessibility and regularity of attendance.	As agreed	Exceptionally, in case of justified reason, students may subsequently perform individual practical exercises
Midterm exam 1	Students answer to pre-printed test questions, they round the exact answer, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	As agreed	Students who have passed midterm exam 1 can take midterm exam 2
Midterm exam 2	Students answer to pre-printed test questions, they round the exact answer, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	As agreed	Students who have passed midterm exam 2, are exempted from the written exam
Written exam	The exam can be taken by students who have attended certain practical exercises. Students answer to pre-printed test questions, they round the exact answer, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	Exam terms	-

Elements for assessment	Description	Term	Compensation for absence
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **(Ex20 FEx80)/100**		

Obligatory literature

1. Pentek, T., 2012: Otvaranje šuma (.pptx and .pdf lectures 1-15), Faculty of Forestry, University of Zagreb.
2. Pentek, T. 2002: Računalni modeli optimizacije mreže šumskih cesta s obzirom na dominantne utjecajne čimbenike, Doctoral thesis, Faculty of Forestry, University of Zagreb, Zagreb, pp 1-271, chosen chapters.
3. Pičman, D., 2007: Šumske prometnice (university textbook), Faculty of Forestry, University of Zagreb, pp 1-460, chosen chapters.
4. Dietz, P., H. Löffler, & W. Knigge, 1984: Walderschließung, Eine Lehbruch für Studium und Praxis unter besonderer Berücksichtigung des Waldwegebaus. Verlag Paul Parey, Hamburg und Berlin, pp 1-196, chosen chapters.

Recommended literature

1. Schlaghamersky, A. 1993: Feinerschliessung, Fachbereich Forstwirtschaft in Göttingen, pp 1-146, chosen chapters.
2. Šikić, D. i dr., 1989: Tehnički uvjeti za gospodarske ceste, Znanstveno vijeće za promet JAZU, Zagreb, pp 1-40, chosen chapters.
3. Trzesniowski, A. 1988: Forstliches bauingenieurwesen, Universität für Bodenkultur, pp 1-216, chosen chapters.

Forest Products

DŠT2002

ECTS 4

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.

Associate teacher for exercises
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.
Assist. Prof. Andreja Đuka, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Types of forest products (renewable and non-renewable). Features of wood forest products, development and use; locations and techniques of processing and the ways of use throughout history and today. Methods of processing at the stump (buck-to-quality) and processing at the landing (full tree, tree-length, half-tree-length, cut-to-length) and chipping method. Forms of forest product harvesting organization. Development of standardization of wood products (standards, CEN, ISO), harmonization with European standardization, measurement and records techniques, procurement chains, storage, sales methods, formation of market prices of products. All other goods from the forest of living and non-living origin (edible and medicinal herbs and fruits, mushrooms, essential oils, tannins, wood charcoal, bark, gravel, sand, stone, grazing and the like), collection and storage of secondary forest products, sustainable potential of forest ecosystems, legal bases and legal constraints. Usable value and degree of usability of secondary forest products, raw material processing and new products, sales methods.

Type of course:

Forest Products (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the division of forest products and standardization of products and development of standardization (standards and norms, classification and reporting of primary forest products according to UNECE / FAO methodology, nomenclature of commercial tree species, classification of trees according to norms, primary and secondary forest products, legal and by-law acts, European (CEN) and International (ISO) product and Procedures standardization).	Exercises, Partial exam, Final Exam	C2
Analyze methods of forest products records (traditional and current methods, methods of measurement according to HRN and HRN-EN normative systems, methods of measurement and expression of results).	Exercises, Partial exam, Final Exam	A1
Classify primary forest products according to the HRN normative system - wood for technical use, wood for chemical use and firewood, and HRN-EN normative system - roundwood and solid biofuels (wood defects, quality grading, minimum dimensions and allowed defects, quality assurance system).	Exercises, Partial exam, Final Exam	B8
Valorize other forest products (fruits and seeds of forest trees, shrubs and ground vegetation, aboveground commercial mushroom species, underground commercial mushroom species, medicinal plants, edible plants, game and wildlife, exploitation of mineral raw materials).	Exercises, Partial exam, Final Exam	B10

General competencies
The aim of this course is to provide an insight on all forest products and key aspects of their harvesting and use.

Type of instruction

Lectures

Exercises

Field work
Field work will be performed stationary at NPŠO Zalesina. Felling, bucking, processing and grading of wood assortments of conifer and broadleaf tree species will be performed. The application of norms for measurement and classification of wood assortments according to the existing program and on the field computer will be presented. Students will also be provided with an insight on using secondary forest products in selective forests.

Working methods:
Teachers' obligations:
Presenting original lessons - lectures, exercises, field work. Compiling knowledge tests and evaluating them. Providing partial exams, written, oral exams and consultations. Creating teaching materials.
Students' obligations:
Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Field work				16		0.5
Exercises (E)	10%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15		0.5
		Neat, with bigger corrections and on time	Good (3)			
		Neat, with minor corrections and on time	Very good (4)			
		Neat, accurate and timely	Excellent (5)			
Partial exam (PE)	15%	60-70%	Sufficient (2)		10	0.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (WE)	25%	60-70%	Sufficient (2)		20	0.75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (OE)	50%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10+PEx15+WEx25+OEx50)/100**		61	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(FEx75+Ex10+PEx15)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures and exercises	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from a maximum of 20% of the lectures and 10% of the exercises.	semester (45 hours of direct teaching)	-
Field work	The attendance is checked and the attendance of the students is recorded.	in accordance with the agreed terms	
Exercises preparation	Exercises are attended in groups. At the beginning of the first exercise, students will get task templates, as well as the outlook of the file, the paperback and the list of suggestions in which they will fill in the results. The accuracy and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student can compensate the absence of the individual exercise
Partial exam	Minimum dimensions and allowed defects for individual wood assortments are exam. The colloquium is evaluated and participates in the final evaluation of the subject.	10^{th} week	-
Written exam	Examinations can be attended by students who have completed exercises. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program content. The final grade is calculated according to formula: **(Ex10+PEx15+WEx25+OEx50)/100**	Exam terms	

Obligatory literature

1. Zečić, Ž., Vusić, D., Presentations (Script).
2. Krpan, A.P.B., Zečić, Ž.., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1-98.
3. Anon., 1997: Hrvatske norme za oblo drvo. DZNM, Zagreb.
4. Anon., 1994: Crvena knjiga biljnih vrsta Republike Hrvatske. Ministarstvo graditeljstva i zaštite okoliša, Zavod za zaštitu prirode, Zagreb, 1-522.

Recommended literature

1. Ugrenović, A., 1957: Eksploatacija šuma, Poljoprivredni nakladni zavod Zagreb, 1-481.
2. Recent publications in domestic and foreign professional and scientific journals (CROJFE, Mehanizacija šumarstva, Šumarski list, Drvna industrija, Glasnik za šumske pokuse, FTI, Holzzentralbllat, FERIC, ...).

Integrated Forest Protection

DŠT2003

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof. Josip Margaletić, PhD.

Associate teacher for exercises
Assist. Prof. Milivoj Franjević, PhD.
Assist. Prof. Marko Vucelja, PhD.
Jelena Kranjec Orlović, PhD.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Forest protection is a comprehensive unit which primarily relies on the forest entomology, forest phytopathology, forest growing, but also on all other disciplines. Its integrity results from it. The task of the subject is to show students the connection and interdependence of certain disciplines in the common solution of protective tasks. For this purpose, the influence and protection of forests from the harmful influence of abiotic factors will be examined (extremely high and low temperatures, wind, water, air and soil pollution). Apart from that, weeds in forests and nurseries, on one side as harmful and on the other as useful plants (in certain conditions) are dealt with. Relying on the knowledge of biology of harmful insects and pathogen fungi, integrated protection methods are indicated, as well as the knowledge and application of plant protection products. Damages caused by wild game and small rodents are particularly dealt with, as well as methods of protection from them. Regarding forest fires, the forest economic factor will be greatly dealt with as preventions of forest fire occurrence and models of evaluation of the danger of forest fire occurrence.

Type of course:

Integrated Forest Protection (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describing the protection measures in ash and oak forests (protection measures against the pathogens, determining the number of populations of defoliants, large game and small rodents, calculating the pest's critical numbers).	Written and oral exam	B2, B5
Presenting the protection measures in common beech, fir and spruce forests (protection measures against different pests, determination of the bark beetles abundance).	Written and oral exam	B2, B5
Valorizing the protection measures in Mediterranean forests (abiotic and biotic factors, organization of terrestrial fire protection).	Written and oral exam	B2
Suggesting the use of different machinery in forest protection (Techniques and Technologies).	Written and oral exam	B6, B16

General competencies
To solve protection problems it is necessary to include all the components which affect certain plants and a forest as a whole. Best solutions are obtained by their integration in time and space. It is also necessary to know all the technical means for carrying out specific protection measures. Good results are obtained by proper connection of all the factors which endanger plants and habitats in order to take safe protection measures.

Type of instruction

Lectures

Exercises

Field work
Getting acquainted with the situation in the field, determining the population density of pests, suggestions for solutions.

Working methods:
Teachers' obligations:
Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures	-	-	-	30	-	1
Exercise	-	-	-	15	-	0.5
Seminar (S)	30%	-	-	-	15	0.5
Exam (E)	70%	60-74%	Sufficient (2)	-	30	1
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Field work		-	-	16	15	1
TOTAL	**100%**	**(Sx30+Ex70)/100**		51	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(Sx30+Ex70)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Attendance of exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer	Attendance of exercises

Evaluation elements	Description	Deadline	Compensation
Writting seminar	Students write and present their seminar work related to relevant forest protection topics	semester	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exame.	Exam terms	
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	

Obligatory literature

1. Group of authors: Upute za kontrolu nekih značajnih šumskih štetnika u dijagnostičko-prognostičke svrhe na području SR Hrvatske. Radovi, 31, 65 str.
2. Group of authors, 1996: Care for Croatian forests from 1846 to 1996 Book 2, Croatian Forestry Society Zagreb, 430 p.
3. Group of Authors, 2001: Science in Sustainable Management of Croatian forests. Faculty of Forestry of the University of Zagreb, Jastrebarsko Forestry Institute, Croatian Forests, p. Zagreb, 636 p.
4. Kišpatić, J., 1991: Forest Phytopathology. University Publishing Zagreb, 356 p.
5. Uščuplić, M., 1996: Pathology of forest and ornamental trees. Faculty of Forestry Sarajevo, 366 p.
6. Vajda, Z., 1973: Forestry Science. Školska knjiga Zagreb, 482 str.
7. Altenkirsh, W., Majunke, C., Ohnesorge, B., 2002: Waldschutz auf ökologischer Grundlage. Eugen Ulmer Verlag, Stuttgart, Deutschland. ISBN 3-8001-3684-8, 434 str.

Recommended literature

1. Scientific articles in journals

Silviculture

DŠT2004

ECTS 5

English language R1

E-learning R1

Teaching hours 124
Lectures 30
Exercises 30
Field work 64

Lecturer
Prof. Igor Anić, PhD.
Assist. Prof. Stjepan Mikac, PhD.

Associate teacher for exercises
Prof. Igor Anić, PhD.
Assist. Prof. Stjepan Mikac, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Students are acquainted with the primary forest and its significance for forest management. The course entails the definition of the primary forest; its range in the world, Europe and Croatia; the development stages and phases of the primary forest; its development cycle; primary forest texture and structure; knowledge about primary forests that is significant for silviculture, with special relation to regeneration and production in primary forests.
The course includes the following: the analyses of the forest stand genesis, the biological, ecological and economic preconditions for natural regeneration, with their impact upon regeneration success; the biology and ecology of generative and vegetative regeneration; features of natural and artificial regeneration.
The course deals with the concept, purpose, technique, and influence of forest care in younger development stadia of the stand until the first thinning. Besides thinning methods, it includes the analyses of how theory and practice of thinning has been developing in this country, and in other European forestry schools. The course also deals with the influence of thinning upon stand structure, habitat, stability, qualitative and quantitative increment, and tending rationalisation analysis.
Silvicultural procedures in management stands of all stand and silvicultural forms are analysed, together with the silvicultural procedures in protection forests and the forests for special purposes; in cases of dieback and stand and habitat deterioration, and the silvicultural procedures for revitalisation of degraded forests, expecially in the Karst region.
The aims and types of silvicultural systems; silvicultural systems in Croatia today and in the past; development of silvicultural systems in Croatia, and silvicultural systems in some European countries. Other silvicultural systems. Choice and conversion of systems.

The concept of permanent forest and sustainable forest management accompanied by the concept of bio-diversity is studied together with the impact of silvicultural procedures upon the bio-diversity of forest stands.
The exercises are aimed at reinforcement, analysis, and practical study of the following teaching unit: natural regeneration in primary forest and close-to-nature management forest; natural regeneration over small areas (irregular shelterwood system); additive methods and substitution methods of regeneration; tending of young growth under shelter and tending of young growth after the final felling; tending by cleaning and rationalisation of cleaning operation; methods of thinning; methods of stand conversion; revitalisation of degraded ecosystems after pedunculate oak dieback (case studies in forests of Kalje, Žutica, Pokupski bazen); silvicultural procedures in stands of beech, sessile oak and chestnut; the influence of fir-beech stand structure on natural regeneration; silvicultural procedures in fir-beech stands damaged by dieback; revitalisation of pubescent oak stands; the influence of silvicultural treatment on diversity of stand; silvicultural planning.
Field work deals with the following three teaching units: I – stands of pedunculate oak and common hornbeam: habitat, structure, tending, regeneration; floodplain stands of pedunculate oak with narrow-leaved ash: habitat, structure, tending, regeneration; stands of black alder: habitat, structure, tending, regeneration; stands of narrow-leaved ash: habitat, structure, tending, regeneration; II – stands of sessile oak with common beech and common hornbeam: habitat, structure, tending, regeneration; stand tending by thinning illustrated by stands of sessile oak, beech, and common hornbeam, and stands of common beech; and natural regeneration upon small areas by shelterwood cuts; III – stands of fire and beech: habitat, structure, tending, regeneration; stands of sycamore maple and European ash: habitat, structure, tending, regeneration; stands of common beech: habitat, structure, tending, regeneration.

Type of course:

Silviculture (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Valorize of virgin forest and close to nature forest management (development cycle, texture and structure, comparison of structure, production, regeneration and selection in the rainforest and the management forest).	Exercises, Final exam	B5
Suggest the silvicultural procedures in forest stands (the principles of rationalization in silviculture, method of classifying trees in the stands, the method of thinning, the thinning intensity, Assmann's theory).	Exercises, Final exam	B2

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present special forest regeneration methods (biological, ecological and silvicultural preconditions of natural regeneration and their impact on the success of natural regeneration, comparison of generative and vegetative and natural, artificial and combined regeneration, regeneration theory on small surfaces, theory of combined regeneration methods - additive and substitution combinations).	Exercises, Final exam	B2
Valorize special methods of forest management and silviculture forestry in the conditions of habitat change (two-layered high forest, high forest with reserves, pioneering and transitional forest management).	Exercises, Final exam	B2
Present conversions (replacement, conversion of coppice forest to high forest, conversion of coppice with standard forest to high forest).	Exercises, Final exam	B2
Compare silvicultural techniques by forest stands and sustainability (silvicultural planning, forest biodiversity, concept of permanent forest).	Exercises, Final exam	B2

General competencies
This course is established in the science and practice of close-to-nature silviculture, which has been here developed under the name of „Zagreb school of silviculture“. It is conceived as the forest silviculture that directs the stand development by the principles of primary forest development, but based on the criteria emerging from management targets. The course trains students for independent silvicultural stand analysis, silvicultural procedures in all types of forest stands, and independent solution of silvicultural problems with making decisions on the implementation of the silvicultural procedures in all types of forest management.

Type of instruction

Lectures
Lectures cover 14 units according to the teaching plan.

Exercises
14 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 3 days. Three themes are discussed.

Working methods:
Teachers' obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	60-70%	Sufficient (2)	94	0	3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (WE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20+WEx80)/100**		124	30	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (124 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Anić, I., 2009: Uzgajanje šuma. Skripta za internu uporabu, Sveučilište u Zagrebu, Šumarski fakultet, 100 str.
2. On the web site http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=99, under the subject of Silviculture, there are links to Exercises, author I. Anić.
3. Matić, S., I. Anić, M. Oršanić, 2003: Uzgojni postupci u bukovim šumama. U: S. Matić (ur.), Obična bukva (*Fagus sylvatica* L.) u Hrvatskoj, Akademija šumarskih znanosti, 340 – 369, Zagreb.
4. Matić, S., M. Oršanić, I. Anić, 2003: Uzgojni postupci u niskim i degradiranim bukovim sastojinama. U: S. Matić (ur.), Obična bukva (*Fagus sylvatica* L.) u Hrvatskoj, Akademija šumarskih znanosti, 393 - 405, Zagreb.
5. Matić, S., I. Anić, M. Oršanić, 2001: Uzgojni postupci u prebornim šumama. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 407–460, Zagreb.
6. Matić, S., B. Prpić, I. Anić, M. Oršanić, 2001: Uzgojni postupci u jelovim šumama oštećenima propadanjem. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, 461–478, Zagreb.
7. Matić, S., 1996: Uzgojni radovi na obnovi i njezi sastojina hrasta lužnjaka. U: D. Klepac (ur.), Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj, HAZU i Hrvatske šume p.o. Zagreb, 167 – 212, Zagreb.

Recommended literature

1. Burschel, P., J. Huss, 1997: Grundriss des Waldbaus. Parey Buchverlag, 487 str., Berlin.
2. Korpel, Š., J. Penaz, M. Saniga, V. Tesar, 1991: Pestovanie lesa. Priroda, 465 str., Bratislava.
3. Matić, S., 1994: Šume visokih gora i planina dinarskog područja. U: Đ. Rauš (ur.), *Silvae nostrae Croatiae*, Ministarstvo poljoprivrede i šumarstva Republike Hrvatske, 145 – 153, Zagreb.
4. Matić, S., 1991: Njega šuma proredom. Šumarski fakultet, 45 str., Zagreb.
5. Matić, S., J. Skenderović, 1992: Uzgajanje šuma. U: Đ. Rauš (ur.), Šume u Hrvatskoj, Šumarski fakutet Zagreb & Hrvatske šume p. o. Zagreb, 81 – 97.
6. Matić, S., M. Harapin, 1986: Uzgajanje i zaštita šuma. Savez inženjera i tehničara šumarstva i drvne industrije, 177 – 194, Zagreb.
7. Matthews, J. D., 1991: Silvicultural systems. Clarendon press, 284 str., Oxford.

Forest Products Trade

DŠT2005

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The aim of this course is to provide an insight on the world trends in production and trade in forest and wood products, the theory of price formation and market principles, supply and demand forecasts, forestry trading techniques and the methods of forest products price formation in Croatia.

Type of course:
Forest Products Trade (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze the prices of forest products over the past few years according to the price list, domestic and international auctions and plan the sale price of all forest products according to market forecasts.	Final exam	A1, C5
Organize the sale of certain quantities of forest products according to the place of sale; standing volume, felled (and processed) volume, at the landing.	Final exam	C2

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Plan and manage the delivery of wood assortments according to the deadlines of contracted customer agreement.	Final exam	B1

General competencies
The aim of this course is to provide an insight on the forms and places of sale of forest products.

Type of instruction

Lectures

Working methods:
Teachers' obligations:
Conduction of teaching program – oral presentations. Conduction oral exams and consultations. Creation of teaching materials.
Students' obligations:
Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS points
Lectures	-	-	-	15	0	0.5
Exam (OE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**(OEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Checking the attendance of students on lectures.	semester (15 hours of direct lecturer)	-
Oral exame	Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%	Exam terms	

Obligatory literature

1. Sabadi, R., 1998: Osnove trgovačke tehnike, trgovačke politike i marketinga u šumarstvu i drvnoj industriji, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1-254.
2. Sabadi, R., 1992: Ekonomika šumarstva. Školska knjiga Zagreb, 1-280.

Recommended literature

1. Ugrenović, A., 1934: Tehnika trgovine drvetom-dio prvi. Tisak nadbiskupske tiskare Zagreb, 1 – 275.
2. Ugrenović, A., 1935: Tehnika trgovine drvetom-dio drugi. Tisak nadbiskupske tiskare Zagreb, 291–593.
3. Anon., 1946: Šumarski priručnik II. Poljoprivredni nakladni zavod Zagreb, 769-1582.
4. Recent publications in domestic and foreign professional and scientific journals (CROJFE, Mehanizacija šumarstva, Šumarski list, Drvna industrija, Glasnik za šumske pokuse, FTI, Holzzentralbllat, FERIC, ...).

Ergonomics of Forest Machines

DŠT2006

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Marijan Šušnjar, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The task of this subject is to inform students about the basic terms and meaning of ergonomics, development and perspective of this scientific discipline, load of workers in forestry, forms of load, definitions of basic terms. Lectures include the introduction with the significant elements of technical ergonomics, noise and vibrations at the workplace, forces of moving operating handles, performance and demands for forest vehicle cabins. Students also learn about the methods of measuring noise and vibrations and the legislations in the area of protecting workers from noise and vibrations, particularly with ISO standards.

Type of course:
Ergonomics of Forest Machines (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the ergonomic and safety features of forest machines (meaning and the ergonomics development, the workload of forest workers, the impact of ergonomic principles on the construction of forest machines, requirements of ISO standards in machine construction, ergonomic and safety requirements for construction of cabins and winches for forest vehicles, internationally recognized tests).	Written exam	C3
Estimate the noise level during the work of forest machines (sound, sound characteristics, frequency, intensity and sound power, sound pressure, area of hearing, ear sensitivity, permissible and total noise level, noise measurement, frequency analysis and protective equipment).	Written exam	B6
Analyze vibration level during the work of forest machines (sources and sensitivity the organism, vibration and resonance of individual body parts, ways of measurement and frequency analysis of vibrations, permitted exposure, consequences, protection measures and the possibility to reduce vibration levels).	Written exam	B6

General competencies
Students are informed about the most contemporary measuring equipment, and the technical legislation in the area of protecting workers from the noise and vibrations, particularly with ISO-standards in measuring noise and vibrations.

Type of instruction
Lectures
Lectures cover 4 methodical units according to the teaching plan.

Working methods:
Teachers' obligations:
Maintaining lectures, consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0.5
Written exam (WE)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Students lay inly written exam. The students in the printed exam answer the questions asked. The written exam is evaluated and represents the final grade of the subject.	Exam terms	-

Obligatory literature

1. CD s predavanjima u „Windows Power Point" prezentaciji te ispis istih.
2. Međunarodne (ISO, IEC...) i nacionalne (HN) norme i napuci u svezi s ergonomijom.

3. Goglia, V., i Horvat, D., 2002: Izvješće o ispitivanju nekih tehničkih i ergonomskih značajki šumskog prorednog skidera, studija Šumarskog fakulteta, str 1-64.
4. Horvat, D., Šušnjar, M., 2003: Temeljni sigurnosni i tehnički zahtjevi ISO normi za konstrukciju skidera, studija, str 1-98.
5. Izabrani stručni i znanstveni članci objavljeni u znanstvenim časopisima koji su na raspolaganju studentima u knjižnicama Šumarskoga fakulteta i Zavoda za šumarske tehnike i tehologije.

Recommended literature

1. Lipoglavšek M.: Ergonomija v gozdarstvu. Tehnička založba Slovenije, Ljubljana, 1991, str. 1-168.
2. Stručni i znanstveni članci s međunarodnih savjetovanja s ergonomskom problematikom radova u šumarstvu prema izboru nastavnika (raspoloživi u knjižnici Zavoda za šumarske tehnike i tehnolgije).

Mechanical Technologies of Wood Processing

DŠT2007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Tomislav Sinković, PhD.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Knowledge about mechanical technologies of wood processing. Wood as final product of forestry and properties of wood important for mechanical technologies of wood processing. The influence of physical and mechanical properties of wood on sawmilling. Technologies of sawmilling. Products of sawmilling. Veneer. Technologies of veneers productions. The influence of physical and mechanical properties of wood on veneers productions. Plywood. Physical and mechanical properties of plywood. Composite boards. Physical and mechanical properties composite boards. Hydrothermic wood processing. The influence of physical and mechanical properties of wood on hydrothermic wood processing.

Type of course:

Mechanical Technologies of Wood Processing (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Defining basic procedures of mechanical processing of wood.	Partial exams, final exam	A2, B1, B2
Determination and valuation of timber or logs for mechanical processing of wood.	Partial exams, final exam	A2, B1, B2

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination and evaluation of wood quality from the field of mechanical processing of wood.	Partial exams, final exam	A2, B1, B2
Determination and valuation of wood defects in mechanical processing of wood.	Partial exams, final exam	A2, B1, B2
Valuation and comparative analysis of the properties and aspects of trees for mechanical processing of wood.	Partial exams, final exam	A2, B1, B2

General competencies

The student gains knowledge about wood as final product of forestry and properties of wood important for mechanical technologies of wood processing. Sawmilling, veneers, plywood, composite boards and hydrothermic wood processing. The influence of physical and mechanical properties of wood on mechanical technologies of wood processing.

Type of instruction

Lectures

Lectures on theoretical bases prepare the students to acquire basic knowledge about basic methods of mechanical processing of wood. Influence of tree factor on mechanical processing of wood as well as the applicability of wood. Possible silvicultural works that would contribute to the better usability of wood from trees.

Working methods:

Teachers' obligations:

Maintaining original lessons – lectures. Providing exams and consultation. Creating teaching materials.

Students' obligations:

To attend the lectures. To attend exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0.5
Exam (E)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (15 hours of direct lectures)	-
Written and oral exam	The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Horvat, I. i sur.: Osnove nauke o drvu, Zagreb, 1985, str. 1-89.
2. Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.

Recommended literature

1. Kollmann, F.R, Cote, W.A.Jr.: Solid wood, New York, 1968, str. 1-592.
2. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Forest Fires

DŠT2008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Assist. Prof. Milivoj Franjević, PhD.

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Students are introduced to the problems of forest fires in Croatia and the world experience connected with forest fires, particularly Mediterranean countries of the European Union. The lectures include numerous factors significant for the mentioned problems like: legal regulations, methods of evaluation of dangers from the occurrence of forest fires in Croatia, EU and in the world, forest fire types, the importance of vegetation, habitat conditions, soil, relief, geological basis and climate for forest fire occurrence, forest arrangement and combustible material, the preventive role of a forester and his/her tasks during the fire, damages caused by fires as a whole, the sanitation of areas affected by fires and regeneration.

Type of course:

Forest Fires (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Enumerate forest fires by the type and destruction of mechanisms that govern and interpret them to identify parts of the fires, using professional terminology.	seminar work, final exam	B4, B8, C6
Categorize a concrete forest fire according to the learned typology.	seminar work, final exam	B4, B8, C6

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze statistical numerical and graphical data on fire records at year level.	seminar work, final exam	B4, B8, C6
Interpret fire season based on insights into all parameters affecting the frequency and intensity of forest fires.	seminar work, final exa	B4, B8, C6
Evaluate the map of risk and critically challenge or confirm the n account of their own insights into the available data.	seminar work, final exam	B4, B8, C6
Actively monitor and apply new legal and organizational solutions and accordingly adapt the existing forest fire, forestry, enterprise, forest owner's fire prevention system.	seminar work, final exam	B4, B8, C6

General competencies

To categorize a concrete forest fire according to the typology typed. Identify the most important vegetation types and categorize them according to their risk of forest fires. Combine vegetation factors (climate, soil, relief) together with vegetation in a complex mapping process of different risk stacks. Participate and independently create a map of threatened stands. Evaluate the risk maps created and critically challenge or confirm their own insight into the available data. Measure the newly flared surface and make a calculation of direct costs on vegetation. Apply legal regulations in all segments of fire prevention (preventive, repressive). Actively monitor and apply new legal and organizational solutions and accordingly adapt the existing forest fire, forestry, enterprise, forest management system.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)				15	0	1

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Seminar (S)	50%	60-70%	Sufficient (2)	0	20	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (E)	50%	60-70%	Sufficient (2)	0	25	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx50+Ex50)/100**		15	15	45

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			0.5
TOTAL	**100%**	**(Sx50+FEx50)/100**				
*** * final exam without a delivered and defended seminar is not possible**						

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Seminar (S)	In the form of a seminar presentation / presentation, the student demonstrates learned knowledge of the issues of prevention and implementation of forest fires prevention (according to the program). Elaborates the problem in a structured way based on the given example scenario.	Second third of the semester	No compensation
Exam	Students who exhibit and evaluate their seminar and fulfill their student obligations (attendance) get the right to go to final exam Final grade is the result of a combination of a seminar evaluation and an oral final exam. The final written exam cannot be equally accessible to a student who did not made the seminar.	In given exam periods	

Obligatory literature

1. Grupa autora, 2003: Zaštita šuma od požara. iproz CIP Zagreb
2. Grupa autora, 1987: Osnove zaštite šuma od požara. Zagreb

Recommended literature

1. Mattia, F., Galellini, B., Malasapina, A., Pontani, D., 2002: Italy Forest Fires in 2001. State Forestry Corps.

Forest Fire-prevention Infrastructure

DŠT2009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Assist. Prof. Hrvoje Nevečerel, PhD.
Assist. Prof. Kruno Lepoglavec, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject Forest fire-prevention infrastructure teaches students about the measures of protection against forest fires in the forests of the Mediterranean area of Croatia with a special emphasis on preventive, technical measures. The basic components of forest fire-prevention infrastructure are dealt with: forest fire-prevention roads, forest fire-prevention aisles, well areas, handy storages, observation posts, communication systems, etc.
The special emphasis is placed on planning, designing and building of forest fire-prevention roads as a special category of forest roads; this category of forest roads is defined, its basic functions and particularities. Students are taught the procedure of planning forest fire-prevention roads, the technique and technology of their building.
GIS technologies, network analyses and simulations of forest fire-prevention infrastructure efficiency are dealt with.

Type of course:

Forest Fire-prevention Infrastructure (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify factors affecting forest fire and protection issues (forest fire protection measures with emphasis on preventive, technical measures).	Colloquium, Final exam	B8
Present forest fire-fighting - planning, construction and maintenance (basic forest fire fighting infrastructure components: forest fire-fighting roads, floodplains, water reservoirs, manual reservoirs, observation systems, connection systems, and their planning, construction and maintenance).	Colloquium, Final exam	B15
Present the machines for the construction and maintenance of forest fire-fighting roads and fire-fighting vehicles (machinery, techniques and technologies for the construction and maintenance of forest fire-fighting roads and fire-fighting vehicles).	Colloquium, Final exam	B10

General competencies
The task and the objective of this subject is to inform students about all the components in establishing the optimum network of the forest fire-prevention infrastructure on the terrain with a special emphasis on forest fire-prevention roads. Acquired knowledge will enable students to analyse the existing and plan the future forest fire-prevention infrastructure network with the final objective of carrying out the efficient preventive and repressive fight against forest fires in forests of the Mediterranean area.

Type of instruction

Lectures
Lectures cover 3 methodical units according to the teaching plan.

Working methods:
Teachers' obligations:
Providing lectures, consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0.5
Exam (WE)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Students only have a written exam. The students in the printed exam answer the questions asked. The written exam is evaluated and makes the final grade of the subject. The final grade of the subject is obtained according to the formula	Exam terms	-

Obligatory literature

1. Pentek, T. (1998): Forest fire prevention roads as a special category of forest roads and factors that influence their distribution in space, Glasnik za šumske pokuse vol. 35, Zagreb, Hrvatska, s. 93-141.

2. Pentek, T., Pičman, D. 2003: Uloga šumskih prometnica pri gospodarenju šumama na kršu s posebnim osvrtom na Senjsku Dragu, Šumarski list vol. 127 (suplement), Zagreb, Hrvatska, s. 65-78.

Recommended literature

1. Dimitrov, T. 1990: Šumski požari i sistemi procjene opasnosti od požara, Osnove zaštite šuma od požara, CIP, Zagreb, s. 181-256.
2. Bilandžija, J. 1988: Organizacija preventivnih mjera zaštite šuma od šumskog požara, Zbornik radova „Drugo savjetovanje o naučno-istraživačkom radu Šumarskog instituta Jastrebarsko“, Jastrebarsko, XXIII (75) s. 205-213.
3. Scientific and professional papers on the subject matter of domestic and foreign authors published in journals and conference proceedings such as:
4. Pičman, D., Pentek, T. 1998: Raščlamba troškova izgradnje šumskih protupožarnih cesta i mogućnosti njihova smanjenja, Mehanizacija šumarstva 23 (3-4), Zagreb, Hrvatska, s. 129-137.
5. Pičman, D., Pentek, T. 1998: Relativna otvorenost šumskoga područja i njena primjena pri izgradnji šumskih protupožarnih prometnica, Šumarski list vol. 122 (1-2), Zagreb, Hrvatska, s. 19-30.

Forest Road Design

DŠT3001

ECTS credits 6

English R1

E-learning R1

Teaching hours 92
Lectures 30
Exercises 30
Field work 32

Lecturer
Prof. Tibor Pentek, PhD.

Associate teacher for exercises
Prof. Tibor Pentek, PhD.
Assist. Prof. Ivica Papa, PhD.
David Janeš; MSc.

Grading system
Fair (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The course Forest Road Design focuses on the second phase of the establishment of an optimal network of forest roads in the field – the design. The design phase is divided in two components: field work and office work. The course covers the complex design procedure, defines the basic types of projects with an emphasis on and the elaboration of a detailed final forest road design. Students gain knowledge of the technical requirements and the required technical characteristics of forest roads in Croatia and the world. The course elaborates on the criteria for the categorization of primary forest roads. Students gain knowledge of the different phases of field work, measurement methods and procedures, and the collection of necessary data by using the classical method, the tachymeter, or GPS. The course explains the data processing in the classical method and on a personal computer. The course elaborates in detail on the rules and professional postulations to be observed in the horizontal and vertical development of the forest road route. It analyzes the positioning plan, the graphical longitudinal section and the graphical cross sections. The course explains methods for staking out horizontal curves, carriageway widening in horizontal curves and transition curves. The course also discusses normal profiles and drainage facilities.
Students get acquainted with the topics of incurved and curved grade level, vertical curves and fitting the grade level. They also learn how to calculate the earth volume, make an earth volume diagram, they learn about equalizing and transport of materials. The course also deals with the technique and technology of construction and maintenance of forest roads and with the different methods for improving soil quality during the construction of forest roads. The course looks into the basic bridge types, forest fire protection roads and cable yarding.

Type of course:

Forest roads design (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain forest road design and the basic elements of the transport of timber (determine the towing capacity for motor vehicles, resistance to the motion of vehicles, trucks, truck units, primary and secondary legislation, ordinances, guidelines, regulations, etc., direct/indirect pole setting for forest roads, design procedure for forest roads, documentation for forest road design).	Practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B1
Analyze the detailed positioning plan of the forest road and use computer programs for the design of forest roads (zero line, operational and axial polygon of the forest road, design software, develop the final design for a forest road).	Practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B5
Describe the staking out of main points and the methods for staking out detailed points of horizontal curves, transition curves and serpentines, detailed construction marking of the forest road cross-sections for the beginning of construction in the field.	Field classes, practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B5
Explain the longitudinal section, the cross section and the lower layer of a forest road (written and graphical longitudinal cross section, design the incurved grade level, curved grade level, select the vertical curve radius, normal/type/orientation cross-sections, advantages and disadvantages, possible problems and restrictions in the application of type-cross sections in specific cases).	Practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B4
Recommend the structures for the safety/protection of the lower structure of a forest road and drainage facilities (retaining walls, types and forms of retaining walls, stability check and dimensioning of the retaining walls, combination retaining and revetment walls, the effects of water on forest roads, surface and underground drainage facilities for forest roads).	Practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B1

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Evaluate the pavement construction and the causes of damage on forest roads (dimensioning of pavement constructions, stone pavements, causes of damage on forest roads, develop the final design of a forest road, positioning of road structures, final adjustments to the detailed positioning/situation plan).	Practical exercises in the computer classroom, midterm exams, knowledge test, final exam	B4

General competencies
The main objective and purpose of this course is to use the theoretical and practical base to get students acquainted with the forest road design procedure and with methods and techniques for the collection, processing and critical interpretation of results. It is also necessary to help students develop competencies for the independent and comprehensive preparation of the forest road design documentation by using different work methods.

Type of instruction

Lectures
Lectures cover 15 units according to the teaching plan.

Exercises
Practical exercises in design consist of fifteen sessions in planning and design of forest roads. The exercises build on the knowledge acquired in lectures.

Field work
In field classes students apply the knowledge acquired in lectures and practical exercises using a specific example of forest road design. When fitting the zero-line polygon in the terrain, students use GPS devices to determine cardinal points and to calculate the slope of individual segments of the zero-line polygon in order to successfully connect the first and the final profile of the designed forest road route. Furthermore, by using contemporary terrain measurement methods, students collect all necessary terrain data needed to develop the main/final forest road design.

Working methods:
Teachers' obligations:
Teaching activities - lectures, practical exercises and field classes. Organization of field classes, office hours, midterm exams and written and oral exams. Preparation of teaching materials.

Students' obligations:
Regularly attend and actively participate in lectures, practical exercises and field classes. Take midterm exams, or written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Completion of exercises and assignments for field classes (E)	20%	Partly disordered and incomprehensible, with major corrections and within time	Fair (2)	62	10	2
		Neat, legible, with major corrections and within time	Good (3)			
		Neat, legible, with minor corrections and within time	Very good (4)			
		Neat, legible, accurate and within time	Excellent (5)			
Midterm exams (I and II)	(80)%	60-70 %	Fair (2)	0	45	1.5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
Exam (WE)	80 %	60-70 %	Fair (2)	0	43	1.5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
TOTAL	**100%**	**(Ex20+PE2x40)/100**		92	98	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam* (FE)		60-70% 71-80% 81-90% 91-100%	Fair (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx80+Ex20)/100**				
*** students who do not pass the midterm exams during the semester shall take the final exam that makes up for 80 % of the grade, the remaining 20 % being the grade for practical exercises**						

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Elements for assessment	Description	Term	Compensation for absence
Lectures + practical exercises	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	Semester (60 hours of direct teaching)	-
Completion of practical exercises	Students attend practical exercises in groups. A total of 15 design exercises are carried out using a suitable computer program. At the beginning of the first practical exercise, students get templates with data on one forest road, and the appearance of the file where all documents of the designed forest road will be stored after certain exercises. Assessment is given for accuracy, commitment and attendance in exercises.	As agreed	Exceptionally, in case of justified reason students may subsequently perform individual practical exercises
Midterm exam I	All students can take the first midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	7^{th} week	
Midterm exam II	Only students who passed the first midterm exam can take the second midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	15^{th} week	
Written exam	The exam can be taken by students who attended practical exercises. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	Exam term	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **(Ex20+FEx80)/100**		

Obligatory literature

1. Pentek, T., 2014: Projektiranje šumskih prometnica (.pptx and .pdf lectures 1-15), Faculty of Forestry, University of Zagreb.
2. Pičman, D., 2007: Šumske prometnice (University textbook), Faculty of Forestry, University of Zagreb, pp 1-460, selected chapters.
3. Šikić, D. i dr., 1989: Tehnički uvjeti za gospodarske ceste, Znanstveni savjet za promet JAZU, Zagreb, pp 1-40, selected chapters.

Recommended literature

1. Anon., 2002: Forest Road Engineering Guidebook, B.C. Ministry of Forests, pp 1-208, selected chapters.
2. Anon., 2011: Colorado Forest Road Field Handbook, Colorado State Forest Service, pp 1-142, selected chapters.
3. Babić, B., 1997: Projektiranje kolničkih konstrukcija, HDGI Zagreb, pp 1-197, selected chapters.
4. Dragčević V., Korlaet Ž., 2003: Osnove projektiranja cesta, udžbenik, Građevinski fakultet Sveučilišta u Zagrebu, pp 1-93, selected chapters.
5. Dragčević, V., Rukavina, T., 2006: Donji ustroj prometnica, Građevinski fakultet Sveučilišta u Zagrebu, pp 1-187, selected chapters.
6. Korlaet Ž., 1995: Uvod u projektiranje i građenje cesta, udžbenik, Građevinski fakultet Sveučilišta u Zagrebu, pp 1-208, selected chapters.
7. Lacrombe, G., 1999: Forest Roading Manual, Liro Forestry Solutions, New Zeland, pp 1-404, selected chapters.
8. Ryan, T. et al., 2004: Forest Road Manual, Guidelines for the design, construction and management of forest roads, COFORD, Dublin, pp 1-156, selected chapters.

Economics of Forest Company

DŠT3002

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 15
Field work 8

Lecturer
Assoc. Prof. Stjepan Posavec, PhD.

Associate teacher for exercises
Karlo Beljan, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The name, definition, term of forest company economics. Creation, development of microeconomics and macroeconomics. Basic theories of forest management. Production theory, production function. Total, average and marginal costs. Diminishing returns. Structure of fixed and current assets in forestry. Measurement of business performance in forest companies. Accounting and financial balance sheet. Profit and loss account. Business indicators. Calculation, term and classification. Types and calculation methods (previous, on accruals basis, final calculation). Price structure in creation of specific calculations for characteristic productions and products in forestry. Calculation of costs. Costs calculation on the basis from their possibilities for division on the cost drivers. Specifics on costs calculation in forestry. Costs in production systems. Term and division of costs. Types of costs and their dynamics. Break even calculation. Basic terms of break even analyse. Break even diagrams for a part of the production systems in forestry. Control of direct costs in forestry. Control of fixed costs in forestry. Selling price controlling. Methodology of grading effectiveness of production and technology processes in forestry. Criteria for optimal economic choice of technology process. The choice of economically optimal option of technology process in forestry.

Type of course:

Economics of Forest Company (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyse capital and investments in forestry (meaning of the capital in forestry, fixed property and working capital in forestry, categories and importance of investments in forestry).	Exercise, final exam	C1
To present costs, calculation and cost management in forestry (costs in production processes, types and methods of calculation, price structure in creation of specific calculation for characteristic productions and forest products).	Exercise, final exam	C3
To compare economic analyse of business performance in forest company and business indicators (balance sheet, profit and loss account, cash flow, debt ratio, liquidity, activity, profitability, investment and market value).	Exercise, final exam	C3
To estimate specifics of planning processes and business plan (economic statements, influence of forest management planning on business results, functioning of investments and business plans in forest management, goals, contents and shape of the business plan).	Exercise, final exam	B1,C3
To compare economic policy instruments and processes of strategic planning (monetary system, fiscal system, overseas relations and income policy, environment analyses, added value chain analyse, controlling instruments).	Exercise, final exam	B1, C4

General competencies
Problems of economic analysis of forestry business operations, cost calculation. System and process of sustainability of forest resource management. Ideas, concepts and methods used by modern forestry economists.

Type of instruction

Lectures

Exercises

Working methods:
Teachers' obligations:
Conduction of teaching program – oral presentations, exercises and field trip case study. Creation of exams and their ranking. Conduction of written and oral exams and consultations. Creation of teaching materials.
Students' obligations:
Ordinary participation and active participation in classes, exercises and field trip. Individual preparation and exercise submitting. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	10%	Minimal number of attendance in the class	Sufficient (2)	30	0	1
			Good (3)			
			Very good (4)			
		Attendance and active participation in the teaching during semester	Excellent (5)			
Exercises (E)	30%		Sufficient (2)	15	30	1.5
			Good (3)			
			Very good (4)			
		Regular submission of exercise tasks without corrections	Excellent (5)			
Field work (FW)	10%	60-70%	Sufficient (2)	8	0	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Exam (FE)	50%	60-70%	Sufficient (2)		60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx10+Ex30+FWx10+FEx50)/100**		53	90	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(Lx10+ECx30+FWx10+FEx50)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Checking the attendance of students on lectures. Student can miss the lectures justifies more than 15% of exercises.	semester (45 hours of direct lecturer)	-
Partial exam	Exercises are individual. Students are receiving exercise templates in the beginning of the course, and shape of the folder and files, which will be used for the individual tasks. Accuracy, precision and regularity of assignment are evaluating.	15. week	
Written exam	Students could attend exam with successfully and correct finished exercises. Students on printed written exam work on three calculation exams. One positive exam has 10 points. Half of the correct exam gain 5 points. Grades for written exam are: 15-sufficient (2) 20- good (3) 25-very good (4) 30-excellent (5)	Exam terms	
Oral exam	Students with positive written exam are questioned from different part of the course content. Final grade consists achieved percentage together from written and oral exam: Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%		

Obligatory literature

1. Figurić, M.: Uvod u ekonomiku šumskih resursa, Šumarski fakultet, Zagreb, 1998.
2. Figurić, M.: Menadžment troškova u drvno tehnološkim procesima, izabrana područja, Šumarski fakultet, Zagreb, 2003.

Recommended literature

1. Samuelson, P., Nordhaus, W.: EKONOMIKA, Mate, Zagreb, 1992, str. 1-800.

Marketing in Forestry

DŠT3003

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Assoc. Prof. Stjepan Posavec, PhD.

Associate teacher for exercises
Karlo Beljan, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Importance and role of marketing in forestry. Marketing management. Market focus of forest company. Integral marketing concept in forestry. Strategic management and marketing management process in forestry. Adaptability of organisation to environment. Strategic planning process. Integral marketing processes. Possibilities and choice of marketing strategy in forest company. Decision about marketing channels. Decision about retail, distribution of forest products and services. Development of marketing informational system. Branding processes in forestry. Characteristics of production programs in forestry. Process of new products and services introduction and production program. Decisions about the brand, trade mark and marketing channels. Market forecasting. Implementation of methods and technics market forecasting in forestry and trade of forest products. Analyse of structure market behavior of forest products, wood and wood products. Company, suppliers, middlemen, buyers, competitors. Supply, demand and market of products and services. Consumers market and behaviors during purchase process for forest products and services. Analyse of selling for different forest assortments and services. Analyse of selling forest products by different buyers. Estimation of future consumption. Market segmentation and position of forest products and services. Price formation on forest products and services market. Definition of forest products and services (logs, assortments, non-wood products). Products from non-wood forest services.

Type of course:

Marketing in Forestry (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To determine importance, role and social responsibility of marketing in forestry (importance of marketing management, welfare marketing, green marketing, consumerism).	Exercise, final exam	C1
To present research and market segmentation, supply and demand rules, (area and marketing plan, factors and characteristics of marketing information systems, analyse and behavior of competitors, development of new products and services, market, prices and elasticity).	Exercise, final exam	C2, B11
To present product, production program, price construction and distribution.	Exercise, final exam	C2
Evaluate promotion and marketing of goods and services in forestry (economic propaganda, sales improvements, personal sale model and publicity, importance of forest products certification in company market strategy).	Exercise, final exam	B11

General competencies
Needs, interests and consumers' issues, their culture and behavior. How user value specific forest resources, differences between users of certain forest products and services. Differentiated marketing approach in forest resource economics

Type of instruction

Lectures

Exercises

Working methods:
Teachers' obligations:
Conduction of teaching program – oral presentations, exercises. Creation of exams and their ranking. Conduction of written and oral exams and consultations. Creation of teaching materials.
Students' obligations:
Ordinary participation and active participation in classes, exercises. Individual preparation and exercise submitting. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	10%	Minimal number of attendance in the class	Sufficient (2)	30	0	1
			Good (3)			
			Very good (4)			
		Attendance and active participation in the teaching during semester	Excellent (5)			
Exercises (E)	30%		Sufficient (2)	15	15	1
			Good (3)			
			Very good (4)			
		Regular submission of exercise tasks without corrections	Excellent (5)			
Exam (FE)	60%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx10+Ex30+FEx60)/100**		45	45	3

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	60 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(Lx10+Ex30+FEx60)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Checking the attendance of students on lectures. Student can miss the lectures justifies more than 15% of excersises.	semester (45 hours of direct lecturer)	-
Partial exam	Exercises are individual. Students are receiving exercise templates in the beginning of the course, and shape of the folder and files, which will be used for the individual tasks. Accuracy, precision and regularity of assignment are evaluating.	15. week	
Written exam	Students could attend exam with successfully and correct finished exercises. Students on printed written exam work on three calculation exams. One positive exam has 10 points. Half of the correct exam gain 5 points. Grades for written exam are: 15-sufficient (2) 20- good (3) 25-very good (4) 30-excellent (5)	Exam terms	
Oral exame	Students with positive written exam are questioned from different part of the course content. Final grade consists achieved percentage together from written and oral exam: Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%		

Obligatory literature

1. Sabadi, R.: Osnove trgovačke tehnike, trgovačke politike i marketinga u šumarstvu i drvnoj industriji, Šumarski fakultet, Zagreb, 1988, str. 1-254.

Recommended literature

1. Kotler, Ph.: UPRAVLJANJE MARKETINGOM 1 i 2, Informator, Zagreb, 1989, str. 1-813.
2. Samuelson, P., Nordhaus, W.: EKONOMIKA, Mate, Zagreb, 1992, str. 1-800.

Digital Cartography in Forestry

DŠT3004

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. Renata Pernar, PhD.
Assist. Prof. Mario Ančić, PhD.

Associate teacher for exercises
Assoc. Prof. Ante Seletković, PhD.
Jelena Kolić, PhD.

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The curriculum of Digital cartography in forestry is realized through lectures and exercises. The lectures include the following thematic wholes: Elementary of digital cartography; Data form and type; Map digitalization; Scanning; Vectorization; Cartographic projections; Transformations of coordinates; Georeferencing of maps; Orthorectification; Standardization of procedures, colors and symbols for automation of map making, Making of topographic and thematic maps; Advantages and disadvantages of digital cartography.

Type of course:

Digital Cartography in Forestry (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of digital cartography. Describe the goals and tasks of digital cartography. Distinguish cartographic signs. Describe equipment and software support for digital cartography needs. Specify the advantages and disadvantages of digital cartography.	comprehensive exam	D4
Explain the classification and types of maps. List the basic elements and characteristics of the map. Compare the topographic and thematic map. Comment on the purpose of cartographic generalization. Identify the factors on which depends degree of generalization	comprehensive exam	D4
Categorize types and forms of data. Analyze the types of spatial data for the valorization of space. Describe and interpret spatial data models.	comprehensive exam	D4
Explain the term of vector and raster digitalization. Present the transformation process/procedure of the coordinates. Compare and analyze vector and raster digitalization. Explain and show the georeferencing and orthorectifying procedure. Create different thematic maps.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B12, B16, D4
Pronounce the definition of a digital relief model. Describe and explain the ways of creating and editing of DRM data. Present the creation of the DRM. Show the methods of visualizing DRM. Interpret the data obtained from DRM.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B12, B16, D4
Link the use of remote research in digital cartography. Carry out the upgrading and improvement of cartographic displays for remote sensing products. Combine a topographic, thematic map with a created digital relief model and a digital orthophoto. Present a database editing and performing various searching with a purpose to obtain a new digital cartographic layer.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B12, B16, D4

General competencies

The task of this subject is to make students acquainted with the latest achievements in the field of digital cartography in our country and in the world, theoretical fundamentals and skills for making of cartographic surveys and possibilities for use in forestry.

Type of instruction

Lectures

Lectures are performed in form of the block lessons with computer presentations. Within the course, along with regular attendance of lectures, exercises, students during the semester creates individual programs (tasks).

Exercises

Exercises are the upgrading of knowledge adopted in lectures. Exercises are performed in a computer classroom, in groups according to a schedule that adjusts to the number of students.

Working methods:
Teachers' obligations:
Maintaining original teaching - lectures and exercises. Designing topics for seminar papers, compiling knowledge tests and evaluating them. Maintaining midterm exams, oral exams and consultations. Creating teaching materials.
Students' obligations:
Within the course, with the regular attendance of lectures and exercises, students create individual assignments during the semester. Taking an exam is through the obligatory midterm exam and oral exam. Regular attendance and active participation on lectures and exercises, preparation of seminar work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)		-	-	15	7.5	0.75
Partial exam (PE)	25%	60-70%	Sufficient (2)		7.5	0.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Comprehen-sive exam (CE)	75%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PEx25+CEx75)/100**		45	45	3

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises	Exercises are held in a computer classroom. Each student is doing individual tasks. The accuracy, precision, regularity, and engagement on the exercises are evaluated. 2 absences from exercises are allowed with the additional preparation of the seminar work.	In accordance with the syllabus and agreed terms directly with the students.	The student work off for absence from the individual exercise term
Midterm exam	A compulsory midterm exam is laid within the course. The term is agreed with the students. The midterm exam can be accessed by students who have reviewed and accurate individual tasks. A passed midterm exam is a condition for students to get a signature and to go to the oral exam. The midterm exam is repeated during the academic year, according to the published schedule of exams.	Eight days before each test deadline, according to the published schedule.	-
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures and exercises and passed the midterm exam are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures and exercises). A passed midterm examination is a requirement for an oral exam, and grade of a midterm examination is part of the final grade.	Published examination deadlines.	-

Obligatory literature

1. Frančula, N. (2000): Digitalna kartografija, Zagreb, 187 str.
2. Kereković, D. (1998) GIS u Hrvatskoj. INA-INFO, Zagreb, 450 str.
3. Kušan (ed.) (1994): Nove tehnike izmjere i kartografije, Zagreb, 75 str.
4. Pernar, R.: Prezentacije s predavanja

Recommended literature

1. Göpfert, W., 1991: Raumbezogene Informationssysteme, Karlsruhe, 318 str.
2. Digital Photogrametric Systems, Karlsruhe, 1991, 344 str.
3. Razne web stranice

Technologies of Forest Road Construction

DŠT3005

ECTS credits 2

English R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Filed work 0

Lecturer
Prof. Tibor Pentek, PhD.

Grading system
Fair (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The course Technologies of Forest Road Construction focuses on the technologies for the construction of forest roads in flat and sloping terrain. Students acquire knowledge about the sequence of the technological procedure of the construction of forest roads and construction machinery used in the process. Construction machinery is broken down into main groups and subgroups with detailed descriptions. The course elaborates on the theoretical and practical efficiency of each piece of machinery. Students learn about the organization of the forest road construction site. Students gain knowledge about the legal basis relevant for the start of construction and the necessary technical documentation. Students also learn about how to introduce the works to the contractor, write different reports, carry out surveillance and control of works, keep the construction log book and about the procedure of handover of the finished forest road.

Type of course:

Technologies of forest road construction (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Prepare the technical background needed for a public tender for the selection of the most advantageous bid for the construction/reconstruction of a forest road and write the technical part of the contract. Manage surveillance/control and handover of finished works on the lower and upper layer of the forest road.	Knowledge test, final exam	B7
Recommend options and select the most suitable class and type of construction equipment for excavation, loading and transport of solid and bulk materials, compaction and rock works during different stages of construction (reconstruction) and maintenance (repairs) of forest roads.	Knowledge test, final exam	B14
Anticipate difficulties that can occur during the construction of forest roads in flat areas and hilly and mountainous areas (slopes) and recommend measures to avoid/minimize them.	Knowledge test, final exam	B14

General competencies

The objective and purpose of this course is to get students acquainted with technical, technological and legislative components of the complex procedure of forest road construction in different types of terrain. The acquired knowledge will enable students to plan, organize and monitor works on the construction of forest roads from the handover of the construction site to the handover of the finished structure.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Teaching activities – lectures. Elaboration of topics for assignments, drafting of knowledge tests and the assessment thereof. Organization of midterm exams, oral exams and office hours. Preparation of teaching materials.

Students' obligations:

Regularly attend and actively participate in lectures and practical exercises; prepare the assignment and make an oral presentation. Take midterm exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	0.5
Seminar (S)	25%	Student through the seminar process the given problem / topic	50-64% Fair (2) 65-74% Good (3) 75-84% Very good (4) 85-100% Excellent (5)	0	15	0.5
Exam (E)	75%	60-70 % 71-80 % 81-90 % 91-100 %	Fair (2) Good (3) Very good (4) Excellent (5)	0	30	1
TOTAL	**100 %**	**(S2x12.5+Ex75)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam* (FE)		60-70 % 71-80 % 81-9 0% 91-100 %	Fair (2) Good (3) Very good (4) Excellent (5)			1.0
TOTAL	**100%**	**(S2x12.5+FEx75)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	Semester (15 hours of direct teaching)	-

Evaluation elements	Description	Deadline	Compensation
Assignment	At the beginning of the first lecture students are randomly assigned topics for their assignments. Students should thematically elaborate the topics, prepare a presentation and make an oral presentation. Students are assessed for quality of the content, the layout of the presentation and the presentation itself.	As agreed	
Written exam	Only students who have completed the assignment can take the exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written exam is graded and taken into account for the final grade of this course.	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **(S2x12.5+FEx75)/100**		

Obligatory literature

1. Babić, B. 1995: Geosintetici u graditeljstvu, Hrvatsko društvo građevinskih inženjera, Zagreb, pp 263-308.
2. Cornell, J., Mills, K. 2000: Forest Road Management Guidebook, Oregon Department of Forestry, pp 1-32.
3. Slunjski, E. 1995: Strojevi u građevinarstvu, Hrvatsko društvo građevinskih inženjera, Zagreb, pp 1-250.
4. Winkler, N. 1998: Environmentally Sound Road Construction in Mountainous Terrain, Food and Agriculture Organization of the United Nations, Rome, pp 1-54.

Recommended literature

1. Winkler, N. 1999: Environmentally Sound Forest Infrastructure Development and Harvesting in Bhutan, Food and Agriculture Organization of the United Nations, Rome, pp 1-54.
2. Scientific and technical papers focusing on the topic by Croatian and foreign authors published in journals and conference proceedings.
3. Akre, B. 1996: Forest road construction policies, guidelines and codes of practice, Proceedings of the Seminar on Environmentally sound forest roads and wood transport", Sinaia (Romania), 17-22, June 1996., pp 153-173.
4. Aulerich, E. 1996: Better engineering and control of the construction of forest roads, Proceedings of the Seminar „Environmentally sound forest roads and wood transport", Sinaia (Romania), 17-22, June 1996., pp 174-183.
5. Pičman, D., Pentek, T. 1996: Stabilizacija šumskih transportnih sustava vapnom, Mehanizacija šumarstva 21 (2), Zagreb, Hrvatska, pp 83-85.
6. Pičman, D., Pentek, T. 1996: Prilog poznavanju uporabe strojeva za stabilizaciju šumskih prometnica vapnom. Mehanizacija šumarstva 21 (2), Zagreb, Hrvatska, pp 87-96.
7. Pičman, D., Pentek, T. 1996: Uporaba RRP sredstva za stabilizaciju tla pri gradnji šumskih prometnica, šumarski list vol. 120 (11-12), Zagreb, Hrvatska, pp 469-476.
8. Pičman, D., Pentek, T. 1996: Mogućnost primjene sredstva WEGS za stabilizaciju tla pri gradnji šumskih cesta. Mehanizacija šumarstva 21 (2), Zagreb, Hrvatska, pp 97-102.
9. Pičman, D., Pentek, T. 1997: Različite mogućnosti primjene geosintetika kao metode stabilizacije tla pri gradnji šumskih cesta, Šumarski list vol. 121 (7-8), Zagreb, Hrvatska, pp 383-389.
10. Pičman, D., Pentek, T. 1998: Tehnologija rada pri stabilizaciji šumskih cesta primjenom cementa, Šumarski list, vol. 122, no. 7-8, Zagreb, pp 353-358.

Evaluation of Forest Resources

DŠT3006

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Assoc. Prof. Stjepan Posavec, PhD.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Importance of forest evaluation will be elaborated. Description of different ways of natural resource economists use to calculate value of natural resources with social value. Term, significance of forest evaluation as renewable natural resource. On the basis of existing methods and critical view it is clear that traditional classics and neoclassic concept of forest evaluation should be redefined. Achievements to date and papers in this field. How scientific approach should forest values be solved with optimisation of interaction with different factors in concept of total forest evaluation with inclusion of other economic and other factors, ie. nonutilitarian. Review of the forest evaluation models: Income forest value, forest value on the basis of cutting revenue, cost forest value, use-costs evaluation method, rent forest value, amortisation forest value, combined method, cutting value method, market forest value, cost-benefit analyse method, monetary method with demand curve, evaluation of non-wood forest services, environment impact assessment, travel cost method, methodology for evaluation health and scenic services, model of evaluation of forest ecosystem as environment capital, contingent valuation, total economic forest value.

Type of course:

Evaluation of Forest Resources (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To decompose ways and goals of forest value calculation and analyse total economic value concept.	Final exam	A2
Critical judgment of traditional and modern methods of calculation with and without demand curve, for environmental products and services values.	Final exam	C4, B11
To reassess different methods and models of estimation forest values in Croatia with goal of calculation total economic value of forest management unit.	Final exam	B1

General competencies
Introduction with classic and modern forest evaluation methods, calculation ways and differences. Particular estimation and calculation of stand value and forest management unit.

Type of instruction

Lectures

Working methods:
Teachers' obligations:
Conduction of teaching program – oral presentations. Creation of exams and their ranking. Conduction of written and oral exams and consultations. Creation of teaching materials.
Students' obligations:
Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	10%	Minimal number of attendance in the class	Sufficient (2)	15	0	1
			Good (3)			
			Very good (4)			
		Attendance and active participation in the teaching during semester	Excellent (5)			

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Exam (E)	90%	60-70%	Sufficient (2)		45	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx10+Ex90)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(Lx10+FEx90)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Checking the attendance of students on lectures.	semester (15 hours of direct lecturer)	-
Written exam	Seminar paper		
Oral exam	Students with positive written seminar are questioned from different part of the course content. Final grade consists achieved percentage together from written and oral exam: Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%	Exam terms	

Obligatory literature

1. Figurić, M.: Uvod u ekonomiku šumskih resursa, Šumarski fakultet, Zagreb, 1998.
2. Nenadić, Đ: Računanje vrijednosti šuma i šumska statika, Naklada hrvatskog šumarskog društva, Zagreb
3. 1922.
4. POTOČIĆ, Z.: Ekonomika šumarstva, Zajednica studenata Ekonomskog fakulteta, Osijek, 1965.
5. SABADI, R.: Vrednovanje šuma u njihovoj ukupnosti, Hrvatske šume, Zagreb, 1997.

Recommended literature

1. SABADI, R.: Ekonomika šumarstva, Školska knjiga Zagreb, 1992.
2. KLEMPERER, W.D.: FOREST RESOURCE ECONOMICS AND FINANCE, McGraw-Hill Book Comp., New York, 1996

Forest Biomass for Energy

DŠT3007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Željko Zečić, PhD.
Assist. Prof. Dinko Vusić, PhD.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Within this subject, the methods of harvesting and utilizing of forest biomass, especially forest biomass for energy or other purposes, will be discussed. An overview will be presented of the world trends of biomass harvesting and utilization, structure and properties of biomass, other biomass sources: natural forests, plantations, short rotation coppice, energy forests, biomass harvesting and transport technology and techniques, storage, biomass usage areas and techniques, greenhouse effect reduction using biomass, Kyoto and other declarations and domestic legal bases, energy plants, biogas, horticulture.

Type of course:

Forest Biomass for Energy (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present production potential and forms of forest biomass for energy (sources and origin of biomass, energy forests, forms of biomass for use and trade, standards for solid biofuels from forestry, quality testing of wood chips).	Final exam	B8
Evaluate technologies and techniques of harvesting forest biomass as a solid biofuel (transport of compressed and comminuted biomass, storage, areas of application and use of forest biomass, structure of energy wood and brushwood by stand age and tree species, establishment and production of wood biomass in short rotation coppice).	Final exam	B3, B6
Evaluate the environmental suitability, use and storage of forest biomass for energy (reduction of greenhouse gas effects by using biomass, legal acts, energy plants, heat, cogeneration and trigenation plants, forest wood biomass for pellet, briquette, charcoal production).	Final exam	B16

General competencies
The aim of this course is to provide an insight on the potential possibilities of using forest biomass, methods of harvesting, use and value of forest biomass as an alternative energy source.

Type of instruction

Lectures
Working methods:
Teachers' obligations:
Conduction of teaching program – oral presentations. Conduction oral exams and consultations. Creation of teaching materials.
Students' obligations:
Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	0.5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Exam (OE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**OEx100/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Checking the attendance of students on lectures.	semester (15 hours of direct lecturer)	-
Oral exam	Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%	Exam terms	

Obligatory literature

1. Zečić, Ž., Current lectures
2. Hakkila, P., 1989: Utilization of Residual Forest Biomass. Springer-Verlag. Berlin Heidelberg

Recommended literature

1. Röser, D., Asikainen, A., Raulund-Rasmussen, K., Stupak, I., 2008: Sustainable Use of Forest Biomass for Energy, Springer.

Planning of Technological Operations

DŠT3008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Tomislav Poršinsky, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Methods of planning technological operations of tree felling, processing, skidding and a long-range transport, work preparation, applied methods planning and preparation of forest utilisation works, classical sources of data for planning, computer database, introduction of contemporary technologies and possibility of GIS and GPS technology application, logical connection of participants in the production process and a long-range wood transport in the system – forest administration, forest management, working site, auxiliary storage place, buyer, mean of transport, logistics, logistics in top technologies, working design of the site by classical and contemporary technologies.

Type of course:

Planning of Technological Operations (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse elements of strategic-tactical planning of timber harvesting (terrain classification for forestry operations and mobility model of a cable skidder).	Seminar, Final exam	B1, B6

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Evaluate the tactical-operational planning of timber harvesting operations (components of tactical-operational planning of timber harvesting, timber harvesting operations in space and time, operational planning and supervision of timber harvesting procedures, logistics of timber harvesting in a harvester – forwarder system).	Seminar, Final exam	C1, B12
Determine the cost calculations for timber harvesting (types of costs and methods of cost calculations).	Seminar, Final exam	B3, B7

General competencies
Development of competent knowledge for carrying out contemporary operative tasks of wood utilisation and for inclusion in research tasks.

Type of instruction

Lectures
Lectures cover 8 units according to the teaching plan.

Working methods:
Teachers' obligations:
Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams, oral exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
Designing seminar papers (S)	20%	60-70%	Sufficient (2)	0	15	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80+Sx20)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(FEx80+Sx20)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper	The student prepares seminary work on the topic of forestry history. The quality of the seminar work is evaluated.	15. week	
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	

Obligatory literature

1. Anon., 2001: Forest Development Plan Guidebook. Forest Practices Code of British Columbia, 1 – 113.
2. Chipping, D.H., 1999: Timber Harvesting Plan Handbook. California Native Plant Society, 1 – 47.
3. Shaffer, R.M., 1997: A Logger's Guide to Harvest Planning. Virginia Cooperative Extension, Publication 420-088, 1 – 4.

Recommended literature

1. Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.
2. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/Boston/Lancaster, 1 – 371.
3. Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219.

Innovations in Forestry

DŠT3009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Mario Šporčić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Future for those who live on income earned in forestry greatly depends on how decision-makers (forest owners, forest managers, institutions, state authorities and research organizations) respond to transition and globalization changes. An appropriate approach to new understandings and application thereof is an essential condition of forest development.
Changes will be initiated by establishing continuous cooperation with the INNOFORCE Regional Project Centre with the purpose of creation a system in a totally unregulated forestry sector in Croatia. Students will „see through“ case study presentations dealing with product innovations, service innovations, technology innovations and organization. Through interactive work they will become acquainted with the following cycle: „What is an innovation? Innovation created through permanent employment status, institutional support to innovation activities (authorised ministries and institutes, Croatian Government; local self-government, chamber system; non-profit sector, innovators; concentrated technological development centres; consultant networks, legislation dealing with intellectual ownership protection).”
After the work has successfully been carried through, every student will be able to understand that: „To conceptualize something different from the already seen does not necessarily make an innovator, because innovators differ from others on the basis of their objectives, professionalism level, level of affiliation and level of organization. RPC INNOFORCE (http://www.boku.ac.at/innoforce/) will become and remain a point of „frequent visiting“ for majority of students“!

Type of course:

Innovations in Forestry (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Depict the state of innovation and innovativeness in forestry (significance, role and division of innovations, stages of innovation process, innovation systems and monitors, company-level innovations, factors of innovation activity, conditions for innovation activity, innovation behavior, sources of impulses and information for innovation, support and innovation constraints).	Written exam	C5
Explain creativity and inventiveness (features of creativity and inventiveness, process and stage of creative thinking, characteristics of creative people, techniques of encouraging creative thinking, evaluation and choice of ideas/solutions).	Written exam	B13
Expose institutional support for innovation activities and examples of good practice.	Written exam	C1

General competencies
The key issue in forestry management and policy is how many new understandings from other fields and forestry itself is possible to implement in practice. The objective is to learn and master minimum of knowledge and skills with the purpose of recognition the significance of innovations as a key factor in the professional development and growth of modern enterprises.

Type of instruction

Lectures
Lectures include 4 methodological units, according to the teaching plan.

Working methods:
Teachers' obligations:
Giving lectures, consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)				15		0.5

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Exam (WE)	100%	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx100)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.5
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is checked and recorded. The student can justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	The students in the prepared printed exam answer the questions asked and solve the problem tasks. The written exam is evaluated and makes the final grade of the subject. The final grade is obtained according to the formula (FEx100)/100	Exam terms	

Obligatory literature

1. Rametsteiner, E., Weiss, G., Kubeczko, K., 2005: Innovation and entrepreneurship in forestry in central Europe. Leiden Brill Academic Publishers, 1-179.
2. Srića V., 2003: Kako postati pun ideja. M.E.P. Consult, Zagreb, 1-190.

3. Martinić, I., Šporčić, M., Vondra, V., 2006: Inovacijski procesi kao ključ provedbe Hrvatske šumarske politike. Glasnik za šumske pokuse, pos. izdanje 5: 703-715.
4. Posavec, S., Šporčić, M., Antonić, D., Beljan, K., 2011: Poticanje inovacija - ključ razvoja u hrvatskom šumarstvu. Šumarski list 135 (5-6): 243-256.

Recommended literature

1. Srića, V., 2003: Inventivni menadžer u 100 lekcija. Znanje d.d. Zagreb, 1-292.
2. OECD, 2005: Guidelines for Collecting and Interpreting Innovation Data. Oslo Manual, 3rd edition. OECD, Luxembourg, 162 p.
3. Šporčić, M., Landekić, M., Ćosić, M., Bakarić, M., 2017: Inovacijske nagrade u šumarstvu. Nova mehanizacija šumarstva 38: 79-90.

Environmentally Sound Technologies

ŠDT4001

ECTS 4

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof. Tomislav Poršinsky, PhD.
Assist. Prof. Andreja Đuka, PhD.
Assist. Prof. Zdravko Pandur, PhD.

Associate teacher for exercises
Prof. Tomislav Poršinsky, PhD.
Assist. Prof. Andreja Đuka, PhD.
Assist. Prof. Zdravko Pandur, PhD.
Assist. Prof. Dinko Vusić, PhD.
Marin Bačić, MSc.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The basic task of the subject is to inform about the efficient and environmentally acceptable machine methods of wood logging, building forest roads, ecologically acceptable methods of work used in that and the consequences of the use of techniques and technologies in a forest ecosystem. In this, students are taught in details about the various kinds of damaging forest soil, trees and second growth during the work with classical forest technologies as well as with consequences of the use of environmentally acceptable technologies. Procedures of decreasing degree of damaging (choice of technology, organisation of work, choice of a machine, planning method, etc.) as well as a method of rehabilitation make a significant component of the subject.
The subject Environmentally acceptable technologies informs students about the advantages and shortcomings of building forest roads in the natural environment – forest ecosystem. Negative consequences of building forest roads for habitat components are analysed, but possibilities of decrease of damages, i.e. their rehabilitation are suggested. The environmental-ecological and sociological-aesthetic aspect of planning primary and secondary forest roads is observed separately. Methods of determining endangered (risky) areas are described using GIS. Ecologically acceptable technologies of wood logging are discussed, as well as building of forest roads on sloped terrains and in a lowland area. Conventional

and non-conventional methods of soil stabilisation are also considered. Students also learn about biologically-technical methods of rehabilitation of a dam slope and a slope of a forest road excavation.
One of the tasks of the course is to inform students about the basic features of force transmission from the movement system to the soil, tensile features of a vehicle and consequences of a vehicle activity on the soil by normal and tangential forces. The course includes basic analysis of forest vehicles, their dimensional and mass features (morphological analysis). Evaluation methods of a tensile feature and soil compaction are dealt with. Students learn about the measuring equipment for the estimate of soil compaction.
The subject includes lectures, field classes, exercises, computer exercises and seminar papers conceived in a contemporary way and with the use of contemporary teaching methods. Students will be assessed through colloquiums, written and oral part of the examination.

Type of course:

Environmentally Sound Technologies (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse soil compaction and rutting (soil bearing capacity, critical comment on methods of measuring soil bearing capacity, soil penetration resistance and cone index, wheel index, assessment of vehicle mobility according to WES method, soil compaction – reasons and consequences).	Exercises, Final exam	B6
Present and describe stand damage (type of erosion processes and consequences for forest stand, soil erosion as a result of timber harvesting operations, erosion intensity in different timber harvesting systems, methods and measures for the protection of waterways).	Exercises, Final exam	B6
Recommend technology for the construction of forest roads in different terrain categories (mechanical and classical chemical stabilisation of the soil, contemporary chemical stabilisation of soil, soil stabilisation with geo-synthetics).	Exercises, Final exam	B14
Analyse maintenance and reconstruction of forest roads (criteria, reasons/needs, priorities, justification, technological process, schematic/graphical display, technical documentation, adaptation of the procedure of timber harvesting, forest road closing and forest road conversion, removal of forest roads and stand revitalisation, Study of modernisation of forest road pavement structure).	Exercises, Final exam	B14

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To evaluate the environmental benefits of forest machines (environmental pollution with exhaust gases and pollutants from forest machines, impact of working conditions on fuel consumption, ecological norms for exhaust gases, technical solutions for reducing the amount of harmful exhaust gases, energy balance, ecologically acceptable wood harvesting technologies, application of bio-fuels and bio-oils in forest vehicles).	Exercises, Final exam	B6
To analyse development of forest vehicles (development and construction of forest vehicles with hybrid drive, remote monitoring systems for forest machines and vehicles).	Exercises, Final exam	A2, B16

General competencies
The development of competent knowledge for carrying out complex operative and environmentally acceptable professional solutions, independent decision-making and involvement in research tasks.

Type of instruction

Lectures
Lectures cover 15 units according to the teaching plan.

Exercises
10 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 3 days. Three themes are discussed.

Working methods:
Teachers' obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.
Studenats' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	60-70%	Sufficient (2)	54	30	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20+FEx80)/100**		84	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (84 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. CD s predavanjima u „Windows Power Point“ prezentaciji te ispis istih. Studenti koji nemaju osobno računalo mogu ga rabiti u računalnoj učionici Šumarskoga fakulteta i u knjižnici Zavoda za iskorištavanje šuma.
2. Heinimann, H. R. 1998: Opening-up planning taking into account environmental and social integrity, Proceedings of the Seminar on Environmentaly sound forest roads and wood transport, Sinaia (Romania), 17-22 June 1996., p. 62-72.
3. Nonveiler, E., 1979: Mehanika tla i temeljenje građevina. Školska knjiga Zagreb, 1 – 780.
4. Pičman, D., Pentek, T. 1996: Metode rada pri stabilizaciji tla kod izgradnje šumskih prometnica, Savjetovanje “Izzivi gozdne tehnike”, Zbornik radova, Ljubljana, Slovenija, 1996. s. 125-132.
5. Pičman, D., Pentek, T., Poršinsky, T. 2003: Prilog istraživanju oštećivanja stabala mehanizacijom za gradnju šumskih putova, Strojarstvo vol. 45 (4-6), Zagreb, Hrvatska, s. 149-157.
6. Pentek, T., Pičman, D., Nevečerel, H. 2004: Environmental – ecological component of forest road planning and designing International scientific conference: Forest constructions and ameliorations in relation to the natural environment, Technical University in Zvolen, Slovakia, 16th – 17th September 2004. Proceeding CD/DVD MEDIJ, p. 94-102.
7. Ronai, Đ. M., 1983: Teorija kretanja van tvrdih puteva. Fakultet tehničkih nauka Univerziteta u Novom Sadu, 1 – 324.
8. Ronai, Đ. M., 1986: Sabijanje zemljišta kao posledica kretanja točka. Fakultet tehničkih nauka Univerziteta u Novom Sadu, 1 – 227.
9. Racz, Z., 1986: Agrikulturna mehanika tla. Fakultet poljoprivrednih znanosti Sveučilišta u Zagrebu, 1 – 57.
10. Winkler, N. 1998: Environmentally Sound Road Construction in Mountainous Terrain, Food and Agriculture Organization of the United Nations, Rome, p.1-54.
11. Izabrani stručni i znanstveni članci objavljeni u časopisu „Mehanizacija šumarstva“ koji su na raspolaganju studentima knjižnicama Šumarskoga fakulteta i Zavoda za iskorištavanje šuma.

Recommended literature

1. Arnup, R.W., 1999: The extent, effect and management of forestry-related soil disturbance, with reference to implications for the Clay Belt: a literature review. Ontario Ministry of Natural Resources, Northeast Science & Technology, TR-37, 1 – 30.
2. Häyrinen, T., 1998: Forest road planning and landscaping, Proceedings of the Seminar on „Environmentaly sound forest roads and wood transport“, Sinaia (Romania), 17-22, June 1996., p. 50-61.

3. Heinrich, R., 1998: Recent developments on environmentaly friendly forest road construction and wood transport in montainous forests, Proceedings of the Seminar on Environmentaly sound forest roads and wood transport", Sinaia (Romania), 17-22, June 1996., p. 366-376.
4. Hori, T., Y. H. Li, 1989: Terrain classification for forest road network planning by using slope-gradient distribution. I. Investigation of terrain indices, Journal of the Japanese Forestry Society. 1989, 71: 8, p. 303-308.
5. Hori,T., Y. H. Li, 1990: Terrain classification for forest road network planning by using slope gradient distribution. II. Supplementary investigation of terrain indices and slope gradient percentages, Journal of the Japanese Forestry Society. 1990, 72: 2, p. 151-153.
6. Pičman, D., Pentek, T., Poršinsky, T. (2001): Relation between Forest Roads and Extraction Machines in Sustainable Forest Management, FAO/ECE/ILO & IUFRO Workshop on „New Trends in Wood Harvesting with Cable Systems for Sustainable Forest Management in the Mountains", Osiach, Austrija, 18-24.06. Workshop Proceedings, June 2001., p. 185-191.
7. Pičman, D., Pentek, T., Poršinsky, T. (2002): Some Consequences of Secondary Forest Roads Construction in Mountainous Area, Proceedings of International conference „Logistics of wood technical production in the Carpathian mountains", p. 191-198, Zvolen, Slovakia, 09-10.09.2002.
8. Saarilahti, M., Anttila, T., 1999: Rut depth model for timber transport on moraine soils. Proceedings of 13th International Conference of the ISTVS, September 14 – 17, 1999, Techniche Universität München, Germaniy, Volume I: 29 – 37.
9. Saarilahti, M., 2002A: Soil interaction model. Project deliverable D2 (Work package No. 1) of the Development of a Protocol for Ecoefficient Wood Harvesting on Sensitive Sites (ECOWOOD). EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 – 87.
10. Saarilahti, M., 2002B: Dynamic terrain classification – Modelling of the seasonal variation of the trafficability on forest sites. Soil interaction model, Appendix Report No 1, 1 – 22.
11. Saarilahti, M., 2002C: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 1: WES mobility models. Soil interaction model, Appendix Report No 2, 1 – 39.
12. Saarilahti, M., 2002D: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 2: Comparison of the different WES-models. Soil interaction model, Appendix Report No 3, 1 – 28.
13. Saarilahti, M., 2002E: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 3: Interpretation and application of results. Soil interaction model, Appendix Report No 4, 1 – 15.
14. Saarilahti, M., 2002F: Modelling of the wheel and tyre, 1. Tyre and soil contact – Survey on tyre contact area and ground pressure models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 5,1 – 43.
15. Saarilahti, M., 2002G: Modelling of the wheel and tyre, 2. Tyre stiffness and deflection – Survey on tyre deflection models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 6, 1 – 15.
16. Saarilahti, M., 2002H: Modelling of the wheel and tyre, 3. Tyre/soil models for predicting rut formation and soil compaction – Survey on soil deformation models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 7, 1 – 19.
17. Saarilahti, M., 2002I: Modelling of the wheel and soil, 4. Forest soil properties – Survey on forest soil properties and soil compaction for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 8, 1 – 37.
18. Owende, P. M. O., Lyons, J., Haarlaa, R., Peltola, A., Spinelli, R., Molano, J., Ward, S. M., 2002: Operations protocol for Eco-efficient Wood Harvesting on Sensitive Sites. Project ECOWOOD, Funded under the EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 – 74.

19. Stručni i znanstveni članci s međunarodnih savjetovanja s temom ergonomije mehaniziranja radova u šumarstvu prema izboru nastavnika (raspoloživi u knjižnici Zavoda za iskorištavanje šuma).
20. Yoshimura, T. & K. Kanzaki 1998: Fuzzy expert system laying out forest roads based on the risk assesment, Proceedings of the Seminar on „Environmentaly sound forest roads and wood transport“, Sinaia (Romania), 17-22 June 1996., p. 144-150.
21. Wolf, W., 1998: Assessment of forest roads alternatives with special emphasis on environmental protection, Proceedings of the Seminar on „Environmentaly sound forest roads and wood transport“, Sinaia (Romania), 17-22 June 1996., p. 130-143.

Production Organization in Forestry

DŠT4002

ECTS 5

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof. Mario Šporčić, PhD.
Prof. Ivan Martinić, PhD.

Associate teacher for exercises
Assist. prof. Matija Landekić, PhD.
Matija Bakarić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basics of forestry organization theory and forestry companies with reference to particularities in forestry industry, review of legislation dealing with forests and forestry, organizational forms and company structure in forestry. Organizational units, functions, activities and models of their production and business linkage.
Mandate of forestry and forestry companies. .Long-term planning and annual plans for the sector of forest managing. Structure and functional interrelatedness of bottom units by means of horizontal and vertical information flows.
Scientific systems of work research, methods of work experiment research and regular work research, identifying of work process implementation regularities, differentiated basis systems for evaluation of work process components in forestry. Level of normal (optimal) work and extent of efforts invested while working, issues of individual and group work, methods of identifying and balancing means of production capacities, research methods of work conditions in forestry.
Business operation in forest production: actors and places of business operation in production, methods and techniques of production foreseeing and planning, production preparation and design, monitoring and regulation of business events, business operation success analysis.
Business operation in forest company organizational units: improvement of income acquiring and income distribution, work payment and workers' stimulation, doing business with the environment.
Business information system and book-keeping and accounting to enable constant situation and success balancing of production/business processes in forestry.

Type of course:

Production Organization in Forestry (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret the physiological and ergonomic aspects of forest work (physiology of work, ergonomic research in forestry, work load and energy consumption of forest workers, work ability).	Exercises, test of knowledge, final exam	B1
Analyze the elements and phases of the work preparation and work standards in forestry (objectives and tasks, elements and stages of preparation process, specificity and implementation in forestry, content and structure of work norms, forms of work norms, verification of achievement, application in forestry, rates).	Exercises, test of knowledge, final exam	C1, A3
Present planning and management systems in individual segments of forestry production (features, elements, annual planning, functional and revier forest management system, public and private stakeholders in forestry operations, truck transport of wood).	Exercises, test of knowledge, final exam	C1
Present the assessment of production and business efficiency in forestry – methods and approaches (features, application of classical methods i.e. indicators and non-traditional approaches in forestry, advantages and disadvantages, ecological efficiency of organizations, indicators of eco-efficiency, multi-criteria models in forestry, multicriteria decision-making methods, feasibility studies).	Exercises, test of knowledge, final exam	C1, D5
Comment on the role, tasks and responsibilities of the manager in a forestry organization (fundamentals of managerial accounting, human resources and forestry personnel, work stress)	Exercises, test of knowledge, final exam	C5

General competencies
Preparation of forestry students for fast and efficient transformation into planers, analysts, organizers, information scientists, managers and leaders, negotiators, traders, communicators.

Type of instruction

Lectures
Lectures include 5 methodological units, according to the teaching plan.

Exercises
Exercises are performed in the form of methodical, measuring and calculating exercises. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.
Field work
Within the course, students have 3 days of field work according to the curriculum.

Working methods:
Teachers' obligations:
Holding the original teaching: lectures, exercises and field work. Organization of field work, giving consultations and exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures, exercises and field work. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures				30		1
Field work				24		0.75
Exercises (E) and writing of seminars from field work	20%	Partly disordered and incomprehensible, with major corrections, on time	Sufficient (2)	30	15	1.5
		Orderly and comprehensible, with major corrections, on time	Good (3)			
		Orderly and comprehensible, with minor corrections, on time	Very good (4)			
		Orderly, comprehensible and accurate, on time	Excellent (5)			
Exam (FE)	80%	60-70%	Sufficient (2)		55	1.75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20+FEx80)/100**		84	70	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS credits
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1.75
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercies and field work	The student attendance is checked and recorded. Field work and measuring exercises are mandatory. The student can justifiably be absent with a maximum of 20% of the hours of other forms of direct teaching (lectures and calculation exercises).	semester (60 hours of direct lecturer)	-
Excersises	Exercises are attended in groups. Within exercises methodical, measuring and calculating exercises are performed. Students become acquainted with measurement methods and independently solve practical problems and tasks from forestry practice. At the beginning of the first exercise, students receive templates with exercise assignments, as well as the appearance of the file, skin, and template list in which they will answer to the set tasks in printed form. The accuracy, orderliness and regularity (exercises handed on time) are evaluated	15. week	Exceptionally, in the case of a justified reason, the student works of the absence of the individual exercise
Written exam	Exam can be attended by students who solved and submitted exercises. The students in the prepared printed exam answer the questions asked and solve the calculation tasks. The written exam is evaluated and participates in the final grade of the subject	Exam terms	
Oral exame	Students who pass a written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(FEx80+Ex20)/100**		

Obligatory literature

1. Šporčić, M., 2003: Uspostava modela potvrđivanja izvoditelja šumskih radova. Magistarski rad, Šumarski fakultet Sveučilišta u Zagrebu, 1-100.
2. Šporčić, M., 2007: Ocjena uspješnosti poslovanja organizacijskih cjelina u šumarstvu neparametarskim modelom. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, 1- 112.

3. Martinić, I., 1996: Ekonomski i organizacijski kriteriji za oblikovanje šumskih radova. Glas. šum. pokuse 32: 215–299.
4. Posarić, D., 2007: Vodič za revirničke poslove. Hrvatske šume d.o.o. Zagreb, 1-231.
5. Whyte, A. G. D.: Integral decision making in planning & control of forest operations. New Zealand School of Forestry, University of Canterbury, Christchurch

Recommended literature

1. Srića, V., 2003: Inventivni menadžer u 100 lekcija. Znanje d.d. Zagreb, 1-292.
2. Martinić, I., Vondra, V., Šporčić, M., 2007: Razvoj novoga koncepta za unapređivanje šumarske tehnike u Hrvatskoj – područja mogućega doprinosa. Nova mehanizacija šumarstva, vol. 28, pos. izd. 1: 107-113.
3. Alexander Hamilton Institute: Plaće i nagrađivanje. Kako planirati i upravljati učinkov itim programom plaća. Protecon, Zagreb 1998.
4. Vondra, V., 1991: Istraživanje i primjena matematičkih modela za planiranje i kontrolu radova u šumarstvu. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, 1991, 1-334.

Forest Management

DŠT4003

ECTS points 3

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field classes 16

Lecturer
Prof. Mario Božić, PhD.

Associate teacher for exercises
Assist. Prof. Ernest Goršić, PhD.

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:

Within framework of lectures, practice and field work the course comprises following main segments: basis of tree growth and increment; development and increment of forest stands; methods of measurement and determination of absolute stand volume increment; structure of management plan (management protocol, numerical and graphical supplement of management plan); overview map, basic and special maps of forest management, road and forest opening maps, maps of forest cutting plan; preparation work for forest management, forest soil types and surface structure, unproductive forest soil (under roads), spatial management units (compartment, subcompartment, workplace, felling area); volume stock and increment, diameter and age class structure distribution within species, wood stock trend projection, volume increment quality assessment; estimation of assortment structure of wood stock and volume increment in forest management process; forest normality, actual and normal stand and forest structure within even-aged and uneven-aged stand management; defining cutting volume and its value on even-aged (O2), uneven-aged stand (O3) and management class level (O-6, O-7 and O-8), cutting basis; development of management-financial frame, income structure, forest road building cost structure and forest exploitation, conducting evidence and tracking forest management regulation accomplishment.

Type of course:

Forest Management (compulsory course, 4th semestar, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Knowledge proof	Connection with the study program LO
To analyze growth and increment of individual trees (height growth and increment dynamics, diameter, cross section area, volume increment, value of certain tree species)	Practise correction and validation, preliminary exams, final proof	B2, B4, D1, D4
To present development and stand increment (in even-aged stands, pure and mixed; growth and increment of uneven-aged stands, influence of management and habitat changes on tree and stand increment, measurement and stand volume increment determination methods).	Practise correction and validation, preliminary exams, final proof	B2, B4, D2
To formulate forest management planning (management programs, general forest management plan, spatio-temporal forest management, management planning in even-aged, uneven-aged and mixed stands – forest and stand level).	Field exercise, correction and validation, preliminary exams, final proof	B2, B4, C1, D2
To evaluate limiting factors when prescribing performing tree felling (age structure, maximum felling intensity, forest accessibility, health status, calamities, market, regulation tracking and implementation, revision and aditional plan revision).	Field exercise, correction and validation, preliminary exams, final proof	A1, B2, B4, C1

General competencies
Basic goal is obtaining knowledge about basic parts of Forest management plans and procedures required to make forest management plan with emphasis on technical and financial components of forest management. Through lectures, exercises and field practice the goal is to develop skills required for using management plans as well as participating in making them especially in technical aspect of forest management.

Type of instructions

Lectures

Exercises
Exercises are performed as combination of laboratory, computer classroom and field practice. Data collected on two day field trip practice are calculated in classroom.

Field work

Working methods:
Teachers' obligations:
Holding teaching lectures, practice and field work. Creating practice and exam tests and performing the validation. Carrying out preliminary exams, written and oral exams and consultations. Writing teaching material.

Students' obligations:
Continuous attending and active engagement in lectures and exercises, making and submitting of exercises in required time schedule. Passing the colocviums and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Exercises (E)	20%	Partially not clear, with major corrections but on time	Sufficient (2)	15		0.5
		Clear, with major corrections but on time	Good (3)			
		Tidy, clear, with minor corrections and on time	Very good (4)			
		Tidy, clear, without necessary corrections and on time	Excellent (5)			
Field trip practice (FP)	-	-	-	16		0.5
Partial exam 1 (PE1)	40%	[60-70%)	Sufficient (2)		15	0.5
		[70-79,9%)	Good (3)			
		[80-90%)	Very good (4)			
		[90-100%]	Excellent (5)			
Partial exam 2 (PE2)	40%	[60-70%)	Sufficient (2)		15	0.5
		[70-80%)	Good (3)			
		[80-90%)	Very good (4)			
		[90-100%]	Excellent (5)			
Total	**100%**	**(Ex20+ PE1x40+PE2x40)/100**		61	30	3

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS points
Final exam* (FE)		(60-70%) (70-80%) (80-90%) (90-100%)	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(FEx80+Ex20)/100**				
*** students which during semester do not pass the exam through colocvium must attend the exam which comprises 80% of grade. Remaining 20% is grade from practice.**						

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Student presence is recorded. Maximum lecture absence of 20% and practice absence of 10% are tolerated.	Semester (45 hours of classes)	-
Field practice	Student presence and activity during practice is monitored. Field practice attendance is obligatory.	Semester (16 hours of classes)	In certain cases of valid explanation for not beeing able to attend in field practice student is given a seminar and partial exam containing problematics explained in field practice trip
Exercises (E)	In the beginning, students are instructed how practice files should look. At the beginning of every practice, they get templates and learning materials which contain a description of practice thematics with examples. Every practice is evaluated based on accuracy, tidiness, and regularity of practice construction and submission.	According to calendar arrangeme nt	-
Partial exam	To be able to attend the first colocvium students are required to have correct practice that is related to the colocvium. Colocvium is comprised of 12 questions. To pass the colocvium student needs to collect 60% of maximal points. To attend the second colocvium students are required to pass the first colocviom and have correct practice course. Second colocvium is comprised of 12 questions. To pass the colocvium student needs to collect 60% of maximal points.Students which pass both colocviums are passed the exam and get the grade.	Middle and end of semester	-

Evaluation elements	Description	Deadline	Compensation
Written exam (WE)	The exam comprises of 12 questions and includes theoretical and practical knowledge that student learned during lectures, practice and field work. To pass the exam student needs to correctly answer 60% of questions.	Exam schedule defined on the beginning of semester	-
Oral exame (OE)	Requirement for approaching an oral exam is passed written exam within timeframe of registered exam date Theoretical knowledge with subject understanding of lectured classes is checked. Final grade is calculated according to following formula **(WEx40+OEx50+Ex10)/100**		-

Obligatory literature

1. Božić, M., Goršić, E.: Uređivanje šuma, Prezentacije s predavanja i vježbi
2. Klepac, D., 1965: Uređivanje šuma, Znanje, Zagreb.

Recommended literature

1. Davis, L.S. & Johnson, K.N., 1987: Forest management. McGraw-Hill Book Company, New York.
2. *** Osnove gospodarenja gospodarskim jedinicama

Undergraduate university study
D. URBAN FORESTRY, NATURE CONSERVATION AND ENVIRONMENTAL PROTECTION

In the undergraduate program of Urban forestry, nature conservation and environmental protection students are trained in the management of forest ecosystems, protected nature areas and urban green zones from a biological-ecological, technical, and economic aspect.
The study is based on fundamental knowledge in the field of urban forestry, nature conservation and environmental protection with directing students to professional forestry works in urban areas as well as to professional works in the realization of programs for the management of protected natural areas. Students gain the necessary knowledge and skills to solve complex tasks in urban forestry, nature conservation and environmental protection and for coping with the constant technological change, innovation and knowledge. The program is designed so that students are led in a logical sequence from the basic biological and technical disciplines, through disciplines in which they are introduced to the components of forest ecosystems and to techniques that enable the implementation of programs to manage protected nature areas, to those that embrace knowledge of the management of the environment and of forests and forest lands. Through fieldwork students acquire necessary practical experience they are acquainted with the practical application of acquired knowledge.
Students acquire conditions for performing more complex jobs in urban forestry, nature conservation and environmental protection and for continuation of education in graduate studies by individual making of bachelor thesis. Defending the bachelor thesis is requirement for
study conclusion.

List of compulsory and elective courses

I. YEAR

Code	Course	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
1. semester					
	Compulsory courses				
PU1001	CHEMISTRY WITH BIOCHEMISTRY	3	1	0	6
PU1002	MATHEMATICS	3	3	0	7
PU1003	PETROLOGY WITH GEOLOGY	2	1	0	5
PU1004	APPLIED ZOOLOGY	2	1	1	5
PU1005	SOCIOLOGY OF URBAN AND PROTECTED SPACES	1	1	0	3
PU1007	HISTORY OF LANDSCAPE ARCHITECTURE	1	2	0	4
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE				
Total		**12**	**9**	**1**	**30**
2. semester					
	Compulsory courses				
PU2001	BOTANY	3	2	3	7
PU2002	SOIL SCIENCE	2	2	3	6
PU2003	BIOMETRICS FOR SPATIAL VALORIZATIONS	2	2	0	5
PU2004	GROUND SURVEYING WITH FUNDAMENTALS OF CARTOGRAPHY	2	2	3	5
PU2005	CULTURE OF VISUAL THINKING	0	2	0	3
PU2006	INTRODUCTION TO URBANISM	1	1	0	4
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE				
Total		**10**	**11**	**9**	**30**

II. YEAR

Code	Course	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
3. semester					
	Compulsory courses				
PU3001	PHYTOCENOLOGY	2	1	2	6
PU3002	REMOTE SENSING AND GIS FOR PROTECTED AND URBAN AREAS	2	2	0	5
PU3003	GENERAL AND LANDSCAPE ECOLOGY	2	1	2	6
PU3005	MECHANIZATION OF FORESTRY IN URBAN AND PROTECTED AREAS	2	2	3	5
PU3006	PLANT PHYSIOLOGY	2	1	0	4
PU3007	GENETICS AND BREEDING OF TREES AND SHRUBS	2	2	1	4
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
Total		**12**	**9**	**8**	**30**
4. semester					
	Compulsory courses				
PU4001	APPLIED ENTOMOLOGY	2	1	2	7
PU4002	APPLIED PHYTOPATHOLOGY	2	1	2	7
PU4003	DENDROLOGY	3	2	3	7

PU4004	LANDSCAPE DESIGN AND PLANNING	1	1	0	3
PU4005	CONSERVATION OF GENETIC DIVERSITY OF FOREST TREES	2	2	2	6
PU4006	PERENNIAL AND ANNUAL ORNAMENTAL PLANTS	2	0	2	3
	Elective courses				
	PHYSICAL AND HEALTH EDUCATION				
Total		**12**	**7**	**11**	**30**

III. YEAR

Code	Course	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
5. semester					
	Compulsory courses				
PU5001	ENVIRONMENTAL PROTECTION	2	2	1	5
PU5002	ENVIRONMENTAL ECONOMICS	2	1	0	4
PU5003	SILVICULTURE OF SPECIAL PURPOSE FORESTS	3	2	2	6
PU5004	FOREST REGULATION OF FOREST FOR SPECIAL PURPOSES	3	2	2	6
PU5005	TECHNICAL COMPONENTS OF PARK DESIGN	2	1	2	4
PU5006	NATURE PROTECTION	2	1	2	5
Total		**14**	**9**	**9**	**30**
6. semester					
	Compulsory courses				
PU6001	ARBORICULTURE	2	2	2	5
PU6002	ENVIRONMENTAL MICROBIOLOGY	2	1	0	4
PU6003	PROTECTED AREAS MANAGEMENT AND SUPERVISION	2	1	3	5
PU6004	INTRODUCTION TO PHYSICAL PLANNING	1	2	0	4
PU6005	ECOLOGY OF FOREST TREE SPECIES	1	1	0	3
	Elective courses				
PU6006	FOREST MUSHROOMS	1	0	0	1
PU6007	TREE MEASUREMENT	1	0	0	1
PU6008	FLORICULTURE	1	0	0	1
PU6009	EXOTIC WOODY PLANTS	1	0	0	1
PU6010	APPLIED TECHNICAL GRAPHICS	1	0	0	1
	BACHELOR THESIS				6
Total		**11**	**7**	**5**	**30**

Learning outcomes of study programmer

Undergraduate university study URBAN FORESTRY, NATURE CONSERVATION AND ENVIRONMENTAL PROTECTION

A - General engineering competence

A1. apply approach to experimental observing and mathematical modelling, mathematically solving research and practical problems, statistically process, present and analyze data and conclude individually based on analyzed data

A2. use relevance in maintaining, area and possibilities of basic technical components

A3. apply skills in solving practical side of business, either by control measuring, calculations or testing verification

B - Focused engineering competence

B1. identify tree species based on morphological characteristics, identify parts and tree shapes and apply theoretical and practical knowledge of commercially indigenous and foreign tree species and shrubs

B2. recognize and determine the most important types of xylophage's bacteria, insects and funghi on trees species and detect wood defects incurred due to their activity

B3. acquire basic principles of protection of forests from abiotic and biotic factors, and apply basic procedures and means in protection of forests

B4. participate in the realization of programs for the management of protected natural areas

B5. perform biological and technical works in maintenance of parks and green areas

B6. perform all arboricultural works

B7. perform professional field works on protection of plants and trees in urban areas

B8. perform professional field works in forest nurseries including planting and seeding

B9. collaborate in preparation of ecological impact studies and spatial plans

B10. apply knowledge about the machines, techniques and technologies used in professional works in urban areas and protected natural areas

C - Organizational engineering competence

C1. plan and organize integrated management of the environment

C2. plan and organize professional works in realization of programs for the management of protected natural areas

C3. apply actual legislation in management of protected natural areas

C4. conduct monitoring of the environment

C5. calculate basic indicators of successful business, compose basic financial reports, recognize and analyze types of costs

D - Developing engineering competence

D1. continue perfection on university graduate studies on Forestry section on Faculty of Forestry

Connection of the courses learning outcomes with the study program learning outcomes

Course	General engineering competence			Focused engineering competence										Organizational engineering competence					Developing engineering competence
	A1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	C5	D1
PU1001	+																		
PU1002	+																		
PU1003	+					+						+					+		
PU1004						+	+					+							
PU1005	+	+	+																
PU1007							+												
PU2001				+															
PU2002			+				+				+								+
PU2003	+																		
PU2004	+							+				+							+
PU2005							+	+				+							
PU2006								+				+				+			
PU3001	+			+				+				+			+		+		+
PU3002			+					+				+					+		+
PU3003						+		+				+		+	+				
PU3005													+						
PU3006				+							+								
PU3007											+	+		+	+	+	+	+	
PU4001					+														
PU4002					+	+													
PU4003				+															
PU4004							+												
PU4005						+													
PU4006							+												
PU5001														+			+		+
PU5002	+	+	+															+	
PU5003				+				+			+								+
PU5004								+				+		+					
PU5005							+						+	+		+			
PU5006								+				+			+	+			+
PU6001	+		+		+		+		+				+						
PU6002				+	+	+								+					+
PU6003				+										+	+	+	+		
PU6004												+							
PU6005				+			+			+				+					
PU6006					+														
PU6007	+							+				+		+			+		+
PU6008							+												
PU6009								+											
PU6010			+																

Chemistry with Biochemistry

PU1001

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 45
Exercises 15

Lecturer
Vibor Roje, Ph.D., Asst. Prof.

Associate teacher for exercises
Vibor Roje, Ph.D., Asst. Prof.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Chemical thermodynamics: enthalpy, exothermic and endothermic reactions, Hess's law, spontaneous processes, thermodynamic laws, entropy, Gibbs energy, energy exchange in living organisms. Chemical kinetics: chemical reaction rate, reaction rate effects, catalysts and enzymes,
Chemical Balance: The Law of Chemical Balance. Acid-base equilibrium, water dissociation, pH, pH in living organisms, buffers, biologically significant buffers, chemical elements in Nature.
Atmosphere, hydrosphere, lithosphere, soil, biogenic elements, soil, influence of pH and acid rain, reception of biogenic elements, significance of individual biogenic elements. Organic compounds: in general, classification of organic compounds, aliphatic and aromatic hydrocarbons, alcohols, phenols, ethers, polyols. Chirality, stereochemistry. Aldehydes, ketones, reaction reactions of aldehydes and ketones, keto-enole tautomerism, carboxylic acids and their derivatives, esters, acidic agents.
Galic acid, tannin, humus, humic acid, humin, lipids, lipid, fat, oil, fatty acid, fatty acid hydrolysis, phospholipids, waxes, terpenes. Heterocyclic compounds, sulphur compounds.
Carbohydrates, carbohydrate distribution, monosaccharide, α- and β- form, mutarotation, monosaccharide reactions, disaccharides, celobiozes, sucrose, invert sugar, polysaccharides, starch, cellulose. Amino acids, stereochemistry, dissociation, peptide bonding, peptides, proteinisation, enzyme activity and activity, enzyme division, coenzymes.
Nucleosides, nucleotides, nucleic acids, DNA and RNA structure, replication, mutagenic defects.
Energy of biochemical reactions, ADP and ATP, photosynthesis, light and dark reactions, Calvin cycle, polysaccharide synthesis, cellulose synthesis and lignin, Aerobic and anaerobic respiration, pyrolysis acid degradation, Krebs-Martius cycle, breathing chain, anaerobic breathing.

Type of course:

Chemistry with Biochemistry (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To make connections between names, chemical formulas and basic properties of simple inorganic and organic substances.	Exercises, homework, partial exams, written exams, oral exam	A1
To describe the groups of natural organic compounds and to recognize the natural organic compound on the basis of its structure or structure segment representation.	Exercises, homework, partial exams, written exams, oral exam	A1
To describe the basic characteristics of biological membranes, to list the basic groups of enzymes, to describe the basic properties of metabolic processes, to describe the basic characteristics of photosynthetic processes.	Exercises, homework, partial exams, written exams, oral exam	A1

General competences
Scientific thinking, establishing causal relationships between phenomena.
Acquiring chemical symbolism. Solving simple numeric problems.

Type of instruction

Lectures

Exercises
As a part of the exercises, the chemical and stoichiometric problems that follow the lecture will be solved. The exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:
To hold the lectures and exercises. To create the teaching materials. Creating and holding of the exams and assessment of the students' knowledge. Partial exams, regular written and oral exams and consultations.

Students' obligations:
Regular attendance and active participation in lectures and exercises. Setting up partial exams or exams in regular exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1.5
Exercises (E)	-	-	-	15		0.5
1st partial exam	33.3 %	60-70%	Sufficient (2)			

- physical chemistry (1PE)		71-80%	Good (3)		45	1.5
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2nd partial exam - organic chemistry (2PE)	33.3 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
3rd partial exam - natural organic chemistry, biochemistry (3PE)	33.3 %	60-70%	Sufficient (2)		45	1.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(1PE × 33.3 + 2PE × 33.3 + 3PE × 33.3)/100**		60	150	6

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam* (FE)		*60-70%* *71-80%* *81-90%* *91-100%*	Sufficient (2) *Good (3)* *Very good (4)* *Excellent (5)*			*4*
TOTAL	**100 %**	**FE = (WE × 50 + OE × 50)/100**				

*** The students who do not pass the partial exams during the semester are admitted to the exam in a regular or extraordinary exam period. In such a case, the examination consists of a written and oral part, and both parties participate equally in the final assessment.**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	The attendance is regularly checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
1st partial exam	Partial exam refers to the material processed in the first five lessons. It consists of so-called theoretical and computational tasks.	6th week	Students who pass the 1st partial exam can access the 2nd partial exam.

2nd partial exam	The partial exam refers to the material processed from the 6th to the 10th teaching term.	11th week	Students who pass the 2nd partial exam can access the 3rd partial exam.
3rd partial exam	The partial exam refers to the material processed from the 11th to the 14th teaching term.	15th week	Students who pass the 3rd partial exam are eligible for a final grade of Chemistry with Biochemistry.
Written exam	Written exams are attended by students who have a duly attended and certified semester but have not passed the three partial exams.	Exam terms	-
Oral exam	Students who passed a written exam are invited to the oral exam. The results of the written and oral exams equally participate in the final evaluation of Chemistry with Biochemistry.		-

Obligatory literature

1. On the web-site http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=99 under the subject *Kemija s biokemijom* (ŠP 1001), there are links to the .ppt files of the teaching material (in Croatian)
2. M. Sikirica, B. Korpar-Čolig, Chemistry with Exercises 1, Školska knjiga, Zagreb, 1991, and latter editions (in Croatian)
3. M. Sikirica, B. Korpar-Čolig, Chemistry with Exercises 2, Školska knjiga, Zagreb, 1992, and latter editions (in Croatian)
4. M. Sikirica, B. Korpar-Čolig, Organic Chemistry, Školska knjiga, Zagreb, 1996, and latter editions (in Croatian)

Recommended literature

1. M. Sikirica, Stehiometrija, Školska knjiga, Zagreb
2. V. Rapić, Nomenklatura organskih spojeva, Školska knjiga, Zagreb, 1991.
3. L. Streyer, Biokemija, Školska knjiga, Zagreb, 1991.
4. C.E. Mortimer, Chemistry, 6th edition, Wadsworth Publ. Co, Belmont, CA, 1986

Mathematics

PU1002

ECTS 7

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Azra Tafro, PhD

Associate teacher for exercises
Azra Tafro, PhD

Grading
Sufficient (2) 50%
Good (3) 60%
Very good (4) 75%
Excellent (5) 90%

Course content:

Number sets. Real numbers.
Infimum and supremum of a set.
Inequalities
Functions. Continuity of a function. Limit of a function.
Derivative. Derivations of elementary functions. Differential calculus. Function analysis using differential calculus.
Functions of two variables.
Definite integral. Areas. Indefinite integral. Some integration methods. Applications of integral calculus (areas, volumes, moments, centroid).
Differential equations.
Vectors in a two- and three-dimensional space. Vector operations.
Matrices and matrix calculus.

Type of course:

Mathematics (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpretation of basic notions and facts of sets and functions when solving mathematical problems (graphs of elementary functions, sequence limits, domain of a function, properties of functions, composition of functions, inverse functions, function limits, function continuity).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Applications of derivatives (tangents, elementary and compound function derivatives, derivative rules, function growth and decay, extremes of functions, graphs).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of two variable functions (partial derivatives, extremes).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of indefinite integrals (concept of primitive function and indefinite integral, integrating, basic properties of indefinite integrals, integration methods).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Analysis of definite integrals (basic concepts, Newton-Leibnitz formula, calculating areas of plane figures using definite integrals, calculating the volume of a solid of revolution, centroid coordinates, double integral, first order differential equations).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1
Interpretation of vectors and matrices (vectors in two- and three-dimensional space, operations with vectors, matrices and matrix calculus, determinants).	participating in class problems, solving problems, independently solved homework, midterm and final exam, exam	A1

General competences
Mastering the knowledge and skills needed to follow the coursework of other subjects.
Training to formulate mathematical models and solve practical problems.
Developing abstract and analytical thinking, precision of expression and insight.

Type of instruction

Lectures

Exercises
Exercises serve as an upgrade and addition to knowledge obtained in the lectures. Exercises are auditory.

Working methods:

Teachers' obligations:
Teaching in class – lectures and exercises. Formulating the exercises and tests, as well as grading them. Organizing partial exams, exams, oral exams and office hours. Producing teaching materials.

Students' obligations:
Regular attendance and active participation in class, both in lectures and exercises. Taking partial exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			45	30	2.5
Exercises (E)	-			43	32	2.5
Partial exam 1 (PE1)	50%	50-59%	Sufficient (2)	1	29	1
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-59%	Sufficient (2)	1	29	1
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**PE1+PE2**		90	120	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100%	50-59% 60-74% 75-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**FE**				

*** students who fail to pass the partial exams, but have acquired at least 10% of the total score on those exams, can take the final exam which makes up 100% of the grade. The exam consists of a written and an oral part, and students who achieve at least 50% on the written part can take the oral part of the exam.**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Attendance is checked during class. Attendance and participation are necessary for obtaining the lecturer's signature and taking partial exams and exams.	semester (90 hours of direct lectures)	-
Partial exam 1	Students solve problems from the coursework of the first part of the semester. The exam is in written form. A minimum of 10% of the score on the first partial exam is necessary for obtaining the lecturer's signature and taking the second partial exam and further exams.	8th week	Under extraordinary circumstances and with a valid excuse, the student can take the exam at a later date.
Partial exam 2	Students solve problems from the coursework of the second part of the semester. The exam is in written form. A minimum of 10% of the score on the partial exam is necessary for obtaining the lecturer's signature and taking further exams.	15th week	Under extraordinary circumstances and with a valid excuse, the student can take the exam at a later date.
Written exam	The exam includes coursework from the entire semester. Students who obtained the lecturer's signature can take the exam.	Exam terms	
Oral exam	The exam includes coursework from the entire semester. Students who passed the written exam can take the oral exam. The final grade is obtained by combining the results of the written and oral exams.	Exam terms	

Obligatory literature

1. Bradić T. et al: Matematika za tehnološke fakultete, Element, Zagreb, 1998.
2. Javor, P.: Matematička analiza 1, Element, Zagreb, 2003.

Recommended literature

1. Hitrec,V. : Matematika (analiza funkcija), skripta. Šumarski fakultet, Zagreb, 1986.
2. Hitrec,V. : Matematika (funkcije od dvije varijable, integriranje i primjena), skripta, Zagreb, 1991.
3. Šego, B. : Matematika za ekonomiste, Narodne novine d.d., Zagreb, 2005.

Petrology with geology

PU1003

ECTS 5

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof. PhD Dunja Aljinović
Associate prof. PhD Bojan Matoš

Associate teacher for exercises
Associate prof. PhD Bojan Matoš
Senior assistant, PhD. Duje Smirčić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

In the first part of the course students are getting acquainted with the Earth's interior, lithosphere, minerals and their crystallographic, physical and chemical properties. Mineral structure and systematic minerals is explained.
The concept of rock as mineral association and the genesis of different rock groups (igneous, metamorphic and sedimentary) is explained. Occurrences of different rock groups and their structure and texture are explained. For each group of rocks general classification is explained.
Petrographic part of the course is concluded with processes of rock weathering and erosion in relation to soil formation. The goal is to get the idea of soil formation and pedogenic processes as the introduction for pedologic courses later in the study program.
After the petrological part of the course, basic geological knowledge is being taught for understanding: endogenous and exogenous, physical and chemical processes that influence the geological features, formation of relief, geological structural elements, surface and ground water regimes, formation of morphological features in the karst area, landslides, and geological roll in environmental protection, exploitation of mineral resources and protection of the ground water.

Type of course:

Petrology with geology (compulsory, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the Earth's structure (internal Earth's structure, endogenous processes in the Earth's interior, Earth's crust and lithosphere, tectonic plate theory, rocks, minerals, crystalline, crystal lettuce, crystallographic systems, chemical composition of minerals, petrogenic minerals, formation and physical properties of minerals)	Practical part of the exercises, partial exam, final exam	A1
Analyze igneous, sedimentary and metamorphic rocks (magma/lava, classification of igneous rocks according to their place of formation, chemical and mineral composition, Bowen's sequence, igneous rock bodies, postmagmatic crystallization, basic characteristics of sedimentary rocks, metamorphism, structural and mineral changes in metamorphic rocks, stages of metamorphism).	Practical part of the exercises, partial exam, final exam	A1
Explain the classification systems and principles in the concept of geological time: lithostratigraphical, biostratigraphical, chronostratigraphical and geochronological systems.	Practical part of the exercises, partial exam, final exam	A1
Discriminate primary and secondary (deformation) geological structures in rocks of the Earth's crust.	Practical part of the exercises, partial exam, final exam	A1, C4
Annotate the influence of surface and ground water on mechanical and chemical weathering of minerals and rocks and relief formation.	Practical part of the exercises, partial exam, final exam	B9, C4
Explain the causes of manifestation, array, frequency and intensity of earthquakes and movement on slopes.	Practical part of the exercises, partial exam, final exam	B3, B9, C4

General competences

The program of the course offers the basic knowledge from mineralogy, petrology and geology to forestry students and allows the students to gather the knowledge form**:** basic classifications of minerals and rocks, rock forming processes**,** formation of relief and soils**,** understanding and using the geological map**,** understanding of hydrogeological characteristics of surface and ground water flows**,** role of geology in the environmental protection and planned, sustainable development.

Type of instruction

Lectures

Exercises

Exercises are organized in a practical way, where students are getting acquainted with mineral and rock samples and basic principles of their determination and description. Specific methods of rock and mineral determinations are used, and classification of each rock type is learned. Students are learning basic knowledge in geological mapping: map orientation, recognizing geological principle of mapping and principle for construction of the geological profile.

Working methods:

Teachers' obligations:

Lecturing and textual and graphical presenting (ppt) following the main elements/content related to the basics of petrology and geology. Preparation of exercises and partial exams and their grading. Organizing partial exams, oral exams and consultations. Preparation of lecture material.

Students' obligations:
Regular attendance and active participation on lectures and exercises. Construction and delivery of the program/geological profile in the agreed time. Attending the partial exams, and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	30%	-		30	15	1,5
Partial exam 1 – Earth's interior, minerals, physical properties of minerals and igneous rocks (genesis, classification)	20%	50-62%	Sufficient (2)	1	30	1
		63-75%	Good (3)			
		76-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 – Sedimentary and metamorphic rocks	20%	50-62%	Sufficient (2)	1	30	1
		63-75%	Good (3)			
		76-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 3 – Geology, geological structures, hydrology and hydrogeology	20%	60-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Construction of the geological profile	10%			4	15	0,5
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		37	120	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	60	2
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Attendance of the course is conducted in the beginning of the lectures. Students can be excused from 20% of the total lecture hours.	semester (45 hours of direct lecturer)	-
Attendance of exercise	Exercises are conducted in groups. Each exercise term s practical where students are acquainted first the minerals and rocks, and afterwards with geological structures and a geological map. During the construction of the program (geological profile) students are following the steps and at the end of each term an examination is carried out. In the last term of the exercises students are delivering the correctly constructed program and are getting the signature as a part of the obligation for getting the grade.		In case of any need compensation is planned according to the plan of the course.
Partial exam 1	All students can approach the partial exam. It has 25 points and is graded according to the percentages.	6. week	
Partial exam 2	All students can approach the partial exam. It has 13 points and is graded according to the percentages.	9. week	
Partial exam 2	All students can approach the partial exam. It has 60 points and is graded according to the percentages.	14. week	There is a possibility of a correction of one of the partial exams.
Written exam	Students who did not get the grade through partial exams are approaching the written exam. The exam is composed of the whole course material and has a total of 100 points, 60 of which are for a positive grade.	Exam terms	-
Oral exam	Only students that are participating in the commissioned exam are being tested via oral exam.		-

Obligatory literature

1. Tišljar, Josip: Petrologija s osnovama mineralogije, Zagreb, Rudarsko-geološko-naftni fakultet, 1999.
2. Vrkljan, Maja: Uvod u mineralogiju i petrologiju. Zagreb, Rudarsko-geološko-naftni fakultet, 2012.
3. Pavelić, Davor: Opća geologija. Zagreb, Rudarsko-geološko-naftni fakultet, 2014

Recommended literature

1. Plummer, C.C., McGeary, D., Carlson, D.H. (1999): Physical geology. 8th Edition, WBC – McGrar-Hill Publisher, Boston-Toronto.
2. Vrkljan, M. (2001): Mineralogija i petrologija – osnove i primjena. 1-2017, Udžbenici Sveučilišta u Zagrebu, izd. RGN fakultet, Zagreb.
3. Pavelić, Davor: Opća geologija. Zagreb, Rudarsko-geološko-naftni fakultet, 2014

Applied zoology

PU1004

ECTS 5

English language R1

E-learning R1

Teaching hours 53
Lectures 30
Exercises 15
Field work 8

Lecturer
Prof. Josip Margaletić, PhD

Associate teacher for exercises
Linda Bjedov, PhD
Asst.prof. Marko Vucelja, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students become acquainted with the basic characteristics of the animal kingdom. They become acquainted with the basics of taxonomy and the division of animals into phyla and the morphological, physiological, ecological and etological differences among these. An overview of the lower taxa of the phyla, concentrating in particular on the relevant organisms, which inhabit protected areas (national parks, nature parks, horticultural objects), their biology, ecological role and possible harmfulness. The course emphasizes the importance of animals in the processes of cycling matter and energy and the maintenance of stability and diversity of life in various biotopes.

Type of course:

Applied zoology (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret animal promorphology (importance and meaning of zoology, differences between plants and animals, the division of zoology, the size and form of animals, the plan of animal bodies (promorphology), the position of animals in space and time (ecological, geographic, geological), trophic chains.	Written and oral exam	B3, B4, B9
Present animal phylogeny (inheritance and evolution, animal taxonomy, type of Protozoa, Sarcodine, Mastigophore, Eusporozoa, parasites of humans, insects and other arthropods, type Parazoa, Ameria, Platodes, Turbellaria, Trematodes and Cestodes, Cnidaria, Nematoda, Mollusca organization of Polymeria, Onychophora and Tardigrad - theories about the emergence of insects).	Written and oral exam	B3, B4, B9
Identify the division, morphology, biology and physiology of Arthropoda, Trilobitomorph and Chelicerata (Arachnida, Acarina, Ticks, Annelida, Crustacea, ecological role, land genera in the process of circulating matter, bioindicator value, Tracheata, Myriapoda, Insecta).	Written and oral exam	B3, B4, B9
Present the evolution, anatomy, morphology, physiology and systematics of Vertebrate Classes - Vertebra – Pisces, Amphibia and Reptilia - Anatomy and morphology, role and importance for the forest ecosystem.	Written and oral exam	B3, B4, B9
Present the morphology, biology and physiology of Aves (organ system for movement (bones, muscles), comparison of skeletons of different groups of birds, digestive, nervous, respiratory, urinary system, system of reproductive organs, internal gastrointestinal system, the importance of birds in ecosystems).	Written and oral exam	B3, B4, B9
Present the morphology, biology and physiology of the order Mammalia - mammals (system of motion organs, digestive, nervous, respiratory, urinary system, reproductive system, internal gastrointestinal system, importance and significance of mammals in ecosystems).	Written and oral exam	B3, B4, B9

General competences

The course is based on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures
Exercise
Fieldwork

Working methods:

Teachers' obligations:
Holding lessons – lectures, exercise and fieldwork. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, exercise and fieldwork. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lecture	-	-	-	30	-	1
Exercise	-	-	-	15	15	2
Fieldwork	-	-	-	8	10	0,5
Exam (PE)	100%	60-70%	Sufficient (2)	-	70	2,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			53	95	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		70	2,5
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (30 hours of direct lecturer)	-
Attendance of exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer	-
Attendance of fieldwork	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (8 hours	-

		of direct lecturer	
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam.	Exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	-

Obligatory literature

1. Matoničkin, I., 1981: Beskralješnjaci, Biologija viših avertebrata, Školska knjiga, Zagreb.
2. Oštrec, Lj., 1998: Zoologija, štetne i korisne životinje u poljoprivredi. Zrinski d.d., Čakovec, 232 str.
3. Matoničkin, I., Erben, R., 2002: Opća zoologija, Školska knjiga, Zagreb, 381 str.

Recommended literature

1. Schwenke, W., 1981: Letfaden der Forstoologie und des Forstchutzes gegeb Tiere. Pareys Studientexte 32, Verlag Paul Parey, Hamburg und Berlin, 188 pp.
2. Young, J. Z., 1995: The life of vertebrates, 3rd edn., Oxford University Press Inc., New York, 645 pp.
3. Randal, D., Burggren, W., French, K., 1998: Eckert animal physiology. Mechanisms and adaptations; W. H. Freeman and Company, New York, 825 pp.

Sociology of urban and protected spaces

PU1005

ECTS 3

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Anđelina Svirčić Gotovac, Assistant Professor

Associate teacher for exercises
Anđelina Svirčić Gotovac, Assistant Professor

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 81%
Excellent (5) 91%

Course content:

Explain the phenomenon of urbanization, hyperurbanization in the contemporary world (increase of urban population in the world, urban poverty and urban problems).
Explain the position of Croatia in today's urbanization context, the cause-and-effect relationship between global, national and local (urban) processes.
Inform about the urban-sociological theories and phases of the urbanization process from the beginning of the 19th century to today's postmodern phase.
Interpret the postmodern and information context of today's cities (how information technology allows for new division and evaluation of work (international and interregional).
Analyze the phenomenon of globalization and global (glocal) development in a neoliberal context.
Interpret quality of life in urban systems (objective level - primary and secondary level of equipment of household and neighborhood or immediate environment of housing).
Present the concept of sustainable development (the importance and role of international agreements aimed at resolving the ecological crisis (eg Kyoto Protocol and the Paris Agreement) and environmental footprint.
Analyze the elements of ecological crime (ways and species that lead to the destruction of natural resources by the anthropogenic impacts on the environment, and the role of multinational companies in crisis.
Highlights the importance of urban forestry and urban gardening for the sustainability of today's urban space.

Type of course:

Sociology of urban and protected spaces (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate the definitions and phases of the development of the urbanization process in the contemporary world and the cause-and-effect relationship between global, national and local processes	Seminar papers and presentations, colloquia, written and oral exams	B1
Interpret the postmodern and information context of today's cities and how information technology enables a new division and evaluation of the work of this new migration of the working population. Understand the phenomenon of globalization and global development in a neoliberal context.	Seminar papers and presentations, colloquia, written and oral exams	B3
Understand the concept of sustainable development (Kyoto Protocol and the Paris Agreement). Analyze the state of the ecological crisis and ecological footprint towards environmental sustainability.	Seminar papers and presentations, colloquia, written and oral exams	B5

General competences

Distinguishing and identifying the basic criteria and conditions that define the phenomenon of urbanization and the characteristics of its stage development.
Interpret and understand the postmodern and information context of today's cities.
Understand the concept of sustainable development (the role of international agreements aimed at resolving the ecological crisis, eg the Kyoto Protocol and the Paris Agreement).
Determine the state of the ecological crisis in the context of urban sustainability and positive existing EU models.

Type of instruction

Lectures and seminars

As part of the seminar exercises, there are several examples and topics from the contemporary context of Europe and the world. Seminars are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original classes - lectures, seminars. Designing topics for seminars and workshops and assembling knowledge tests and evaluating them. Holding of colloquia, written and oral exams and consultations. Creation of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and seminars, preparation and presentation of seminar work. Take a colloquium or a written and oral exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students work load outside the direct teaching	ECTS
Lectures (L)	20%			30		1
Exercises (E)	20%	50-60%	Sufficient (2)	15		0,5
		61-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	60%	60-70%	Sufficient (2)	15	30	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy20+Exy20 + PExy60)/100**		45	45	3

Evaluation elements	Maximum points or Share in evaluation	Grade	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-60% 61-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of students is checked and recorded. The student can be legally absent with up to 15% of the hours of direct instruction.	semester (45 hours of direct lecturer)	-
Partial exam	Students can pass the exam through two colloquiums (each bearing 50% of the material exhibited). A colloquium is evaluated and takes part in the final grade of the course.	15. week	-

Written exam	The exam can be attended by students who have a seminar conducted. Students who passed both colloquia do not write a written exam. Students who did not pass both colloquia must write a written exam consisting of 10 essay questions. The written exam is evaluated and is involved in the final grade of the course.	Exam terms	-
Oral exame	tudents who pass a written exam ask questions from different parts of the program content. The final grade from the subject is obtained according to the formula **Vx20+K2x20+PIx60/100**	Exam terms	-

Obligatory literature

1. On the website http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the subject Sociology of urban and protected areas under LECTURE there are links to all lectures made during the semester. The lecturer and the script of the course are Anđelina Svirčić Gotovac.
2. Lewis Mumford (1988). City in History, Naprijed, Zagreb.
3. Jana Šarinić and Ognjen Čaldarović (2015). Contemporary sociology of the city. From "New Urban Sociology" to "Sociology of Urban", Sociološka biblioteka, Naklada Jesenski i Turk, Zagreb.
4. Mike Davis (2011). Planet of Slums. VBZ, Zagreb.
5. Anđelina Svirčić Gotovac (2015). New Housing Estates in the Settlement Network of Zagreb – Community Infrastructure. U: Svirčić Gotovac, A. i Zlatar, J. (Ur.). *Kvaliteta života u novostambenim naseljima i lokacijama u zagrebačkoj mreži naselja*, Institut za društvena istraživanja u Zagrebu, Posebna izdanja, pp. 45-75.

Recommended literature

1. Ivan Cifrić (2003). Environment and sustainable development - environmental vulnerability and landscape aesthetics, HSD, Zagreb.
2. David Harvey (2013). Short History of Neoliberalism. VBZ, Zagreb.
3. Anđelina Svirčić Gotovac and Jelena Zlatar (2015). Urban Processes in Zagreb. Residential and Commercial Developments., *Geografski glasnik*, Vol. 77/1, pp. 29-45.

History of Landscape Architecture

PU1007

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 15
Exercises 30

Lecturer
Prof. Mladen Obad Šćitaroci, PhD

Associate teacher for exercises
Prof. Mladen Obad Šćitaroci, PhD
Marko Rukavina, PhD
Ana Sopina, teaching assistant

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The course gives an overview of the history of landscape architecture in the world and in Croatia, in the context of general history of art. The history of landscape architecture is presented as a part of general culture and from the standpoint of the aesthetics and artistic composition.
Themes: Introduction to the course and landscape architecture. Contemporary landscape architecture. Landscape architecture of the Antiquity and the Middle Ages. Islamic tradition of landscape architecture. Italian Renaissance and Mannerist gardens. Dubrovnik Renaissance gardens. French Renaissance and Baroque gardens. English landscape park. Public parks of the 19th century. Maksimir Park in Zagreb. Landscape architecture of the 20th century (Art Nouveau and Modernism). Chinese tradition of landscape architecture. Traditional landscape architecture of Japan. Gardens and parks heritage of Croatian towns. Parks of Croatian castles and manors.

Type of course:

History of Landscape Architecture (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to describe the development of landscape art from Antiquity till the end of the 19th century (ancient and medieval gardens, Islamic, Chinese, Japanese, Italian, French and English landscape architecture tradition);	written and oral exam	B4
to interpret the characteristics of landscape formation in the 20th and 21st century as well as modern and contemporary landscape architecture;	written and oral exam	B4
to analyse landscape heritage of Zagreb and Croatia (Dubrovnik renaissance park, Maksimir park in Zagreb, castle parks and garden and park heritage of Croatian towns);	written and oral exam	B4
to describe public town parks in Europe and the world (19th and 20th century).	written and oral exam	B4

General competences
By taking these course students gain an insight into the historical development of landscape architecture, with a special emphasis on artistic, aesthetic and functional values of the selected examples. Architecture of gardens and parks is considered in the context of history and its architectural and urban context.

Type of instruction

Lectures

Exercises
Besides lectures, students are also asked to make papers consisting of an analysis of selected examples of parks in Croatia and in the world. The papers consist of on-site surveys and literature analysis. These papers are the basis for the exam.
Field work consists of study visits to selected parks, primarily in Zagreb and possibly in other Croatian towns. It consists of an on-site analysis of park composition and of elements of protection of historic parks. The parks in Zagreb are: Maksimir, park squares of the «Green Horseshoe», Ribnjak, Kresimir park, Jarun, landscape architecture of residential neighbourhoods in Novi Zagreb.

Working methods:

Teachers' obligations:
Direct teaching - lectures and exercises. Designing and planning exercises, devising knowledge tests and grading them. Administering written and oral exams and holding consultations if necessary. Creating teaching materials.

Students' obligations:
Regularly attending and actively participating in lectures ad exercises, creating and submitting a seminar paper in the given period. Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	1
Exercises (E)	20%	60-70%	Sufficient (2)	30	20	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	40	2
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of rules for preparing, implementing and taking midterm exams, seminar papers, partial exams and written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	Students' attendance is checked and recorded in classes. Student can be absent with a reason from 15% of direct classes at the most.	Semester (45 hours of direct teaching)	-
Creation of exercises	Students create short seminar papers on their own in which they analyse the chosen examples of parks in Croatia and the world (field work analysis and the analysis of examples from literature) and present them according to the arranged schedule. If the seminar grade is insufficient or the seminar has not been presented, it can be submitted subsequently within the arranged time period (under the condition that the student was not absent from classes more than is allowed).	According to the arranged schedule	Exceptionally, in case of a valid reason, a student can compensate for being absent by creating a field work report with photo documentation to prove it.
Written exam	The exam can be taken by students who have completed the exercises. Students answer the given questions on a printed exam prepared in advance. The written exam is graded and included in the final grade for the course. The written exam consists of a combination of drawing and theory tasks/questions. Drawings are done by hand.	Exam period	-

	To pass the exam it is necessary to have 60 out of 100 points in total (60%).		
Oral exam	Students who pass the written exam get questions from different parts of the course content. Final grade for the course is calculated based on the following formula: **(FEx80+Ex20)/100**	-	-

Obligatory literature

1. PERIVOJNA ARHITEKTURA - PREDAVANJA KOLEGIJA I SAŽETCI PREDAVANJA, digital base of lesson notes of the Faculty of Forestry / PDF in the course library
2. Bojanić Obad Šćitaroci, Bojana; Obad Šćitaroci, Mladen (2004.) GRADSKI PERIVOJI HRVATSKE U 19. STOLJEĆU – JAVNA PERIVOJNA ARHITEKTURA HRVATSKIH GRADOVA U EUROPSKOM KONTEKSTU, Zagreb: «Šćitaroci» and Faculty of Architecture University of Zagreb, ISBN 953-97121-3-0
3. Obad Šćitaroci, Mladen (1997) VRTOVI, PERIVOJI I PARKOVI, Tehnička enciklopedija, 13: 566-577, Zagreb: Leksikografski zavod Miroslav Krleža
4. Obad Šćitaroci, Mladen; Kovačević, Maja Anastazija (2015) ARBORETUM TRSTENO – PERIVOJ RENESANSNOG LJETNIKOVCA, Art Bulletin, 64: 101-132. / PDF in the course library
5. Maruševski, Olga; Jurković, Sonja (1992) MAKSIMIR, Zagreb: Školska knjiga, ISBN 86-03-00523-0

Recommended literature

1. Cresti, Carlo (1970) LE CORBUSIER, Zagreb / Ljubljana / PDF in the course library
2. Horvat, Jesenko (2015.) MODERNI GRAD – ISHODIŠTA SUVREMENOGA URBANISTIČKOG PLANIRANJA, Zagreb: Faculty of Architecture University of Zagreb, ISBN 978-953-8042-03-4. / PDF in the course library
3. Jellicoe, Geoffrey and Susan (1987) THE LANDSCAPE OF MAN, London: Thames and Hudson
4. Johnson, C. (2008) GREEN MODERNISM: THE IRONY OF MODERN GARDEN CITIES IN SOUTH-EAST ASIA, 44th ISOCARP Congress / PDF in the course library
5. Knežević, Snješka (1996) ZAGREBAČKA ZELENA POTKOVA, Zagreb: Školska knjiga, ISBN 953-0-60-524-2
6. Le Corbusier (1929) A CONTEMPORARY CITY, The City of To-morrow and Its Planning, Courier Corporation, 1987 / PDF in the course library
7. Montavon, M.; Steemers, K; Cheng, V.; Compagnon, R. (2006) LA VILLE RADIEUSE BY LE CORBUSIER – ONCE AGAIN A CASE STUDY, The 23rd Conference on Passive and Low Energy Architecture, Geneva, 2006 / PDF in the course library
8. Mlinar, I. (2014) REMETINEČKI GAJ – POČETAK SUSTAVNE URBANIZACIJE NOVOZAGREBAČKOG PODRUČJA, Faculty of Architecture University of Zagreb / VB
9. Obad Šćitaroci, Mladen (1991, 1993, 2005) DVORCI I PERIVOJI HRVATSKOGA ZAGORJA, Zagreb: Školska knjiga, ISBN 953-0-60525-0
10. Obad Šćitaroci, Mladen (1992) HRVATSKA PARKOVNA BAŠTINA - ZAŠTITA I OBNOVA, Zagreb: Školska knjiga, ISBN 86-03-00085-9
11. Obad Šćitaroci, Mladen; Bojanić Obad Šćitaroci, Bojana (1998) DVORCI I PERIVOJI U SLAVONIJI – OD ZAGREBA DO ILOKA, Zagreb: «Šćitaroci», ISBN 953-97121-0-6
12. Obad Šćitaroci, Mladen; Bojanić Obad Šćitaroci, Bojana (2003) VRBANIĆEV PERIVOJ U KARLOVCU – STUDIJA ZAŠTITE I OBNOVE PERIVOJA, Zagreb: «Šćitaroci» and Faculty of Architecture University of Zagreb, ISBN 953-97121-2-2
13. Scott, J.C. (1998.) THE HIGH-MODERNIST CITY: AN EXPERIMENT AND CRITIQUE, Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed, Yale University Press / PDF in the course library
14. Trkulja, Tanja; Aleksić, Dubravko (2012) RELATIONSHIP BETWEEN LANDSCAPE DESIGN AND ART IN THE WORK OF ROBERTO BURLE MARX, Prostor, 20(44): 368-379. / PDF in the course library

Physical and health education

ECTS points 0

English R1

Teaching hours 60
Exercises 60

Leader of exercises
Sen. Lec. Davor Pavlović

Evaluation
Continuous monitoring of presence and participation in exercises and the acquisition of motor skills of kinesiology.

Course contents:

The Physical and health programs at the Faculty of Forestry of the University of Zagreb are carried out as:

- Basic programs,
- Special programs,
- Programs for students with special needs
- Elective programs for students of senior years.

Teaching is carried out by choice of students of a particular teaching unit and content that is a part of one of the above programs. The aim of this course is the acquisition of theoretical and practical kinesiological knowledge with the purpose of training students for independent physical exercise. At the same time, students are informed about the importance of health education in order to preserve and improve health, the harmfulness of various forms of addiction to health, in particular the impact on intellectual efforts and physical exercise.
Students acquire knowledge about the importance of quality nutrition and the most interesting results of previous research carried out on the student population in the health segment (prevention, diseases, diet, diagnostics, stress, physical activity as a relaxation agent).

Types of classes:

Physical and health education (compulsory elective course, 1^{st} – 4^{th} semester)

Learning outcomes and methods of verification

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the structure of the physical exercise class.	exercises, correction and evaluation exercises	D1
Explaination of the impact of physical exercise on health.	exercises, correction and evaluation exercises	D1
Choose fitness exercises designed to strengthen individual muscle groups.	exercises, correction and demonstration	D1
Demonstrate specific exercises with regard to kinesiologic activity.	exercises, structural analysis, assistance, correction and evaluation exercises	D1
Organize constructive free time	Exercises and evaluation exercises	D1
Assess personal diet and physical exercise habits.	exercise, diet diary correction and evaluation exercises	D1
Demonstrate general preparatory exercises and stretching exercises.	exercises, description, demonstration, correction	D1
Understanding kinesiology programs and their target orientation.	vježbe, korekcija i vrednovanje vježbi	D1
Control emotions and strengthen self-control.	Exercises, correction	D1

Type of instruction:

Field work
Practical exercises in different sports facilities depending on the choice of activity

Lectures
Health care for students

Exercises
Practical exercises from basic, special or elective programs in different working conditions, with the option to apply different trainers and aids

Working methods:

Teacher responsibilities:
Teaching - exercise and consultation with students, professional training of teachers, organization and preparation of sports teams and organization of faculty sports competitions. Creating teaching materials.

Student responsibilities:
Regular attendance and active participation in exercises.

Reccomended literature:

1. Bos, K. (2004.) Walking to health, Mozaik knjiga
2. Colwin, C., M. (1998). Swimming for the 21st Century, Gopal d.o.o.
3. Cook, B., C. (1996) Strength Basics. Your Guide to Resistance Training for Health and Optimal Performance, Human Kinetics
4. Ćurković, S. (2010). Kinesiological Activities and Risk Behavior of Students, Dissertation. Faculty of Kinesiology, University of Zagreb
5. Janković, V. i Marelić, N. (1995). Volleyball, Faculty of Physical Culture in Zagreb

6. Neljak, B. i Caput-Jogunica, R. (2012) Kinesiology Methodology in Higher Education, Faculty of Kinesiology, University of Zagreb
7. Pavlović, D.(2010.) Script for Students of the Faculty of Forestry of the University of Zagreb
8. Sertić, H. (2005.) The Basics of Martial Arts, Faculty of Kinesiology, University of Zagreb
9.Šatalić, Z.(2016.) Sports nutrition, Znanje d.o.o, Textbooks of the University of Zagreb
10. Šnajder, V. (1995) From start to finish, Školske novine, Zagreb
11. Proceedings International Scientific Conference on Kinesiological Recreation and Quality of Life, ur. M. Andrijašević (2008) Faculty of Kinesiology, University of Zagreb

Botany

PU2001

ECTS 7

English language R1

E-learning R1

Teaching hours 99
Lectures 45
Exercises 30
Field work 24

Lecturer
Prof. dr. sc. Jozo Franjić
Prof. dr. sc. Željko Škvorc

Associate teacher for exercises
Doc dr. sc. Daniel Krstonošić
Doc. dr. sc. Krunoslav Sever
Doc. dr. sc. Martina Temunović

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction – history and division of botany. Plant anatomy, use of a microscope. Basic characteristics and structure of a plant cell. Types of tissue that form plant tissue and their characteristics. Anatomical structure of vegetative plant organs, basic classification of leaves, shedding of leaves, structure of monocotyledon and dicotyledon-gymnosperm stem. Anatomical structure of wood, anatomical structure of bark, anatomical structure of the root. Phylogenetical development of stele. Historical development of plant classification, methods of phylogenetical classification, classification units (taxons), taxonomy and nomenclature of plants. Systematic division of the wildlife world and basic characteristics of specific groups – Virota, Procaryota, Bacteriobiota, Eucaryota, Vegetabilia. General characteristics of plants, reproduction of plants. Basic characteristics of fungi and their role in the ecosystem. Morphologic and anatomical structure of fungi. Fungi reproduction and nutrition. Systematic classification of real fungi and basic characteristics of specific groups: Archimycotina, Siphonomycotina - Oomycetes, Zygomycetes. Septomycotina: Ascomycetes - Protoascomycetidae, Plectomycetidae, Discomycetidae, Basidiomycetes - Phragmobasidiomycetidae, Holobasidiomycetidae. Systematic classification of plants and basic characteristics of particular groups: Rhyniophyta, Bryophyta – mosses, Lycopodiophyta – club-mosses, Equsetophyta - horsetails, Polypodiophyta - ferns. Systematic classification and basic characteristics of specific groups of gymnospermae. Ontogenetical development of conifers. Angiospermae, morphologic structure of angiospermae, structure of vegetative organs – root, stem, leaf. Structure of reproductive organs – flower, seed, fruit. Ontogenetical development of angiospermae. Systematic classification of angiospermae and basic characteristics of specific families.

Type of course:

Botany (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To present the plant cell structure and function and plant function and plant histology (cytology, cytoplasm, plastids, mitochondria, cell wall, pits, cell nucleus, chromosomes, DNA, mitosis, meiosis, primary, secondary meristems, phellogen, vascular cambium, permanent or final cells, dermal and vascular tissue).	Practicum, Preliminary exam	B1
To interpret the anatomy of vegetative plant organs (leaf, stem structure, tree structure of Gymno- and Angiosperms, bark anatomy, root anatomy, phylogeny of stele).	Practicum, Preliminary exam	B1
To present plants systematics and systematic life division (systematic units (taxa), artificial and phylogenetic systems, plant evolution, speciation, hybridization, plant propagation, general characteristics and division of Cormophyta).	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Pteridophyta.	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Gymnosperms.	Preliminary exam	B1
To explain the general characteristics, systematic division, morphology and ontogenetic development of Angiosperms (vegetative and reroductive plant organs, function, basic forms, plant organs transformations)	Practicum, Preliminary exam	B1
To show the most important families and genera of the Croatian flora with emphasis on endangered and protected species (diversity, taxonomic status, distribution, significance).	Preliminary exam	B1

General competences
Students are introduced to basic botanical terms which are the base for senior-year courses. Furthermore, they are introduced to a great diversity of the world of plants, fungi and microorganisms, as well as to basic characteristics of particular groups of classification. All of that develops their understanding of the functioning and r ole of particular parts of different ecosystems they will work in after their graduation.

Type of instruction:

Lectures

Exercises
As part of laboratory exercises, practical exercises in plant anatomy using microscopes are carried out. In addition, laboratory as well as field exercises in morphology and determination of plants are carried out. Exercises serve as an upgrade to the knowledge adopted in lectures.

Field work
Field work is carried out in order to introduce students to the plants characteristic for individual ecosystems and to make herbarium collections for the purpose of learning and passing the exam. During field work, practical work on plant collection, herbarium technique

and plant identification is carried out. Field teaching is performed in groups and is carried out in the most significant forest plant communities present in the Republic of Croatia.

Working methods:

Teachers' obligations:
Performing original teaching - lectures, exercises, field works. Compiling and evaluating of knowledge tests. Examination and evaluate Herbar collections. Providing preliminary exams, oral exams and consultations. Production of teaching materials

Students' obligations:
Regular attendance and active participation in lectures, exercises and field works. Making herbarium collection. Passing preliminary exams and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	10%	Partly messy and incomprehensible, with major corrections	Sufficient (2)	30	0	1
		Orderly, legible, with major corrections	Good (3)			
		Orderly, legible, with minor corrections	Very good (4)			
		Orderly, legible, correct	Excellent (5)			
Field work (FW)	-	-	-	24	-	1
Herbarium (H)	10%	Partly messy, some plants were poorly herbarized, with major corrections, minimum number of plants	Sufficient (2)	-	15	0,5
		Orderly, plants properly herbarized, with major corrections, minimum number of plants	Good (3)			
		Orderly, plants properly herbarized, with minor corrections, more than minimum number of plants	Very good (4)			
		Orderly, plants properly herbarized, correct, significantly more than minimum number of plants	Excellent (5)			
Partial exam - plant	10%	60-70%	Sufficient (2)	-	15	0,5
		71-80%	Good (3)			

determination (PE1)		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - plant anatomy (PE2)	20%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - plant systematics (PE3)	20%	60-70%	Sufficient (2)	-	20	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - final(PE4)	30%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E*10+H*10+PE1*10+PE2*20+PE3*20+PE4 *30)/100**		99	110	7

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures+exercies+field works	The attendance of students is checked and recorded at the lectures. The student can justifiably be absent with a maximum of 20% of lectures and 10% of the exercises. Field work must be done in 100% amount. Exercises are attended in groups. On the web site students can see the template of the folder and worksheet which they are required to prepare and have on the exercises. Students are required to have the lab equipment listed on the web pages, which is also presented at the first lessons. Before the first exercise, students are required to study the template script about microscopy that can be downloaded from the web site. Prior to field work, students are required to study the instructions about collecting and herbarizing plants that can be downloaded from the web site which is also presented at the lectures.. For field	semester (99 hours of direct lecturer)	Exceptionally, in the case of a justified reason, the student compensates the absence of the individual exercise

	work, they must prepare a field folder with papers for collecting plants.		
Makeing exercises	Evaluated are accuracy, regularity and active participation in the exercises.	in accordance to the agreed deadline	
Making herbarium collection	Students are obliged to make herbarium collection according to the instructions presented during lectures and field work and that are also listed on the web site. The template for the field folder and herbarium labels should be downloaded from the web site. The accuracy, the orderliness and the quality of the herbarium are evaluated. Herbarium should contain at least 150 plants systematically sorted by families. The herbarium collection should be reviewed and positively evaluated prior to takeing the final exam	in accordance to the agreed deadline	
Partial exam in plant recognition (PE1)	Students have to recognize plant species from photographs. The accuracy of the recognition and pronunciation of the Latin names of plants is evaluated.	in accordance to the agreed deadline and exam schedule	
Partial exam in plant anatomy (PE2)	Partial exam can be accessed by students who have passed the pre-exam in recognition of plants (PE1). The partial exam consists of a written and oral part. The written part consists of 10 questions to which the students answer textually or by anatomical drawings of individual plant parts.	After 10th week in accordance to the agreed deadline and exam schedule	
Partial exam in plant systematics (PE3)	Partial exam can be accessed by students who have passed the pre-exam in plant anatomy (PE2). The partial exam consists of a written and oral part. The written part consists of 15 questions.	in accordance to the agreed deadline and exam schedule	
Partial exam – final (PE4)	Final exam can be accessed by students who have passed all the previous partial exams and have positively evaluated exercises and herbarium collection. The partial exam consists of a written and oral part. The written part consists of 15 questions. If during the academic year the students do not pass the final exam, in the new academic year, they must re-submit the partial exams (PE1-PE3) before takeing the final exam. The final grade of the subject is obtained according to the formula: **V*10 +** **H*10+K1*10+K2*20+K3*20+ZK*30/100**	in accordance to the agreed deadline and exam schedule	

Obligatory literature

1. Franjić, J., Ž. Škvorc, 2010: Šumsko drveće i grmlje Hrvatske. Šumarski fakultet Sveučilišta u Zagrebu, 432. str.
2. Franjić, J., Ž. Škvorc, 2014: Šumsko zeljasto bilje Hrvatske. Šumarski fakultet Sveučilišta u Zagrebu, 626. str.
3. Vidaković, M., J. Franjić, 2004: Golosjemenjače. Sveučilište u Zagrebu-Šumarski fakultet. Zagreb.
4. Franjić, J., 1998: Praktikum iz anatomije bilja (interna skripta), 1-22. Zagreb.
5. Franjić, I., Škvorc, Ž., Trinajstić, I., 2008: Anatomija bilja (interna skripta), 1-63. Zagreb.
6. Trinajstić, I., 1976: Sistematika bilja (opći dio, bakterije i gljive), (interna skripta), 1-43. Zagreb.
7. Trinajstić, I., 1976: Sistematika bilja (Embriobyonta), (interna skripta), 1-117. Zagreb.

Recommended literature

1. Alegro, A. i sur. 2010: Botanički važna područja Hrvatske. Školska knjiga, Zagreb
2. Nikolić, T., Milović, M., Bogdanović, S., Jasprica, N., 2015: Endemi u Hrvatskoj flori. Alfa d.d., Zagreb.
3. Nikolić, T., 2017: Morfologija biljaka. Alfa d.d., Zagreb
4. Nikolić, T., 2013: Sistematska botanika - raznolikost i evolucija biljnog svijeta. Alfa d.d., Zagreb
5. Nikolić, T., 2013: Praktikum sistematske botanike - raznolikost i evolucija biljnog svijeta. Alfa d.d., Zagreb.
6. Šugar, I., 1990: Botanički leksikon. Globus Zagreb.
7. Nikolić, T., 1996: Herbarijski priručnik, Školska knjiga. Zagreb.
8. Domac, R. 1994: Flora Hrvatske. Priručnik za određivanje bilja. Školska knjiga, Zagreb.
9. Nikolić, T. (ur.) 2019: Flora Croatica Database (URL http://hirc.botanic.hr/fcd). Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu.

Soil Science

PU2002

ECTS 6

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof. dr. sc. Nikola Pernar
Prof. dr. sc. Darko Bakšić
Doc. dr. sc. Ivan Perković

Associate teacher for exercises
Prof. dr. sc. Darko Bakšić
Prof. dr. sc. Nikola Pernar
Doc. dr. sc. Ivan Perković

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

The curriculum of Soil Science is realized through lectures, practical part and field courses.
The curriculum of lectures can be divided into 5 parts, or 9 methodological units (including the exercises and field courses) for which the learning outcomes are expressed. The first, introductory part gets students acquainted with the subject and aims of soil science, development of soil science and specific soil qualities of various ecosystems. The second part elaborates the genesis of soil in nature. Generally speaking, the second part elaborates soil-forming processes. Moreover, this part is about the sources of soil mineral compound – weathering of rocks and minerals and characteristics of products of weathering. Organisms as the source of organic soil matter and its decay, and products of decay – transformations and cycling of matter in soil-plant system are elaborated separately. The third part elaborates soil characteristics as anisotropic and polydisperse natural body: physical characteristics; sorption characteristics; physical aspects of water in the soil; heat characteristics of soil and chemical aspect of water in the soil – soil solution. The fourth part, after students have acquired basic, general knowledge of soil, elaborates the migration processes in the soil, specific soil-forming processes, soil-forming factors, and soil evolution and profile morphology. The fifth part elaborates soil classification and provides the overview of the characteristics of main taxonomic units.

Type of course:

Pedology (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compare the role of soil and pedosphere. Identify the global significance of soil. Interpreted the specificity of forest soil.	partial examination, laboratory exercises, full examination	D1
Group primary soil minerals and compare their properties. Group the most usually rocks and compare their properties that are most important to soil properties. Explain to weathering of minerals and rocks. Explain the properties of rocks and minerals.	partial examination, laboratory exercises, full examination	D1
Enumerate and classify the most important soil organisms. Describe the accumulation of organic residues - quantity and quality. Describe the method of degradation of organic residues and the formation of humus. Describe composition and properties of humus. Analyze a soil humus acidity and character of humus	partial examination, laboratory exercises, full examination	A3, B4, B8, D1
Describe biological circulating of matter and role of soil. Identify specific cycles of some biogenic elements. Explain the principles of soil sorption. Explain the composition and role of the colloidal complex of soil. Analyze the sorption characteristics of soil.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1
Explain the solid soil phase composition. Enumerate and distinguish the properties of mechanical particles of soil. Particle size distribution and soil structure Enumerate and distinguish the properties of shapes and elements of the soil structure. Soil porosity and soil densities. Enumerate and explain the soil consistency indicators.	partial examination, laboratory exercises, full examination	A3, B4, B8
Natural dynamic water in soil. Describe water forms in soil. Analyze the soil water constants. Explain quantity and quality of soil air. Analyze soil air capacity. Explain thermal properties of soil. Explain chemical properties of soil solution. Analyze and interpret soil reaction. Explain the significance and nature of the redox potential of the soil. Describe the dynamics of biogenic elements in the soil solution	partial examination, laboratory exercises, full examination	A3, B4, B8
Soil-forming factors. Identify the nature of some soil-forming factors in Croatia. Enumerate and explain some soil-forming processes. Identify the role of sol-forming factors and processes on a specific soil profile.	partial examination, laboratory exercises, full examination	B4, B8
Soil horizons. Explain the properties of some soil horizons. Soil classification system. Enumerate the sections, classes and types of soil.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1

Explain the basic characteristics of the most important soils at the class level and type of soil. Classify soil according to taxonomic affiliation.		
Explain the plan, ways and purpose of soil sampling. Explain a representative soil samples. Describe the types of soil samples. Describe sampling and mark of soil samples. Enumerate and describe field observations of soil parameters.	partial examination, laboratory exercises, full examination	A3, B4, B8, D1

General competences
Interpretation of pedogenic relations in some area. Soil sampling, cooperation in the implementation of laboratory analyzes and interpretation of analysis results. Interpretation of pedophysiographic features in forming economic measures. Understanding the physiographic properties with the application in optimizing soil fertility.

Type of instruction

Lectures
The lectures are realized in blocks-hours in one of the major classroom. They are based on PP presentations and correspond to a material in the text-book.

Exercises
Exercises are the upgrading of knowledge adopted in lectures and there are platforms for understanding individual chapters. During laboratory exercises students perform 18 practical exercises on which they prepare a report on the exercises. Exercises are performed in the Ecological-Pedologycal laboratory in small groups (8 students in group).

Field courses
Field courses maintains close to the Faculty (Maksimir or Dotršćina) with goal to present the relationship between soil-forming factors, understanding of the general soil morphology, present soil sampling (soil profile, sounding, composite and individual samples) and description of morphological properties of the soil.
The second part of field work maintains in the mountainous area (Medvednica or Samoborsko gorje) and in the lowland area (near Zagreb), where students present different relationships of soil-forming factors, different physiographic features and different soil type, specialty in terms of using his roles.

Working methods:

Teachers' obligations:
Teaching - lectures, exercises, field courses.
Designing topics for seminar task, compiling knowledge tests and evaluating them.
Observations of written and oral exams and consultations.
Creating teaching materials.

Students' obligations:
Regular attendance and active participation on lectures, exercises and field courses;
preparation of exercises report and preparation and presentation of seminar work (possibly).
Partial and/or full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	30	1,5
Laboratory Exercises (LE)	10 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	30	1,5
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time; commitment to exercises	Very good (4)			
		Clean, easy, accurate and timely; an emphasis on exercises	Excellent (5)			
Field courses (FC)				24	6	1
Exam (E)	90 %	50-60 %	Sufficient (2)	4	56	2
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Vx10 + K2x15 + PIx75)/100**		88	92	6

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	On the lectures is checked the students presence.The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	Semester (30 hours of direct teaching)	-
Laboratory Exercises (LE)	Exercises are attended by groups. 18 practical exercises are performed. At the beginning of the exercise, students receive a report template. The accuracy, regularity and the engagement in the exercises are evaluated.	According syllabus and agreement with the students	In the case of a justified reason, the student draws up absence from the particular exercise term
Field courses (FC)	Field work is performed in groups during the second half of the semester, and the terms are published at the beginning of the semester.	Second half of the semester.	-
Partial exam (PE)	Students can take the exam in two parts (partial). The first part takes place after ~ 60% of theoretical	Agreement with the	-

	teaching, and the term is agreed with the students .The exam consists of a written and oral part (the written part of the exam must be passed for oral instruction), and it is about 60% of the subjects provided by the theoretical program. Partial exams can be accessed by students who have no more than one absence from the lectures. Those students who take the first partial exam will also take the second part of the exam on some of the regular test terms by the end of the current academic year. The arithmetic mean of the two grades represents the grade of the exam that) gives the final grade.	students in second half of the semester.	
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade.	Published test deadlines.	-

Obligatory literature

1. Pernar, N., 2017: Tlo; nastanak, značajke, gospodarenje. Šumarski fakultet, Zagreb, XVIII + 799 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Scheffer, F. & P. Schachtschabel, 2010: Lehrbuch der Bodenkunde. 16. Auflage, neu bearbeitet und erweitert von Blume et al. Spektrum Akademische Verlag Heidelberg, Berlin, 578 p. (neubearbeitet von H. P. Blume, G. W. Brümmer, H. Fleige, R. Horn, E. Kandeler, I. Kögel-Knabner, R. Kretzschmar, K. Stahr & B.-M. Wilke).
2. Blume, H. P., G. W. Brümmer, H. Fleige, R. Horn, E. Kandeler, I. Kögel-Knabner, R. Kretzschmar, K. Stahr & B.-M. Wilke, 2016: Scheffer/Schachtschabel Soil Science.Springer, 629 p.

Biometrics for spatial valorizations

PU2003

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0

Lecturer
Professor Anamarija Jazbec, PhD

Associate teacher for exercises
Assistant professor Ernest Goršić, PhD
Assistant professor Mislav Vedriš, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basic biometric terms (observations, data, population). Types of variables. Graphical tools. Descriptive statistics. Frequency table. Measures of central tendency. Measures of position. Measures of variation, asymmetry and skewness. Normal distribution. Binomial distribution. Normal approximation to a binomial distribution. Sampling methods. Central limit theorem. Estimators. Standard error. Confidence interval. Interval estimation of the mean and proportion. T-distribution. Hypothesis testing and inference. Testing expected value. Testing proportion. Testing variances. F distribution. Testing means from two samples. Testing proportions from two samples. Paired t-test. $\chi 2$ distribution. Chi-square test.

Type of course:

Biometrics for spatial valorizations (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain types of variables: numeric (continuous and discrete) and categorical (dichotomous, ordinal i nominal); graphical presentation and frequency tables, classification of graphs according to data types: bar chart, histogram, frequency polygon, line chart, pie chart, scatterplot, stem-and-leaf plot, Box-Whisker plot; relative frequencies, cumulative absolute and cumulative relative frequencies, calculation and analysis	2 partial exams, Written and oral final exam	A1
Describe measures of central tendency and measures of position (arithmetic mean, geometric mean, harmonic mean, quadratic mean, minimum, maximum, median, lower and upper quartile, mode)	2 partial exams, Written and oral final exam	A1
Explain measures of variation (data range, interquartile range, standard deviation, variance, coefficient of variation)	2 partial exams, Written and oral final exam	A1
Interpret theoretical distributions or models of population distributions (normal Gaussian distribution, Student's t-distribution, binomial distribution, chi-square distribution, F-distribution, definition of density function and distribution function, calculating probability (area) under the density function for normal and t-distribution, calculating probability for binomial distribution, normal approximation to the binomial distribution)	2 partial exams, Written and oral final exam	A1
Explain point estimates of arithmetic mean, variance and proportion (central limit theorem, sampling distribution, standard error) Distinguish population parameters from their sample estimates; estimate population arithmetic mean (expected value), variance and proportion based on the sample	2 partial exams, Written and oral final exam	A1
Present hypothesis testing of arithmetic mean and proportion (rules and procedure of testing, type I (α) and type II (β) errors, power of the test (1- β), testing (assumed constant) arithmetic mean and proportion of population	2 partial exams, Written and oral final exam	A1
Present interval estimates of expected value and proportion, testing of proportion, variances (F-test) and arithmetic mean (Student t-test) from two independent samples and testing difference of arithmetic means from two dependent samples (paired t-test)	2 partial exams, Written and oral final exam	A1
Present analysis of observed and expected frequencies for categorical variable using chi-square test	2 partial exams, Written and oral final exam	A1

General competences

Collect and organize data, statistically analyse, present and interpret analysed data.
Discuss and make conclusions based on analysed data

Type of instruction

Lectures

Exercises

Exercises complement subject exposed in lectures. During exercises, students work out numerical examples by computer and hand calculation as a preparation for the written exam.

Each student gets additional individual assignments for work at home that are reviewed by associate teacher.

Working methods:

Teachers' obligations:
Direct teaching – lectures and exercises. Designing and reviewing the student assignments. Composing and evaluating written exams. Carrying out oral exams and consultations. Designing and composing of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preapering, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	15	1,5
Exercises (E)				30	45	2,5
2 Partial exams (PE)	100%	65-74	Sufficient (2)	4	26	1
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
Final exam (FE)	100%	60-70	Sufficient (2)	3	-	-
		71-80	Good (3)			
		81-90	Very good (4)			
		91-100	Excellent (5)			

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance is checked for all students during the semester. Each student is allowed to be absent up to 4 hours of lectures and 4 hours of exercises.	End of semester	-
Partial exam	Two partial exams are carried out, each with 5 assignments and resulting maximum 100 (2*50) points. Minimum 65 points (20 points per exam) can substitute the final exam.	During semester	-
Written exam	Students that meet attendance criteria can access to the written exam. Written part consists of 5 assignments making maximum total 100 points.	Exam terms	-

Oral exam	Students that pass written part can access the oral exam.	Exam terms	-

Obligatory literature

1. Biometrika course on e-learning system Merlin: https://moodle.srce.hr/2018-2019/course/view.php?id=36293
2. Jazbec, A., 2009: Osnove statistike, Šumarski fakultet, Zagreb

Recommended literature

1. Pranjić, A., 1986: Šumarska biometrika,. Šumarski fakultet, Zagreb, 204 pp.
2. Sokal, RR., Rohlf, FJ., 1995: Biometry. Freeman and Company. New York. 880 pp.
3. Prodan, M., 1961: Forstliche Biometrie., BLV München, 432 pp.
4. Kozak, A., Kozak, R., Staudhammer, C., Watts, S., 2008: Introductory probability and statistics: Applications for forestry and natural sciences. CABI International, 408 pp.

Ground surveying with fundamentals of cartography

PU2004

ECTS 5

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof.dr.sc. Renata Pernar

Associate teacher for exercises
Doc.dr.sc. Mario Ančić
Dr. sc. Jelena Kolić

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The curriculum of the subjects of Ground surveying with fundamentals of cartography is realized through lectures, exercises and field teaching. The subject is conceived so that during lectures and laboratory work, as well as by means of practical reports (programs), students are dealing with themes regarding ground surveying. The teaching includes: fundamentals of elevation and orthogonal projection; measuring units, norms, errors during measuring; methods for surveying of points, lengths, angles, surfaces, height differences; measuring devices and accessories; methods for displaying of individual objects and phenomena in maps; methods of mapping - graphical, numerical; map interpretation, using of maps, measuring on maps, orientation by means of a map.

Type of course:

Ground surveying with fundamentals of cartography (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes and evaluation methods	Learning outcomes and evaluation methods	Learning outcomes and evaluation methods
Explain cartography and its tasks. Extract objects of display and object names (toponyms) on different cartographic views (TK 50000, 25000, 5000). Describe and explain the difference between topographical and thematic maps.	Performing exercises, midterm exam, comprehensive exam	D1
Specify a measurement definition, used measuring units, specify standards, and explain measurement errors. Explain the difference between direct and indirect measurements. Determine scale. Construct linear and transverse scale. Calculate allowed deviations and measurements.	Performing exercises, midterm exam, comprehensive exam	A1, D1
Adopt the basics of orthogonal and quoted projections. Explain the quoted projection of the topographic plane and its application. Calculate the largest slope line and constant slope line. Explain and make a cross section of the topographic plane with the vertical plane and direction. Create a terrain profile.	Performing exercises, midterm exam, comprehensive exam	A1, B5, B9, C4, D1
Explain and share map projections. Explain the coordinate systems. Specify the types of coordinates. Calculate coordinates on different topographic maps ((TK 50000, 25000, 5000). Measure the size on topographic maps 1: 50.000 and 1: 5.000 (angle, length, altitude difference, gradient).	Performing exercises, midterm exam, comprehensive exam	A1, D1
Describe cadastre and its organization Describe the land registry and its organization State and explain the difference between the old and the new cadastre. Explain and describe the indirect method of determining the surface on cadastral maps. Calculate area with the different methods (dot grid, grid squares grid and analytical calculation of area).	Performing exercises, midterm exam, comprehensive exam	A1, B5, B9, C4, D1
Explain triangulation, polygonometry. Calculate the direct and indirect geodetic task. Describe the methods of direct and indirect length measurements. Determine azimuths, distances, height differences, and inclinations between the points. Mapping certain points in the default scale.	Performing exercises, midterm exam, comprehensive exam	A1, B5, B9, C4, D1
Collect data, calculate and explain measurements with the compass. Describe and perform the recording of the details by a polar and orthogonal method. Calculate the altitude difference, explain and enumerate type of leveling.	Performing exercises, midterm exam, comprehensive exam	A1, B5, B9, C4, D1
Describe the global positioning system and its parts. Indicate GPS application in forestry. Explain GPS measurement errors. Apply GPS to determine spot positioning in terrain.	Field work, comprehensive exam	A1, B5, B9, C4, D1

General competences
The task of the subject is to make student acquainted with the need for ground surveying and cartography in forestry and nature conservation and environment protection. Apart from that, students must be acquainted with the fundamentals of cartography and ground surveying, so as to prepare them for studying and practical use of mapping and terrain surveying methods in practice.

Type of instruction

Lectures
Lectures are performed in the form of a block of classes with computer presentations, and simpler measurements are practically performed, while more complex methods and modern instruments are presented in demonstration exercises.

Exercises
Exercises are the upgrading of knowledge adopted in lectures. Exercises are performed in groups according to a schedule that adjusts to the number of students.

Field work
Lecture is held near to the Faculty (Maksimir) and includes:
1.Orientation on the terrain, finding objects on the basis of reading maps, finding objects using a compass, finding objects using GPS.
2.Setting and measuring using the compass. Measuring lengths on flat and rough terrain, determining the incline of the terrain.
3.Setting and measuring detailed leveling, line and surface leveling, measurement and calculation

Working methods:

Teachers' obligations:
Teaching - lectures, exercises, field work.
Designing seminar topics (compensation for justified absences from lectures and exercises). Assembling tests and evaluating them. Maintaining the midterms exam, Written and Oral Exams and Consultations. Creating teaching materials.

Students' obligations:
In the course with regular attendance of lectures, exercises and field work student will produce 10 individual programs (tasks), and 3 projects tasks on field work. Exam through two midterm exam or written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1

Exercises (E)	10%			30	7,5	1,25
Field work (FW)	10%			24	6	1
Partial exam (PE) and/or Comprehensive exam (CE)	80%	60-70%	Sufficient (2)		52,5	1,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10+FWx10+CEx80)/100**		84	66	5

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises (E)	Exercises are attended in groups. 10 practical exercises are performed. At the beginning of each exercise, students are received templates with tasks. The accuracy, precision, regularity, and engagement on the exercises are evaluated.	In accordance with the syllabus and agreed terms directly with the students.	The student work off for absence from the individual exercise term
Field work (FW)	Field teaching is performed in groups in the second half of the semester, and the terms are published at the beginning of the semester. Attendance on field teaching is a prerequisite for approach to exam	May	-
Midterm exam	Students can take the exam through two partial exam. The first partial exam is held after 50% of theoretical teaching and exercises. The term is arranged with students. Students who have a committed and correct 5 individual programs can access partial exam. Students who have passed the first partial exam, are eligible for the second partial exam, provided the submitted and accurate remain 5 programs, and 3 programs on a field teaching. The second partial exam is held at the end of the semester and before the start of deadlines exams. Each partial exam is in the form of a written exam, consisting of 5 logically set tasks, which are solved calculations and graphically. Both passed a partial exam (arithmetic mean of two grades) are recognized for the students for the final grade.	Agreement with students (April - June)	-

Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures, exercises and field teaching are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures, exercises and field teaching). Students in the written exam solve 5 tasks (calculation and graphically). A written exam is a condition for access to an oral exam, where a final grade is obtained.	Published examination deadlines	-

Obligatory literature

1. Kušan (ed.) (1994): Nove tehnike izmjere i kartografije, Šumarski fakultet Zagreb, 75 str.
2. Niče, V.: Deskriptivna geometrija (odabrana poglavlja), Školska knjiga Zagreb (bilo koje izdanje)
3. Lovrić, P. (1988): Opća kartografija, SNL Zagreb, 291 str.
4. Neidhardt, N. i Tomašegović, Z.: Geodezija u šumarstvu, Zagreb, 266 str.
5. Pernar, R.: Prezentacije s predavanja
6. Šumarska enciklopedija: Geodezija, Geodetski instrumenti, Zagreb
7. Pribičević, B., D. Medak (2003): Geodezija u građevinarstvu (odabrana poglavlja), V.B.Z., Zagreb, 223 str.

Recommended literature

1. Brinker and Minnick, R. (1995): The surveying handbook (second edition), New York, 840 str.
2. Macarol, S.: Praktična geodezija, (bilo koje izdanje) Zagreb)
3. Ziegler, T. (1989): Vom Grenzstein zur Landkarte, Stuttgart, 167 str.

Culture of Visual Thinking

PU2005

ECTS 3

English language R1

E-learning -

Teaching hours 30
Exercises 30

Associate teacher for exercises
Assoc prof. Siniša Justić
Lect. Ana Martina Bakić
Lect. Ivana Tutek
Lect. Roberta Pavlović

Grading
Sufficient (2) 70% exercises done with sufficient quality under supervision of a lecturer

Course content:

Structured visualisation of a concept, development of structured thinking by geometrisation of natural /artificial landscape, cultivating graphic presentation of potential reality, development of a visual culture, development of ability to valuate ambiental qualities and aproppriateness of possible interventions in ambiental qualities.

Type of course:

Culture of Visual Thinking (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse template or model (looking, registering, simplifying, drawing acording to perception)	To identify core qualities of a given whole, is proven by sufficient result of a given exercise	B4, B9
Present and and make graphic interpretation of visual komposition	To design a simpe geometrical composition, is proven by sufficient result of a given exercise	B4, B9
Perspective of a given space.	To make perspective of a given space, is proven by sufficient result of a given exercise	B4, B5, B9
Analyse structure	To design a structure (pattern) whose seemingly complex apearance is produced by simple rules., is proven by sufficient result of a given exercise	B4, B5, B9

General competences
Using drawing to transform early idea into spatial concept. Activate perception of space and to recognise a structure/template for future spatial concept to make geometrysed description of a space.

Type of instruction

Exercises

Working methods:

Teachers' obligations:
To design exercises in order to achieve logical learning proces which leads to given learning outcomes.

Students' obligations:
To attend lectures regularly and to show interest and understanding of given topics in order to achieve learning outcomes.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Exercises (E)	100%	Partly disorderly, unpresentable, with much correction and lack of interest, on time	Sufficient (2)	30	60	3,0
		Orderly, with much correction, on time	Good (3)			

		Orderly, structured, with correction, shows understanding, on time	Very good (4)			
		Orderly, structured, tidy, shows initiattive and understanding, on time	Excellent (5)			

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Regular attendance to exercises, regular homework, visible improvement in field of a course, showing of interest and understanding of a given topics, initiative to research further. Visual and material quality of finalised programs, drawings) and quality of their final presentation.	Final exercise of a semester	Up to 3/14 unattended exercises can be tolerated and compensated by homework according to aditional instruction by lecturer

Recommended literature

1. Rudolf Arnheim: Art and Visual perception

Introduction to Urbanism

PU2006

ECTS 4

English language R1

E-learning R1

Teaching hours 30
Lectures 15
Exercises 15
Field work 0

Lecturer
Associate Professor, Ivan Mlinar, Ph.D.

Associate teacher for exercises
Associate Professor, Ivan Mlinar, Ph.D.

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Lectures and exercises summarize the basic urban issues starting from the introduction to the topics of the course, history and culture of cities around the world and Croatia, the 19th and 20th century ideal cities, 20th century cities and housing developments, urban planning legislation, physical and urban planning documents, functional and physical structures and infrastructure of the city, up to competitions for urban and architectural designs.

Type of course:

Introduction to Urbanism (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe and sketch historical, modern, contemporary and ideal examples of cities and housing developments;	evaluation of exercises and seminar paper and final exam	B5
interpret and analyze urban planning legislation, physical and urban planning documents, planning maps, functional and physical structures and city infrastructure;	evaluation of exercises and seminar paper and final exam	B9
interpret and analyze urban planning legislation, physical and urban planning documents, and planning maps.	evaluation of exercises and seminar paper and final exam	C3

General competences
Acquisition of basic knowledge in the field of urbanism and development of space perception as a prerequisite for urban analysis, valorization and intervention.

Type of instruction

Lectures

Exercises
Exercises are thematically related to the whole with comparative lectures, and seminar paper is a student's content extension of selected topics within the course content. In exercises and in seminar paper, students apply and present the knowledge gained in the lectures and structure the knowledge needed to complete the final exam.

Working methods:

Teachers' obligations:
Designing and maintenance of original teaching – lectures and exercises, followed by supervision and evaluation of exercises and seminar papers. Final exams and possible consultations. Preparation and application of prepared teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises and seminar paper within the given time frame. Taking final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Making exercises and seminar paper	50%	60-70%	Sufficient (2)			
		71-80%	Good (3)			

(E)		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	50 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	45	2
TOTAL	**100%**	**(FExy50+Exy50)/100**		**30**	**90**	**4**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students' attendance is checked and recorded in classes. Student can be absent with a reason from 15% of direct classes at the most.	semester (30 hours of direct lecturer)	-
Partial exam	Students take up the prepared templates for work papers, maps and seminar papers, as well as the instructions for making the seminar paper. The activity of the student in the exercises is recorded in the timely submission of sketches and seminar paper. Tidiness, forethought, accuracy and regularity are evaluated (time-honored exercises).	according to the schedule	
Final exam	The conditions for entering the final exam are positively evaluated exercises with a seminar paper. Theoretical knowledge in written, sketched and oral questions is answered in writing, sketches and orally. Final grade is calculated based on the following formula: (FEx50+Ex50)/100	Exam period	-

Obligatory literature

1. Mlinar, Ivan (2016), Uvod u urbanizam, Udžbenici Sveučilišta u Zagrebu, Zagreb.
2. Pegan, Srečko (2007), Urbanizam : Uvod u detaljno urbanističko planiranje, Acta architectonica : Udžbenici i priručnici, Zagreb.
3. Prinz, Dieter (2006), Urbanizam, Svezak 1. : Urbanističko planiranje, Golden marketing – Tehnička knjiga; Sveučilište u Zagrebu : Arhitektonski fakultet, Zagreb.
4. Prinz, Dieter (2008), Urbanizam, Svezak 2. : Urbanističko oblikovanje, Golden marketing – Tehnička knjiga; Sveučilište u Zagrebu : Arhitektonski fakultet, Zagreb.
5. Neufert, Ernst (2002), Elementi arhitektonskog projektiranja, Golden marketing, Zagreb.

Recommended literature

1. Milić, Bruno (1994), Razvoj grada kroz stoljeća I : Prapovijest – antika, Udžbenici Sveučilišta u Zagrebu, Zagreb.

2. Milić, Bruno (1995), Razvoj grada kroz stoljeća II : Srednji vijek, Udžbenici Sveučilišta u Zagrebu, Zagreb.
3. Milić, Bruno (2002.), Razvoj grada kroz stoljeća III : Novo doba, Udžbenici Sveučilišta u Zagrebu, Zagreb.
4. Pegan, Srečko (2006), Osnove urbanističkog i graditeljskog zakonodavstva s tumačenjem stručnih pojmova, Sveučilište u Zagrebu : Arhitektonski fakultet, Zagreb.
5. Evers, Bernd (2003), Architectural Theory : From the Renaissance to the Present, Taschen, Köln.

Phytocenology

PU3001

ECTS 6

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof.dr.sc. Dario Baričević
Prof.dr sc. Joso Vukelić

Associate teacher for exercises
Prof.dr.sc. Dario Baričević
Prof.dr sc. Joso Vukelić
Dr.sc. Irena Šapić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Phytocenology – definitions, divisions. Historical development of vegetation science in Europe and Croatia. Concept of biogeocenosis or ecosystem. Basic characteristics of biocenosis. Natural and close-to-natural ecosystems. Work methods. Analytical processes and synthetic classification. Statistical data analysis. Synecology. Relationships of plant communities to climate, soil, relief and biotic factors. Syndynamics. Progressive and regressive succession. Developmental phases and stages. Degradation stage. Synchronology and synchorology. Plant fossils and pollen analysis. Development of vegetation in the primeval period. Development of vegetation following the ice age. Land area of the forest communities of our country. Spatial distribution and zonation of plant communities. Mapping vegetation. Systematics of plant communities. General overview of the presence and distribution of various forms of vegetation in the Republic of Croatia. Description of the most significant plant communities. Possibilities of applying phytocenology in practice.
The course is based on the classic assumptions of the Braun-Blanquet approach, as well as using the most up-to-date information and technological aids. The course relies on the principle of naturalness, sustainable management and bio-diversity. It is made up of lectures and laboratory exercises, with the use of the most modern teaching aids, and a field component in real forest and grassland ecosystems.

Type of course:

Phytocenology (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain phytocenology and ecosystems (role and tasks, division and historical development of phytocenology, phytochenological directions and schools, biocenosis and natural and anthropogenic ecosystems).	Preliminary exam, final exam	B9, C4
Vegetation synmorfology and synecology (qantitative and qualitative indicators, data collection, analytical processing and synthetic development, synmorphology (structure and composition) of plant communities, classification of synecological factors, relation of plant species and plant communities to the synecological factors of their adherence - soil, climatic, geomorphological and biotic factors)	Practical exercises, preliminary exam, final exam	A1, B5, B9
Syndynamics of plant communities (vegetation succession, syndynamics units, initial, transitional, permanent and climatic communities, practical importance).	Preliminary exam, final exam	B1, B5, B9, C4
Present the synhorology of plant communities (definition and types of area of distribution of plant communities, floral geoelements and area, spatial distribution and zoning of vegetation, altitude and horizontal distribution, disorders and disturbance of vegetation).	Preliminary exam, final exam	D1
Explain systematics of vegetation (historical development, nomenclature rules, associations, higher and lower systematic units).	Preliminary exam, final exam	D1
Present the forms of vegetation, development and their distribution in Croatia (vegetation of halophytes and ridges, water vegetation, mountainous rocks, rockery, rocks, climatogenic grasslands, anthropogenic grasslands, weed vegetation, ruderal vegetation, forest vegetation, most important forest communities, forests of urban areas and protected areas, plant fossils, pollen analysis, vegetation development).	Preliminary exam, final exam	B1, B5, B9, C4, D1
Explain the application of phytocenology in urban and protected areas (role and application of phytocenology in urban planning, protected areas, ecological studies and Natura 2000 project implementation).	Preliminary exam, final exam	A1, B1, B5, B9, C2, C4, D1

General competences

The objective of the course is to acquaint the students with the basic concepts of phytocenology, which they will know how to practically demonstrate the definition of forest stands, grass, weed and other surfaces under natural or close-to-natural vegetation as well as concrete vegetation units from which their functioning, general benefit and significance in urban areas and areas under various levels of protection will be evident.

Type of instruction

Lectures

According to the curriculum lectures include 7 teaching units in 15 terms.

Exercises
15 exercises are performed in the form of field, computer and auditorial exercises. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is planned for 2 days, according to the curriculum.

Working methods:

Teachers' obligations:
Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-		30	0	1
Creating exercises and field work reports (E)	20%	Partly untidy and incomprehensible, with major corrections and on time	Sufficient (2)	31	39	2,33
		Neat, legibly, with bigger corrections and on time	Good (3)			
		Neat, legibly, with small corrections and on time	Very good (4)			
		Neat, legibly, correct and on time	Excellent (5)			
Partial exam (2)	80%	60-70%	Sufficient (2)	0	80	2,66
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + Pex80)/100**		61	119	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		80	2,66
TOTAL	**100%**	**(FEx80+Ex20)/100**				

* Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 80% of the final grade, and the remaining 20% is grade from exercises

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercies + reports	The presence of students is being checked and noted. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lectures)	-
1. Partial exam	1st partial exam is available to students who have participated lectures, exercises and field work of the first half of the semester. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject, whereupon 60% of the points are to be collected for passing.	8. week	-
2. Partial exam	2nd partial exam is available to students who have participated lectures, exercises and field work and passed the first partial exam. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject. The two partial exams are scored with a total of 80 points, each with 40 points. A total of 48 points of 80 points (60%) have to be collected for passing.	15. week	
Written exam	The exam can attend students with realized exercises and field work. The students in the pre-printed exam answer the questions asked. The written exam is evaluated and participates in the final assessment of the subject, whereby it is necessary to collect 60% points for passing	Exam terms	-
Oral exame	Students who pass a written exam are being asked questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Skender, A., 1990: Fitocenologija u spontanim i antropogenim ekosistemima. Sveučilište u Osijeku, Poljoprivredni fakultet, 239 str.
2. Vukelić, J. & Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.

Recommended literature

1. Dierschke, H., 1994: Pflanzensoziologie. Ulmer, Stuttgart, 686 str.
2. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
3. Horvat, I., 1949: Nauka o biljnim zajednicama. Nakladni zavod Hrvatske, 434 str.
4. Kovačević, J., 1979: Poljoprivredna fitocenologija. Nakladni zavod Znanje, 269 str.
5. Podani, J., 1994: Multivariate data analysis in Ecology and Systematics. SPB Academic Publishing bv. Den Haag.
6. Topić, J. & J. Vukelić, 2009: Priručnik za određivanje kopnenih staništa u Hrvatskoj prema Direktivi o staništima EU. Državni zavod za zaštitu prirode, 376 str.

Remote sensing and GIS for protected and urban areas

PU3002

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Prof.dr.sc. Renata Pernar
Izv. prof. dr. sc. Ante Seletković

Associate teacher for exercises
Doc.dr.sc. Mario Ančić
Dr. sc. Jelena Kolić

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

The curriculum of the subjects of Remote sensing and GIS for protected and urban areas is realized through lectures and exercises. The lectures include the following thematic wholes: Fundamentals of remote sensing. Types of photographs, sensors and satellites. Possibilities for application of aerial and satellite images in nature conservation and environment protection.
Fundamentals of geographic information systems (GIS). Vector and raster GIS. Data forms and types in GIS. Data entry. Database organization regarding environment.
Establishment of tree cadastre. Integration of databases with geometrical data; Spatial search. Three-dimensional visualization. Data analyses in GIS, and application of GIS in urban and protected areas

Type of course:

Remote sensing and GIS for protected and urban areas (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of remote sensing Describe the historical development of remote sensing. Compare digital and analog photography. Explain ways of stereoscopic observation.	Performing exercises in a practicum, midterm exam, comprehensive exam	D1
Identify the basic principles of remote sensing and their physical and technological basics. Explain and describe parts of the electromagnetic spectrum. List reflection and emission properties of natural objects. Describe the spectral characteristics of objects on Earth surface.	comprehensive exam	D1
List the types and characteristics of photography Describe procedures of aerial survey and errors that occur in aerial surveying. Describe and demonstrate the preparation of images for measuring and orientation procedure of the aerial photographs. Perform visual, measurement and digital photo interpretation on aerial photographs. Specify the application of aerial photographs for urban forestry, nature conservation and environmental protection purposes.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B9, C4, D1
Specify the types of satellites and their classification according to purpose and orbit. Explain ways of interpretation of satellite images. Carry out a visual interpretation of satellite imagery. Show and explain the procedure of digital interpretation of satellite image (supervised and unsupervised classification). Specify the application of satellite images in urban forestry.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B9, C4, D1
Pronounce the definition of the geographic information system (GIS). Specify a historical overview of GIS development. Explain the GIS organization.	comprehensive exam	D1
Show the establishment of a database in GIS. Apply different forms of data for displaying objects. Carry out linking of the attribute database with geometric data.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B9, C4, D1
Explain the difference and the basic features of raster and vector GIS. Compare and describe the analysis of vector and raster data. Create thematic maps based on the interpretation of the images. Explain the application of RS and GIS in urban forestry, nature conservation and environmental protection.	Performing exercises in a practicum, midterm exam, comprehensive exam	A3, B5, B9, C4, D1

General competences
Students acquire knowledge on latest achievements in the field of application of remote sensing methods in protected and urban areas in our country and in the world, theoretical fundamentals of remote sensing, types of photographing and methods of photographing, as well as possibilities for the application of aerial and satellite images in nature conservation and environment protection. Methods for establishment of geographic information systems in urban forestry, as the aid for data saving, processing and analysis, as well as their maintenance and integration with other disciplines.

Type of instruction

Lectures
Lectures are performed in form of the block lessons with computer presentations. Within the course, along with regular attendance of lectures, exercises and field work, students during the semester creates individual programs (tasks), and two project tasks from field work.

Exercises
Exercises are the upgrading of knowledge adopted in lectures. The first part of the exercises is related to lectures from the field of remote sensing, and the second part on the geographic information systems. Therefore, the exercises are performed in the practicum and computer classroom, in groups according to the schedule. Groups adjusts to the number of students.

Working methods:

Teachers' obligations:
Teaching - lectures and exercises.
Preparing seminar topics (compensation for justified absences from lectures and exercises).
Providing midterm exams, oral exams and consultations. Creating teaching materials.

Students' obligations:
Within the course, with the regular attendance of lectures, exercises and field work, students create individual assignments during the semester. Taking an exam is through the 2 midterm exam and oral exam. Regular attendance and active participation on lectures and exercises, preparation of seminar work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)				30	7,5	1,25
Midterm exam (ME)	25%	60-70%	Sufficient (2)		37,5	1,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Comprehensive exam (CE)	75%	60-70%	Sufficient (2)	4	41	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(MEx25 + CEx75)/100**		64	86	5

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises (E)	Exercises are attended in groups. Each student is doing individual tasks. The first part of the exercise is related to remote sensing (exercises in practicum), and the second part on the geographic information systems (exercises on computers in computer classroom). The accuracy, precision, regularity, and engagement on the exercises are evaluated. 2 absences from exercises are allowed with the additional preparation of the seminar work.	In accordance with the syllabus and agreed terms directly with the students.	The student work off for absence from the individual exercise term
Midterm exam	A compulsory two midterm exams is laid within the course. The first midterm exam is held after 50% of theoretical teaching and exercises. The term is arranged with students. The midterm exam can be accessed by students who have submitted accurate individual tasks. Those students who hold the first midtermexam will get the right to go to the second exam, with the condition of submitted and accurate remaining tasks, and the programs from the field teaching. The second midterm exam is held at the end of the semester and before the start of deadlines exams. Two passed a midterm exam is a condition for students to get a signature and go to the exam. The midterm exam is repeated during the academic year, according to the published schedule of exams.	Eight days before each test deadline, according to the published schedule.	-
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures, exercises and field teaching and passed two midterm exams are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures, exercises and field teaching). A passed midterm examination is a requirement for an oral exam, and grade of two midterm examinations is part of the final grade.	Published examination deadlines	-

Obligatory literature

1. Oluić, M. (2001): Snimanje i istraživanje Zemlje iz svemira, HAZU, Zagreb, 580 str.
2. Tutić, D.; Vučetić, N.; Lapaine, M. (2002): Uvod u GIS, Geodetski fakultet, Zagreb, 39 str.
3. Pernar, R.: Prezentacije s predavanja
4. Braum, F.: Fotogrametrija u urbanizmu i prostornom planiranju, Geodetski fakultet, Sveučilište u Zagrebu, 1989.
5. Brukner, M. (1994): GIZIS – osnove. INA-INFO, Zagreb, 204 str.

Recommended literature

1. Lillesand T.M., Kiefer R.W. and J. W. Chipman (2004): Remote sensing and image interpretation, Wiley & Sons, 763 str.
2. Skidmore A. (2003): Environmental Modelling with GIS and Remote Sensing. Taylor & Francis, London, 268 str.
3. Haines-Yonng, R., Green D, Cousinss (1993): Landscape ecology and GIS, Teylor & Francis, London, 288.str.
4. Campbell J. B. (1996): Introduction to Remote Sensing , 2nd ed., Guilford, 622 str.
5. Donassy, V., Oluić, M., Tomašegović, Z. (1983): DI u geoznanostima, Zagreb, 333 str.

General and Landscape Ecology

PU3003

ECTS 6

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 15
Field work 15

Lecturer
Prof. dr. sc. Ivica Tikvić
Izv. prof. dr. sc. Damir Ugarković

Associate teacher for exercises
Izv. prof. dr. sc. Damir Ugarković

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:

The course General and Landscape Management covers the basics of ecology, the historical development of ecology and its sub-branches, relationship and position of ecology with other scientific disciplines, significance of ecology for human civilization, global and regional ecological problems. Introduction into landscape ecology, concept of landscape, definition of landscape, function and changes to landscape, elements of landscape. Concept of ecosystem, the main types of ecosystems on Earth, biological relationship, processes of production and decomposition in ecosystems, homeostatic relationships in ecosystems, endangerment and decay of ecosystems. Landscape diversity, energy cycling, changes and stability of landscapes. Types of biogeochemical cycling of matter, ecological patterns, physical factors crucial for the development of organisms, temperature, light, radiation, water, climate, nutrients, organisms in ecosystems, plants, animals, microorganisms, relationships of organisms at the population and community levels, types of interactions and types in ecosystems. The ecology of fresh water systems, ecological relationships in lakes and streams, ecology of the sea, organisms and zones in seas. Ecology of terrestrial ecosystems on earth, tundra, evergreen forests of northern regions, rainforests of North America, forests in moderate regions, subtropical deciduous forests, grasslands of moderate regions, tropical savannas, tropical rain forests, deserts. Influence of agriculture, forestry and hunting on natural resources. Ecology of man, landscape structures, analysis of landscape elements, natural processes in landscapes, forms of relief, hydrological systems, geological foundations, anthropogenic influences. Landscape planning and management.

Type of course:

General and landscape ecology (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Adopt basic principles for the protection of forests against abiotic and biotic factors and to apply the basic procedures and means for forest protection.	practical exercises, test of knowledge, oral exam	B3
Participate in the realization of a program of management of protected nature facilities.	practical exercises, test of knowledge, oral exam	B5
Collaborate on the development of environmental studies and environmental spatial plans.	practical exercises, test of knowledge, oral exam	B9
Plan and organize an integrated environmental management.	practical exercises, test of knowledge, oral exam	C1
Plan and organize professional tasks of the implementation of economic programs of protected nature facilities.	practical exercises, test of knowledge, oral exam	C2

General competences
Knowledge of the position and trends of forestry profession in the country and the world. Complete training for the management of forest ecosystems in all respects. Realization of the forest management program

Type of instruction

Lectures
As part of the lectures, students are introduced to theoretical and practical knowledge from individual thematic units.

Exercises
As part of the exercise, 10 exercises from the general and landscape ecology are performed. Exercises are an upgrading of the knowledge gained in lectures.

Field work
On the field work, students are introduced with practical examples of the application of knowledge of the general and landscape ecology in urban forestry and nature protection. Practitioners take part in it.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Design the theme for the seminars and compiling tests and their evaluation. Providing written tests, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the tests and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students	ECTS

					workload outside the direct teaching	
Lectures (La) attendance	5%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	30	-	1
Exercises (Ea) attendance	5%	100% 90% 80%	Excellent (5) Very good (4) Good (3)	15	-	0.5
Field work (FWa) attendance	3%	100%	Excellent (5)	15	-	0.5
Writing exercises (E) and field practice report	40%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	-	50	1,8
		In order, easy, with bigger corrections and on time	Good (3)			
		In order, easy, with minor corrections and on time	Very good (4)			
		In order, easy, accurate and timely	Excellent (5)			
Partial exam (PE)	37%	50%-62.5%	Sufficient (2)	4	48	1,6
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam (OE)	10	50%-62.5%	Sufficient (2)	0,5	17,5	0,6
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4) +(PEx0,37)+(OEx0,1)**		64,5	115,5	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lecture-attendance (La)	*5%*	*70-100%* *80-100%*	*2-5* *3-5*	*30*	*30*	*1*
Exercises - Attendance (Ea)	*5%*	*100%*	*5*	*15*	*15*	*0,5*

Field Work - Attendance (FWa)	*3%*	*50-100%*	*2-5*	*15*	*15*	*0,5*
Exercises and reports from the field work (E)	*40%*	*50-100%*	*2-5*	-	*50*	*1,8*
2 written tests or 1 final test (PE)	*37%*	*40-100%*	2-5	*4*	*52*	*1,6*
Oral Exam (OE)	*10%*			*0,5*	*18*	*0,6*
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)**		64,5	115,5	6

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and 20% exercises and can not be absent from the field work. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (64,5 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures or field work
Exercises and reports from the field work	Exercises are attended by groups. As part of the exercise is carried out 15 practical exercises in forest ecology. At the beginning of each exercise, students receive task templates and the layout of exercise reports in printed form. Estimated accuracy, neatness and regularity (exercise submitted on time). From each exercise, the student gets a grade and the average of all grades in the exercise is taken when calculating the final score from the subject.	In accordance with the agreed terms.	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	Exam terms	The student has the right three times to go to the exam.
Oral exame	Students who pass a written test and who receive passive grades from exercises, and have passive grades from lectures, exercises, and field work attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)**	Exam terms	The student has the right three times to go to the exam

Obligatory literature

1. EKOLOŠKI LEKSIKON, Glavni urednik Oskar Springer, Zagreb: Barbat, Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, 2001., 361 str.
2. Vjekoslav Glavač, 1999. UVOD U GLOBALNU EKOLOGIJU, Državna uprava za zaštitu prirode i okoliša : Hrvatske šume. 207 str., Zagreb.
3. Mihovil Gračanin, Ljudevit Ilijanić, UVOD U EKOLOGIJU BILJA, Školska knjiga, Zagreb 1977.
4. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.

Recommended literature

1. Daniel B. Botkin, Edward A. Keller: ENVIRONMENTAL SCIENCE EARTH AS A LIVING PLANET (1-649 str.)
2. Eugene P. Odum, 1971.: FUNDAMENTALS OF ECOLOGY (1-574 str.)
3. Robert E. Ricklefs, 1990.: ECOLOGY (1-885 str.)
4. Biološka i krajobrazna raznolikost Hrvatske, Državna uprava za zaštitu prirode i okoliša, Zagreb 1999, str. 151.
5. Richard T.T. Forman, Michel Godron, 1986: Landscape Ecology. John Wiley and Sons, Inc. New York, p. 1-620.
6. Biodiversity, E.O.Wilson, Editor, National Academy of Science, 1988, p. 521

Mechanization of forestry in urban and protected areas

PU3005

ECTS 5

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof.dr.sc. Marijan Šušnjar
Doc.dr sc. Zdravko Pandur

Associate teacher for exercises
Prof.dr.sc. Marijan Šušnjar
Doc.dr sc. Zdravko Pandur
Marin Bačić, mag. ing. silv.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students learn about the development, basis and classification of the most important forest machines for mechanisation of forest works with the particular attention given to machines used in urban and protected forest areas, principles of their building and their most important energetic and ecological features. The first part of the classes deals with chapters with basic knowledge on measuring, measured values, measuring systems, materials for building forest machines and their characteristics and chosen chapters from the engineering thermodynamics, technical hydromechanics and technical electrical engineering. After having met the components of forest machines, their driving engines, the lectures include the review of the individual group of machines, like devices for cutting and processing (motor chain saws), equipment of mechanised loading and unloading (forest cranes and forest winches), special forest vehicles (adapted agricultural tractors, skidders, forwarders, forest lorries) and machines for mechanisation of nursery production and silvicultural works in a forest stand, machines used for protection and specific machines for urban areas.

Type of course:

Mechanization of forestry in urban and protected areas (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain hydraulic systems and devices (pressure in liquids, hydrostatic pressure, Pascal's law, hydrodynamics, Bernoulli equation, flow resistances).	Exercises, Colloquiums, Final exam	B10
Show the principle of the internal combustion engine operation (Otto engine (4-stroke and 2-stroke engine, 4-Mix engine) and Diesel engine).	Exercises, Colloquiums, Final exam	B10
Expound operation of chainsaw, trimmers, and brushcutters (technical features, parts, work principle, hazards to worker health and environmental pollution, noise, vibration).	Exercises, Colloquiums, Final exam	B10
Typify tractors and implements (basic technical features, types, transmission, load distribution, adaptation of tractor for forest work, articulated tractors, three point linkage of tractor, PTO shaft, tractor tools).	Exercises, Colloquiums, Final exam	B10
Interpret the use of forest vehicles in protected areas (forest vehicles - skidders, forwarders, tractors with semi-trailer, transmission, wheel load, methods of soil bearing capacity determination, impact of vehicles on forest soil).	Exercises, Colloquiums, Final exam	B10

General competences

Apart from the basic knowledge of measured values, materials for building forest machines, with the chosen chapters from the mechanics, engineering thermodynamics, technical hydromechanics and machine elements, important for understanding the principle of building and work of forest machines, students learn about the ways of measuring some values and processing of measurement results by a personal computer using specially made softwares.

The second important objective of the subject is to inform students about the basic analysis of forest machines for mechanisation of specific forest works (silviculture, protection, timber logging, forest roads, etc.) whose building and work they partly see in the field classes. In studying machines, particular attention is given to mechanised procedures in urban and protected areas, i.e. their ecological possibility.

Type of instruction

Lectures

Lectures cover 6 methodical units according to the teaching plan.

Exercises

Exercises are performed in the form of measurement and calculation. On measuring exercises, students independently carry out measurements, data processing and interpretation of results. Calculation exercises are based on actual measured values. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is scheduled for 3 days according to the teaching plan.

Working methods:

Teachers obligations:
Maintaining original teaching: lectures, exercises and field teaching. Organization of field trips. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Field work				24		0,75
Exercises (E) and writing of reports from filed work	20%	60-70%	Sufficient (2)	30	36	2,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE1)	40%	60-70%	Sufficient (2)		15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE2)	40%	60-70%	Sufficient (2)		15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PE1x40+PE2x30)/100**		84	66	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the	ECTS

					direct teaching	
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercies and field work	The attendance is checked and the attendance of the students is recorded. Filed work and measuring exercises are obligatory. A student may justifiably be absent with a maximum of 20% of other types of direct teaching hours (lecturers and calculation exercises).	semester (84 hours of direct lecturer)	-
Exercises prepartion	Exercises are attended by groups. 4 measuring tasks are performed within the exercise. Students become acquainted with measurement methods, independently perform measurements and process data. At the beginning of the first exercise, students will receive templates with exercise assignments, as well as the appearance of the collage, jumper, and list of suggestions in which they will respond to the set tasks in printed form.The accuracy, regularity and regularity (time-honored exercises) are evaluated.	in accordance with the agreed terms	
Partial exam (PE1)	1st partial exam can be accessed by students who proper attended direct teaching hours . 60% points must be collected for the exam pass.	10th week	
Partial exam (PE2)	2nd partial exam can be accessed by students who passed the 1st partial exam. 60% points must be collected for the exam pass. Students who have passed both partial exams receive a final grade from a subject that is equal to the average score from both partial exams.	15th week	
Written exam	Examinations can be attended by students who have completed exercises and field teaching but failed on partial exams. Also, students who are not satisfied with the final grade on the basis of passed partial exams can access the written exam. Students on printed exams receive tasks and make calculation on a separate paper. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade is calculated according to formula: **Ex20+PEx80/100**	Exam terms	

Obligatory literature

1. CD with lectures in "Windows Power Point" presentations with printed vesrion.
2. B. Kraut: Strojarski priručnik. Tehnička knjiga Zagreb, 1988, s. 53-74, 133-222, 255-287, 313-482.
3. S. Sever: Šumarski strojevi. Tehnička enciklopedija, LZ “Miroslav Krleža”, svezak 12, Zagreb, 1992, s. 519-531.
4. Šumarska enciklopedija, LZ “Miroslav Krleža”, svezak 1, 2, 3, poglavlja: a) Harvester, s. 50-51., b) Procesor, s. 78-80., c) Skider, s. 208-210., d) Koranje, s. 278-281., e) Traktor, s. 78-80., f) Rasadnik, s. 119-130., g) Žičare, s. 651-659.
5. Selected profesional and scientific papers published in scientific journals which are available for studnets in the libraries of Faculyt of Foresty and Forest Engineering Institute.

Recommended literature

1. C. E. Malmberg: The off-road vechicle. (Volume 1) Atlanta, USA, Montreal, Canada, 1989., s.1-573.
2. C. E. Malmberg: The off-road vechicle. (Volume 2) Atlanta, USA, Montreal, Canada, 1989., s.1-463.
3. Owende, P. M. O., Lyons, J., Haarlaa, R., Peltola, A., Spinelli, R., Molano, J., Ward, S. M., 2002: Operations protocol for Eco-efficient Wood Harvesting on Sensitive Sites. Project ECOWOOD, Funded under the EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 - 74.
4. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/Boston/Lancaster, 1 - 371.
5. Saarilahti, M., 2002: Soil interaction model. Project deliverable D2 (Work package No. 1) of the Development of a Protocol for Ecoefficient Wood Harvesting on Sensitive Sites (ECOWOOD). EU 5th Framework Project (Quality of Life and Management of Living Resources) Contract No. QLK5-1999-00991 (1999-2002), 1 - 87.
6. Samset, I., 1985: Winch and Cable Systems. Martinus Nijhoff / Dr W. Junk, Publishers, Dordrecht, The Nederlands str. 1-539.
7. Professional and scientific papers from international conferences deal with forest work mechanization according to the choice of lecturer (available in the library of Forest Engineering Institute).

Plant physiology

PU3006

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof. dr. sc. Željko Škvorc
Prof. dr. sc. Jozo Franjić
Doc. dr. sc. Krunoslav Sever

Associate teacher for exercises
Doc. dr. sc. Krunoslav Sever
Prof. dr. sc. Željko Škvorc

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction. Importance of plant physiology. Forest plants. Introduction to cell metabolism. Chemical composition of a plant body. Enzymes. Water and plant cells. Absorption, circulation and secretion of water in the plant.
Mineral plant nutrients - absorption and availability of minerals, role of mineral nutrients, mycorrhiza. Assimilation of mineral substances. Transfer of dissolved substances. Chemo-autotrophy, photo-autotrophy, structure of the photosynthesis apparatus, photosynthetic reactions, impact of environmental elements on photosynthesis, heterothropic nutrition. Cell breeding - aerobic, anaerobic. Breeding of a whole plant. Regulation of metabolism within the cell.
Growth, differentiation, maturation, falling off of organs. Plant hormones, auxins, gibberelins, cytokinins, abscisins and other physiologically active substances. Temperature impact on growth and development of wooden plants, dormancy of the buds, dormancy of the seeds, dormancy of the embryos. Impact of light upon growth and development of wooden plants, phytochromes, photomorphogenesis, flowering control. Physiology of fertilization, processes from fertilization to fruit maturity, seed germination. Fruit yielding of forest trees. Surface protection of the plant and protective substances.
Physiology of stress, resistance of wooden plants to low and high temperatures, resistance of wooden plants to drought, resistance of wooden plants to pH values of the soil. Lack of oxygen in the soil, pollution of water, soil and air, resistance of wooden plants to diseases.
Physiology of movement, passive movements, movements of organs, free locomotore movements, movements in the cell, physical movements.

Type of course:

Plant physiology (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain the relationship between water and plants (water potential, plant water uptake and conductivity, root pressure, water extraction, transpiration, embolism of the tree conducting system, plant water status).	Exercises, Preliminary exam, final exam	B1
To explain plant metabolism and mineral nutrition (the structure and activity of enzymes in plant cells, the physiological role of mineral substances in the plant, the assimilation of mineral substances and the role of mycorrhiza).	Exercises, Preliminary exam, final exam	B1
To interpret photosynthesis and respiration (chemoautotrophy, photoautotrophy, the structure of photosynthetic apparatus, photosynthetic reactions, photorespiration, photosynthesis types, influence of environmental factors, aerobic and anaerobic cellular respiration, whole-plant respiration, the regulation of cellular metabolism).	Exercises, Preliminary exam, final exam	B1
To present physiological processes of plant growth and differentiation in relation to key environmental factors (plant hormones, auxins, gibberellins, cytokinins, abscisic acid, bud, seed and embryo dormancy, phytochromes, photomorphogenesis).	Exercises, Preliminary exam, final exam	B8
To interpret the physiology of stress, as well as physiology of motion (passive movements, organ movements, free locomotor movements, motion in the cell, physical movements).	Exercises, Preliminary exam, final exam	B1

General competences
Development of basic knowledge necessary for evaluation of research on plant physiology and its integration into the models of plant functioning. Development of abilities of critical insight into plant physiology, as well as development and improvement of skills in experiment design and statistical analysis.

Type of instruction

Lectures

Exercises
Exercises are performed in the laboratory. Exercises are the upgrading of knowledge adopted in lectures.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	15	0	0,5
Partial exam - exercises (PEE)	30%	60-70%	Sufficient (2)		15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE1)	35%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE2)	35%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PEE*30+PE1*35+PE2*35)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	70%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		60	2
TOTAL	**100%**	**(FE*70+PEE*30)/100**				

*** students who do not pass through the partial exams have to access the final exam that makes 70% of the grade, and the remaining 30% of the grade make the exercise**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	The attendance of students is checked and recorded at the lectures. Student may not be absent more than 20% of lectures and 10% of exercises. The exercises are attended in groups. Exercises are performed in the laboratory. Students have templates for each exercise	semester (45 hours of direct teaching	Exceptionally, in the case of a justified reason, the student may compensate the absence of an individual exercise.
Partial exam - exercises (PEE)	After the exercises are done, the students are obliged to take the partial exam. The students answer the questions on previously printed exam.	in accordance to the agreed deadline	-
Partial exam (PE1)	The students answer the questions on previously printed exam. Students are not obligatory to access the 1st **p**artial exam. If they do not access the partial exam, they have to take the final exam.	9th week	-
Partial exam (PE2)	The students answer the questions on previously printed exam. Students are not obligatory to access the 2nd **p**artial exam. If they do not access the partial exam, they have to take the final exam. If the students have a positive grade in partial exams according to the formula **PEEx30 + PE1x35 + PE2x35** they are not required to access the final exam.	15th week	-
Final exam (FE)	Students who fail to pass the Partial exam are obligatory to attend the final exam. The final exam consists of a written and oral part. In a written part students answer the questions on previously printed exam. Students who pass a written exam are oraly asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **FEx70 + PEEx30**	in accordance to the exam schedule	-

Obligatory literature

1. Škvorc, Ž., Sever, K., Franjić, J., 2013: Fiziologija šumskoga drveća (interna skripta), 1-97. Zagreb

Recommended literature

1. Pevalek-Kozlina, B. 2002: Fiziologija bilja. Profil interrnational. Zagreb
2. Dubravec, K.D., Regula, I. 1995: Fiziologija bilja. Školska knjiga. Zagreb.
3. Pallardy S. G. 2008: Physiology of Woody Plants, 3. izd. Elsevier Inc.

Genetics and breeding of trees and shrubs

PU3007

ECTS points 4

E-learning R2

Teaching hours 68
Lectures 30
Exercises 30
Field work 8

Lecturer
prof. dr. sc. Saša Bogdan

Grading
Adequate (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basics of genetics: plant cell structure, chromosomes, DNA; genes, transcription, translation, gene expression control; Basic rules of inheritance (Mendel's Laws); Deviations from the Mendel rules; Extranuclear inheritance; Polygenic inheritance; Population genetics (population genetic composition, Hardy-Weinberg equilibrium, evolution-adaptation processes); Basics of quantitative genetics (genetic tests, genetic parameters); quantitative properties and environmental performance; modifications, mutations;
Fundamentals of breeding forest woody species: breeding cycles; mass selection and creation of the parent population; individual selection, genetic testing; pedigree, methods of controlled crossing, creation of breeding populations; methods of vegetative propagation of woody species, cell and tissue culture in the breeding of trees and shrubs, methods of breeding (breeding by selection, mutations, hybridisation), conservation and domestication of trees and shrubs, the basics of biotechnology applied to the breeding of trees and shrubs; maintenance of genetic variability of cultivated species.

Course Type:

Genetics and breeding of trees and shrubs (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning Outcome (LO)	Verification	Connection with the study program LO
To discuss interaction of genes and environmental influences on phenotypic properties.	Practicum exercises, colloquium, knowledge test, final exam	B9
To perform basic field and laboratory procedures within the context of DNA analyses (collecting plant material, DNA extraction from plant tissue, PCR method, making agarose gel, electrophoresis procedure).	Practicum exercises, colloquium, knowledge test, final exam	B9 C4
To discuss the utility and procedures of using different types of genetic markers for the genetic characterization of a population and to calculate the appropriate parameters; To compute the results of the calculation and to evaluate the basic genetic state of the population;	Practicum exercises, colloquium, knowledge test, final exam	B8, B9 C1, C2, C3,C4
To explain the importance of genetic diversity, the methods of its determination and the influence of evolutionary factors on genetic diversity; To calculate different parameters that describe: the level of genetic diversity of a population, the level of genetic differentiation of populations and the effective population size; To analyse the genetic diversity of a population based on calculated parameters.	Practicum exercises, colloquium, knowledge test, final exam	B5, B8, B9 C1, C2, C3,C4
To design a genetic test to analyse quantitative phenotypic traits and to describe the process of collecting data from a genetic test; To calculate the basic parameters of quantitative genetic diversity based on data from a genetic test.	Practicum exercises, colloquium, knowledge test, final exam	B8, B9 C5
To explain the process of classical breeding, selection methods and traditional cloning of woody tree species (grafting, rooting cuttings); To choose suitable candidates in the mass selection process; To evaluate individual candidates and choose plus individuals; To perform some basic cloning techniques.	Practicum exercises, colloquium, knowledge test, final exam	B8, C5
To explain the process of genetic testing of the plus individuals and selection of the elite individuals; To calculate the genotypic and breeding values of individuals, heritability and the genetic gain based on data from the genetic test; To select elite individuals based on genetic testing results.	Practicum exercises, colloquium, knowledge test, final exam	B8, C5
To explain the role of controlled crossing and activities required for the implementation of controlled crossing in the breeding cycle;	Practicum exercises, colloquium, knowledge test, final exam	B8, C5

To choose an option and to design a plan of controlled crossing of elite individuals; To design mass production of genetically enhanced varieties;

General competences

Interpretation of theoretical settings of the basisc of genetics, breeding and conservation of genetic diversity of forest tree species. The basics of work in a molecular-biological laboratory (extraction of DNA, PCR, electrophoresis). Monitoring and characterization of genetic diversity of forest tree species. Selection and application of classical tree breeding methods (selection, controlled generative and vegetative propagation, genetic testing, mass production of forest reproductive material).

Forms of teaching

Lectures

Exercises

Within 6 hours of laboratory exercises, the basic working techniques in the molecular biology laboratory (extraction of DNA from plant tissue, PCR, gel-electrophoresis) are performed. Other exercises are conducted as practical with concrete calculations and discussions, and case studies as the dominant forms of exercises.

Field work

Within the one-day field teaching, the students perform: selection of plus individuals, data collection in the genetic test, data processing; discussion about the process of breeding, use of genetic testing data. Getting acquainted with the gene bank of forest trees and discussing the legislative considering the conservation of genetic diversity of forest tree species.

Working methods:

Teachers' obligations:

Maintaining original teaching – lectures and exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Examination and consultation. Creating teaching materials.

Student obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Exercises (V)	-	-	-	30	0	1
Colloquium 1 (K1)	30%	60-70%	adequate (2)		10	0.33

		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
Colloquium 2 (K2)	40%	60-70%	adequate (2)		30	1
		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
Colloquium 3 (K3)	30%	60-70%	adequate (2)		20	0.67
		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**			60	60	4

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam* (ZI)	100%	60-70% 71-80% 81-90% 91-100%	Adequate (2) Good (3) Very good (4) Excellent (5)	-	60	2
TOTAL	**100%**				**60**	**2**

*** students who do not pass colloquiums during the semester will take the final exam that makes 100% of the grade.**

Detailed explanation of the preparation, execution and arrangement of colloquia, seminar papers, partial exams, written and oral exams:

Tracking elements	**Description**	**Deadline**	**Compensation**
Lectures + exercises	The attendance of students is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct teaching)	-
Colloquium 1 (K1)	The students answer the questions in the scope of the basics of Genetics (round the correct answers on the printed test). Written testing is evaluated and participates in the final grade of the course with 30%.	5th week	–
Colloquium 2 (K2)	The students answer the questions in the scope of the basics of the Population Genetics (round the correct answers on the printed test). Written testing is evaluated and participates in the final grade of the course with 40%.	10th week	–

Colloquium 3 (K3)	The students answer the questions in the scope of the basics of the Quantitative Genetics and Tree Breeding (round the correct answers on the printed test). Written testing is evaluated and participates in the final grade of the course with 30%.	15th week	–
Written exam	Exams can be taken by students who regularly attended lectures/exercises and did not want or failed to pass all three colloquia. The students in the pre-printed exam answer to the questions from the entire course content, rounding out the exact answers. The written exam is evaluated and participates in the final grade of the subject	examination deadlines	-
Oral exam	Students who pass a written exam are being asked questions from different parts of the entire course content.	examination deadlines	-

Obligatory literature

1. Bogdan, S. i I. Katičić Bogdan, 2015. Genetika s oplemenjivanjem drveća i grmlja. Interna recenzirana skripta. 224. str. (Nastavni materijal pozitivno ocijenjen od strane stručnog povjerenstva i objavljen na web stranici Šumarskog fakulteta Sveučilišta u Zagrebu) http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=109.

Recommended literature

1. White, T. L., W. T. Adams, D. B. Neale, 2007: Forest Genetics. Wallingford, UK, Cambridge, CAB International. p682.

Applied entomology

PU4001

ECTS 7

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof.dr.sc. Boris Hrašovec

Associate teacher for exercises
Doc.dr.sc. Milivoj Franjević

Grading
Sufficient (2) 65%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:

Students are collecting knowledge on insects as fundamental biotic agents that impair urban greenery. Treated as plant pests and molestants insects are being analyzed through various ecological impacts (on species and population levels). Main aspects of species ecology, their preferences and adaptability are discussed. Population dynamics of the most important species is compared with various anthropogenic influences. Also, the prognostic systems for the most important and detrimental urban pests are presented.
Short review of forest insects that can reach pandemic levels (like defoliators and xylophages) is given with the case-examples. Analysis of the involved mechanisms in the special habitats like forest ecosystems under some degree of nature conservation is performed with the aim to point out the possible reasons for these occurrences and pathways for their suppression.

Type of course:

Applied entomology (compulsory course, 2. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To learn taxonomy, morphology, physiology and nutrition of forest insects, and the importance of insects in the forest ecosystem and urban areas	colloquium, seminar work, final exam	B2
Present growth and ontogenetic development in insects (developmental stage, types of larvae, pupae, physiology of metamorphosis , apolysis, eclosis, ecdosis, hormone system, endocrine glands).	colloquium, seminar work, final exam	B2
Describe the insect sense and communication with the environment in function survival in forest habitat and urban space (sensations of tastes, sight, hearing, smell and taste, intrinsic and interpersonal communication, sexual and aggregate attractants, insect attack symptoms).	colloquium, seminar work, final exam	B2
Define the foundations of the insect ecology of the populations, endangered and rare insect species (fluctuations, oscillations, gradations, gradation types, antagonistic relations and symbiosis, predation and parasitism, endangered and rare insect species, the concept of species preservation through conservation of habitats).	colloquium, seminar work, final exam	B2
Show the most significant pests of urban timber from the group of sucking insects (species from the order of Orthoptera, Thysanoptera and Hemiptera, bionomy, ecology and significance).	colloquium, seminar work, final exam	B2
Show the most significant defoliants of urban wooden plants from the subfamily of butterflies, beetles and other rows.	colloquium, seminar work, final exam	B2
Define the most important xylophages and urban wood destroyers woody plants (xylophagic butterflies, bark beetles, primary and secondary pests in forestry, bionomy, ecology of species and their impact on forest ecosystem).	colloquium, seminar work, final exam	B2
Present insects as molestants and causes allergic reactions to the forest and urban space.	colloquium, seminar work, final exam	B2
Analyze invasive quarantine insect species and their correlation with urban space.	colloquium, seminar work, final exam	B2

General competences

Students acquire special skills and knowledge needed in pest suppression systems in urban environment based on a concept of basic education in the grdauate level courses. Also they learn the basics of synecological relations between insects and their environment and acquire the concept applying biodiveristy principles in the management of protected forest ecosystems.

Type of instruction

Lectures

Exercises

Field work

Working methods:

Teachers' obligations:
Maintaining all forms of teaching - lectures, exercises, field teaching. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%			30	0	1
Exercises (E)	30%	60-70%	Sufficient (2)	15	0	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	60%	60-70%	Sufficient (2)	0	165	5,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		45	165	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			3
TOTAL	**100%**	**(FExy0+Exy0)/100**				**3**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours	semester (45 hours of direct lecturer)	-
Partial exam		15. week	-
Written exam		Exam terms	-
Oral exame			-

Obligatory literature

1. Hrašovec, B., Franjević, M., 2011: Primjenjena entomologija – Opća entomologija-Unutarnja i vanjska građa kukaca, fiziologija, opća ekologija i biologija, Skripta, Šumarski fakultet, 44 str.
2. Hrašovec, B., Franjević, M., 2011: Primjenjena entomologija – Posebni dio Pregled najznačajnijih vrsta šumskih kukaca i njihova osnovna biološka obilježja. Skripta, Šumarski fakultet, 113 str.
3. Tomiczek, C., D. Diminić, T. Cech, B. Hrašovec, H. Krehan, M. Pernek, B. Perny, 2008: Bolesti i štetnici urbanog drveća. Udžbenici Sveučilišta u Zagrebu, Šumarski institut, Jastrebarsko – Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 382 str.
4. Entomološki vodič – skripta "on-line", http://hrast.sumfak.hr/~forbug/ (2004.)

Recommended literature

1. Zúbrik, M., Kunca, A., Csóka, G., Forster, B., Hâruţa, O., Hoch, G., Hrašovec, B., Koltay, A., Kulfan, J., Leontovyč, R., Nageleisen, L.M., Nakládal, O., Novotný, J., Roques, A., Peńa, G.S., Šrůtka, P., Stergulc, F., Sukovata, L., Tomiczek, Ch., Turčáni, M., Vakula, J., Wermelinger, B., 2013: Insects and diseases damaging trees and shrubs of Europe. N.A.P. Editions, ISBN 978-2-913688-18-6, 535 p.
2. Hrašovec, B. 2004: Kukci – važni pokazatelji bioraznolikosti ali i povremeni uzročnici kalamiteta u šumskom ekosustavu. Hrvatsko šumarsko društvo, Zagreb, 76 str.
3. Alford, D.A., 1995: A Colour Atlas of Pests of Ornamental Trees, Shrubs and Flowers. Manson Publishing, London, UK, 448 str.
4. Chapman, R.F., 1998: The Insects – Structure & Function. Cambridge University Press, Cambridge, 770 str.
5. Csoka, G., 1995: Lepke-hernyok. Agroinform Kiado es Nyomda Kft., Budapest, 151 str.
6. Csoka, G., 1997: Plant galls. Agroinform Kiado es Nyomda Kft., Budapest, 160 str.
7. Speight, M.R. & D. Wainhouse, 1989: Ecology and Management of Forest Insects. Oxford University Press Inc., New York, 374 str.

Applied phytopathology

PU4002

ECTS credits 7

English R1

E-leaning R1

Teaching hours 61
Lectures 30
Practical exercises 15
Field classes 16

Lecturer
Prof. dr. sc. Danko Diminić

Practical exercises led by
Jelena Kranjec Orlović, PhD

Grading system
Insufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Applied phytopathology studies causative agents and diseases of trees in urban and protected areas. Contents are divided into general and special part.
In general part students get acquainted with groups of biotic causative agents of diseases.
In special part students learn about most significant fungal pathogens on trees in urban and protected areas.
Phytopatological problems of tree species genera are studied as units (for example, diseases of pines, plane trees, oaks).
For each fungal species students learn about its distribution, morphological-taxonomical characteristics, biology, disease symptoms and harmful effect.
Students learn about other causative agents of tree diseases (for example hemiparasitic flowering plants, bacteria) and abiotic factors significant for each plant species or genus.

Course category:

Applied phytopathology (compulsory course, 4th semester, 2nd year)

Learning outcomes and assessment

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain causative agents of plant diseases (non-parasitic, parasitic, morphology, reproduction and classification of fungi).	Separate fungi among different biotic factors as most common and numerous causative agents of shrubs and trees diseases.	B2
Explain biology and physiology of fungi (reproduction, nutrition, specialization, ecological associations).	Interpret ecological associations among fungi.	B2
Explain pathogenesis and plant resistance towards pathogens (types and sources of infection, incubation, fructification, resistance factors, plant reaction on pathogenic organism).	Compare and understand infection, incubation and fructification as parts of pathogenesis.	B2
Analyse diseases of needles and leaves of urban and forest trees (disease symptoms, biology and harmful effect of the pathogen).	Explain biology and harmful effects of individual pathogen, that is, describe consequences of disease.	B2, B3
Analyse diseases of bark, shoots, branches and stems of shrubs and trees (disease symptoms, biology and harmful effect of the pathogen).	Explain biology and harmful effects of individual pathogen, that is, describe consequences of disease.	B2, B3
Analyse rot fungi of urban trees (their species, most common rot fungi in Croatia, disease symptoms, biology and harmful effect of pathogens, consequences for the health status of affected trees and their economical value).	Identify conditions under which it comes to process of rot in protected forest ecosystems.	B2, B3
Explain anthropological and abiotic damage on urban and forest trees (mechanical damage on bark during cut and skidding and forwarding, frost cracks, drought damage, sunscald wounds).	Interpret anthropological and abiotic damage on urban and forest trees and consequences for a tree	B2, B3
Explain harmful hemiparasitic plants (most common hemiparasitic flowering plants on urban trees).	Identify symptoms caused by hemiparasitic flowering plants.	B2, B3

General competences

Basics of knowledge of plants in order to keep their health status intact.
Application of modern science principles which encompass precise knowledge of pathogenic plant organisms and their association with plants during pathogenesis.
Understanding of micro world and biogenic processes, and effect of environmental factors on plant host and pathogen.

Type of instruction

Lectures

Practical exercises

As a part of laboratory exercises students learn how o recognize causative agent of shrubs and trees disease macroscopically and microscopically.

Field classes

Field classes are held in protected forest ecosystems where examples of disease are shown directly on trees.

Working methods:

Teacher's obligations:
Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:
Regular attendance and active participation in lectures, practical exercises and field classes. Taking partial exams, written and oral exams.

Methods of grading

Elements for assessment	Grade percentage	Grading scale	Grade	Hours of direct teaching	Work hours of an average student outside direct teaching	ECTS
Lectures	-	-	-	30	0	1
Practical exercises (V)	-	-	-	15	0	0,5
Field classes and field class seminar (TN)	-	-	-	16	14	1
Midterm exam on basics of phytopathology (K)	25%	60-70%	sufficient (2)	0	35	1,2
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
Exam (PUI)	75%	60-70%	sufficient (2)	0	100	3,3
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Kx20 + PUIx80)/100**		61	149	7

Elements for assessment	Maximum points or Share in evaluation	Grade scale	Grade	Hours of direct teaching	Total number of work hours of an average student	ECTS
Final exam* (ZI)		60-70% 71-80% 81-90% 91-100%	sufficient (2) good (3) very good (4) excellent (5)	0	135	4,5
TOTAL	**100%**	**(ZIx100)/100**				

*** students who do not pass the midterm exams during the semester shall take the final exam that makes up 100 % of the grade.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Elements for assessment	Description	Term	Compensation for absence
Lectures + practical exercises	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (45 direct teaching hours)	-
Completion of practical exercises	Students attend practical exercises in groups. A total of 8 practical exercises are carried out about microscopic and macroscopic identification of forest shrubs and trees pathogens.	semester (15 direct teaching hours)	In case of justified reason student can additionally compensate for the absence from the exercise.
Midterm exam on basics of phytopathology	All students can take the first midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	From 13th week	Students who passed midterm exam can take written exam.
Written exam	The exam can be taken by students who attended practical exercises and passes the midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written exam is graded and taken into account for the final grade of this course	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **Kx25+PUIx75/100**		

Obligatory literature

1. Glavaš, M., 1996: Osnove šumarske fitopatologije. Sveučilište u Zagrebu, Šumarski fakultet, 140 str.
2. Tomiczek, C., D. Diminić, T. Cech, B. Hrašovec, H. Krehan, M. Pernek & B. Perny, 2007: Bolesti i štetnici urbanog drveća. Šumarski institut, Jastrebarsko, Sveučilište u Zagrebu, Šumarski fakultet, 384 pp. (sveučilišni priručnik).
3. Glavaš, M., 1999: Gljivične bolesti šumskoga drveća. Sveučilište u Zagrebu, Šumarski fakultet, 281 str.
4. Na internetskoj stranici Merlin sustav za e-učenje Sveučilišta u Zagrebu (https://moodle.srce.hr/2018-2019/?redirect=0) pod predmetom Primijenjena fitopatologija studentima su dostupna sva predavanja u formi prezentacija (MicrosoftPowerPoint).

Recommended literature

1. Butin, H., 1995: Tree Diseases and Disorders. Oxford University Press, 252 p.
2. Strouts, R.G. & Winter, T.G., 1994: Diagnosis of ill-health in trees. HMSO, London, 307 str.
3. Hrašovec, B. & Diminić, D., 2000: Pests and diseases of trees in continental urban areas in Croatia - current status and future trends. In: Backhaus, G.F.; Balder, H.; Idczak, E. (eds.) 2000:

International Symposium on Plant Health in Urban Horticulture, Braunschweig, Germany, May 22-24, 2000. Mitteilungen aus der Biologischen Bundesanstalt für Land und Forstwirtschaft Berlin-Dahlem, Heft 370, 63–68.
4. Diminić, D., Hrašovec, B. & Matošević, D., 2003: Up-to-day knowledge and experience on main bark diseases of trees in Zagreb. In: Balder, H.; Strauch, K. H.; Backhaus, G. F. (eds.) 2003: Second International Symposium on Plant Health in Urban Horticulture, Berlin, Germany, August 27-29, 2003. Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft Berlin-Dahlem, Heft 394, 32–34.
5. Glavaš, M. & Diminić, D., 2001: Mikološki kompleks obične jele. U: Prpić, B. (ed.) 2001: Obična jela (Abies alba Mill.) u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 606–625.
6. Diminić, D., 2003: Gljivične bolesti obične bukve. U: Matić, S. (ed.) 2003: Obična bukva (Fagus sylvatica L.) u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 549–560.
7. Diminić, D., 2004: Suncožarne rane na deblima javora u zagrebačkim drvoredima. Agronomski glasnik, 66(3-5): 327–338.
8. Hrašovec, B., Diminić, D., Franjević, M., Jarža, B. & Salamunić, I., 2004: Zdravstveni problemi drvoreda divljega kestena na području grada Zagreba. Agronomski glasnik, 66(3-5): 293–307.

Dendrology

PU4003

ECTS 7

English language R1

E-learning R2

Teaching hours 99
Lectures 45
Exercises 30
Field work 24

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Associate teacher for exercises
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Biological features, morphological characteristics, number of species and distribution of some of the genera of gymnosperms and angiosperms (dicotyledons and monocotyledons). The genera belong to the following families: *Ginkgoaceae*, *Araucariaceae*, *Pinaceae*, *Taxodiaceae*, *Cupressaceae*, *Taxaceae*, *Cycadaceae*, *Ephedraceae*, *Magnoliaceae*, *Lauraceae*, *Ranunculaceae*, *Berberidaceae*, *Platanaceae*, *Hamamelidaceae*, *Ulmaceae*, *Moraceae*, *Juglandaceae*, *Fagaceae*, *Betulaceae*, *Tiliaceae*, *Cistaceae*, *Tamaricaceae*, *Salicaceae*, *Capparaceae*, *Ericaceae*, *Ebenaceae*, *Pittosporaceae*, *Hydrangeaceae*, *Grossulariaceae*, *Rosaceae*, *Mimosaceae*, *Caesalpiniaceae*, *Fabaceae*, *Elaeagnaceae*, *Myrtaceae*, *Punicaceae*, *Cornaceae*, *Loranthaceae*, *Viscaceae*, *Santalaceae*, *Celastraceae*, *Aquifoliaceae*, *Buxaceae*, *Euphorbiaceae*, *Rhamnaceae*, *Vitaceae*, *Staphyleaceae*, *Hippocastanaceae*, *Aceraceae*, *Anacardiaceae*, *Simaroubaceae*, *Meliaceae*, *Araliaceae*, *Apocynaceae*, *Solanaceae*, *Verbenaceae*, *Lamiaceae*, *Oleaceae*, *Scrophulariaceae*, *Bignoniaceae*, *Caprifoliaceae*, *Asteraceae*, *Liliaceae*, *Smilacaceae*, *Ruscaceae* and *Agavaceae*. Morphological characteristics, intra-species variability, distribution, special characteristics, economic and ecological importance of the species among these genera. The subject covers autochthonous and allochthonous tree and shrub species, and the topics of the lectures follow a systematic order.

Type of course:

Dendrology (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To define and explain biological features and morphological characteristics of the genera of autochthonous gymnosperms (6 genera), allochthonous gymnosperms (18 genera), autochthonous angiosperms (trees - 28 genera, shrubs - 45 genera), allochthonous angiosperms (trees and shrubs - 27 genera), autochthonous and allochthonous angiosperms - vines (10 genera),	partial exams and final exam	B1
To identify and describe the autochthonous and allochthonous gymnosperms acording to: habit (21 species), bark (12 species), twigs and buds in winter (5 deciduous species), leaves (49 species), cones and/or seeds (41 species);	partial exams and final exam	B1
To identify and describe the autochthonous and allochthonous angiosperms acording to: habit (41 species), bark (27 species), twigs and buds in winter (72 deciduous species), leaves (196 species), flowers (61 species), fruits and/or seeds (123 species);	partial exams and final exam	B1
To use determination keys for autochthonous and allochthonous gymnosperms and angiosperms;	partial exams and final exam	B1
To group autochthonous and allochthonous gymnosperms and angiosperms (trees, shrubs and vines) according to biological features, morphological characteristics, distribution, economic, horticultural and ecological importance;	partial exams and final exam	B1
To choose autochthonous and allochthonous gymnosperms and angiosperms (trees, shrubs and vines) for various purpose in forestry and urban forestry;	partial exams and final exam	B1

General competences

Students acquire theoretical and practical knowledge about autochthonous and allochthonous tree and shrub species. Theoretical knowledge encompasses biological features, morphological characteristics, intra-species variability, distribution, special characteristics, and the economical and ecological importance of species. Students acquire practical skills to recognize woody species on the basis of different morphological characteristics: habit, bark, leaves and twigs of deciduous species in winter, flowers, cones, fruits and seeds. They also gain knowledge on the practical use of trees and shrubs in forestry and urban forestry.

Type of instruction

Lectures

Exercises

The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, flowers, cones, fruits and seeds. The students use plant material and determination keys.

Field work
Field work is held for three days in the lowland, mountain and Mediterranean regions of Croatia. During field work students collect herbarium specimens.

Working methods:

Teachers' obligations:
Giving lectures, exercises and field teaching. Holding consultations, partial exams, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material. Preparation of new and maintenance of existing herbarium specimens in the scientific herbarium of the Faculty of Forestry. Digitising herbarium specimens and entering data into the database of scientific herbarium.

Students' obligations:
Regular attendance at lectures, exercises and field work. Writing exercise and field work reports. Doing and submitting homework. Collecting herbarium specimens and passing herbarium exam. Passing partial and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				45		1.5
Exercises (E)	5%	60-70%	Sufficient (2)	30		1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Homework (HW)	5%	70-80%	Sufficient (2)		15	0.5
		81-89%	Good (3)			
		90-94%	Very good (4)			
		95-100%	Excellent (5)			
Field work reports (FWR)				24		0.5
Herbarium collection and exam (H)					20	0.7

Partial exam - gymnosperms (PEG)	30%	60-70%	Sufficient (2)		20	0.8
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - angiosperms (PEA)	60%	60-70%	Sufficient (2)		60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex5+HWx5+PEGx30+PEAx60)/100**		99	115	7

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		60	2
TOTAL	**100%**	**(FEx60+PEGx30+Ex5+HWx5)/100**				
*** students who do not pass the course through two partial exams during the semester take the final exam that is 60% of the grade and is the same as the partial exam - angiosperms; the remaining 5% is the grade of the exercises, 5% is the grade of the homework and 30% of the partial exam - gymnosperms**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures, exercies and field work	Student attendance is recorded. Student may not be absent more than 20% of lectures and 10% of exercises.	IV semester	
Exercises	The exercises are attended in groups. The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, flowers, cones, fruits and seeds. The students use plant material and determination keys. At the end of each exercise the accuracy of determination is evaluated, and the evaluation affects the final grade.	IV semester	
Homework	After each lecture and practicum exercises, the students do their homework and submit it via the Herbarium DEND	IV semester	

	application. The homework is evaluated and affects the final grade.		
Field work reports	After field work students prepare reports. Professor's signature confirms the accuracy of the report.	IV semester	
Herbarium collection and exam	On field work and field exercises students collect herbarium specimens. During the semester they take herbarium exam.	IV semester	
Partial exam - gymnosperms	Access requirements: regular attendance at lectures and exercises, positively graded gymnosperm exercises and homework. The partial exam consists of written and oral part. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics.	IV semester	
Partial exam - angiosperms	Access requirements: regular attendance at lectures, exercises and field work; positively graded all exercises and homework; signed field work reports; positively graded gymnosperm partial exam; collected herbarium and positively graded herbarium exam. The partial exam consists of written and oral part. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics. The angiosperm partial exam is the same as the final exam.	IV semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures, exercises and field work; positively graded all exercises and homework; signed field work reports; positively graded gymnosperm partial exam; collected herbarium and positively graded herbarium exam). The written exam is the same as the written part of the angiosperm partial exam.	Exam terms	
Oral exam	Access requirement: positively graded written exam. In the oral part, apart from theoretical knowledge, students have a practical determination of woody species according to different morphological characteristics. The oral exam is the same as the oral part of the angiosperm partial exam. The final grade is obtained according to the formula: (FEx60+PEGx30+Ex5+HWx5)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2005: Listopadno drveće i grmlje u zimskom razdoblju. Šumarski fakultet Sveučilišta u Zagrebu. 256 pp.
2. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
3. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.
4. Šumarska enciklopedija Vol. I-III, 1980-1987. JLZ Miroslav Krleža, Zagreb.

Recommended literature

1. Anić, M., 1946: Dendrologija. Šumarski priručnik I, Zagreb. 475-582 pp.
2. Bean, W.J., 1989: Trees and shrubs hardy in the British Isles. John Murray Publ., Ltd., London.
3. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim. 915 pp.
4. Herman, J., 1971: Šumarska dendrologija. Stanbiro, Zagreb. 470 pp.

5. Hillier, J., Coombes, A. (Eds.), 2007: The Hillier manual of trees and shrubs. A David and Charles Books, Cincinnati.
6. Roloff, A., A. Bärtels, 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart. 853 pp.
7. Roloff, A., Weisgerber, H., Lang, U.M., Stimm, B. (Eds.), 1994–weiter: Enzyklopädie der Holzgewächse: Handbuch und Atlas der Dendrologie. Wiley-VCH.
8. Šilić, Č., 1973: Atlas drveća i grmlja. Zavod za izdavanje udžbenika, Sarajevo. 218 pp.
9. Vidaković, M., 1993: Četinjače – morfologija i varijabilnost. GZH & Hrvatske šume, Zagreb. 744 pp.

Landscape Design and Planning

PU4004

ECTS 3

English language R1

E-learning R1

Teaching hours 30
Lectures 15
Exercises 15

Lecturer
Full.prof. Damir Krajnik, PhD

Teacher for exercises
Full.prof. Damir Krajnik, PhD

Grading
Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to landscape design and planning.
Definition of Landscape. Types of landscape. Impact and level of interaction between man and landscape.
Values and features of landscape. Landscape elements and their interrelations. Graphical interpretation of landscape elements.
Characteristics and values of landscape - Methods of assessment. Cultural landscapes. Methodology of Landscape Design.
Waterscapes. Transformation of river landscapes. *Ramsar* areas. River Sava in Zagreb.
Traffic corridors landscapes. Aesthetics of mobility. Landscape plans and traffic sequence projects. Environmental studies.
Brownfield areas. Landscape transformation of post-industrial sites (IBA Emscher Park).
Post-mining landscapes. Contemporary trends of transformation. Models for transformation of quarries.
Landfill sites. Models of Landfill sites conversion.
Landscape urbanism. Principles of modern large parks design.
Land art.
Legislation on protection of natural values, ecosystems and environment

Type of course:

Landscape Design and Planning (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce definitions of the term landscape, analyse and identify categories of landscape values, draw the analysis of visual features of the landscape as a basis for its evaluation	Exercises and final exam	B4
Identify contemporary principles of waterscapes and trafficscapes planning, transformation of Brownfield areas, recognize and apply principles of modern large scale parks design and practice.	Exercises and final exam	B4
Categorize protected natural values (protected areas) in the Republic of Croatia, identify basic features and permitted activities in certain categories of protected natural area in the Republic of Croatia, Enumerate environmental protection instruments.	Exercises and final exam	B4

General competences
Insight into development of landscape planning and landscape design. Getting acquainted with theory and practice of parks and landscape areas planning and design in the context of spatial and urban planning.

Type of instruction

Lectures

Exercises
Beside lectures, students are asked to make seminar papers with analysis of national or international landscape plans or projects. The papers consist of on-site surveys and literature analysis. Seminars prepare students for exams and active participation in discussions in lectures and exercises.

Working methods:

Teachers' obligations:
Direct teaching - lectures and exercises. Design and planning exercises, devising knowledge tests and grading them. Administering written and oral exams and holding consultations if necessary. Creating teaching materials.

Students' obligations:
Regularly attending and actively participating in lectures and exercises, creating, submitting and presenting seminar paper in the given period. Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	-	0,5

Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	15	1,0
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible, correct and on time	Excellent (5)			
Final exam (FE)	80%	51-70%	Sufficient (2)	–	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + FE/80)/100**		30	60	3

Detailed description of rules for preparing, implementing and taking midterm exams, seminar papers, partial exams and written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	Students' attendance is checked and recorded in classes. Student can be absent with a reason from 15% of direct classes at the most.	Semester (15 hours of direct teaching)	-
Creation of exercises	Students prepare a seminar paper on a selected topic where they analyse examples of national or international landscape plans or projects and present them to colleagues according to arranged schedule.	According to arranged schedule	Exceptionally, if seminar has not been presented, it can be submitted subsequently within the arranged time period.
Written exam	The exam can be taken by students who have completed the exercises. Students answer the given questions on a printed exam prepared in advance. The written exam is graded and included in the final grade of the course. The written exam consists of a combination of drawing and theory tasks/questions. To pass the exam it is necessary to have 51 out of 100 points in total (60%).	Exam period	-
Oral exam	Students who pass the written exam get questions from different parts of the course content. Final grade for the course is calculated based on the following formula: **(FEx80+Ex20)/100**	-	-

Obligatory literature

1. Lectures compedium (http://www.sumfak.unizg.hr, Merlin e-learning System)

Recommended literature

1. Spellman Catharine, ed.: Re - Envisioning Landscape / Architecture, Actar, Barcelona, 2003.
2. Bell, S. (2004), Elements of visual design in the Landscape, Spoon Press, London, 2004
3. Jellicoe, Geoffrey and Susan. 1987. The Landscape of Man, London: Thames and Hudson
4. Magazines (izbor): Architectural Review, Garten+Landschaft, Landscape Architecture, Topos;
5. Web:
6. Virtual Landscape Gallery: 1100 european parks and gardens - www.vilar.com
7. European Landscape Architecture News - www.elanews.com
8. ELASA - European Landscape Architecture Students Association - www.stud.uni-hannover.de/-voell/elasa
9. René Pechere Virtual Library, Multimedia Garden Library - www.bvrp.net
10. GA-LA-NET: Das Fachforum für Landschaftsarchitektur und Garten -und Landschaftsbau - www.ga-la-net.de

Conservation of genetic diversity of forest trees

PU4005

ECTS 6

English language R1

E-learning R2

Teaching hours 76
Lectures 30
Exercises 30
Field work 16

Lecturer
Professor Davorin Kajba, PhD

Associate teacher for exercises
Professor Davorin Kajba, PhD
Assistant Professor Ida Katičić Bogdan, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

Genetic diversity in forest tree species, forest conservation policy and laws, economic evaluation of forest genetic resources (forest genetic resources within international frame, international laws concerning forest genetic material exchange, OECD and EU directives). Importance of genetic diversity in forest ecosystem (amount and pattern of genetic diversity, population genetics of forest tree species, genetic variation of quantitative traits, biochemical markers, DNA markers). Evolution genetics of forest tree species, genetic structure and population effective number, adaptation, adaptability and adaptedness, mating patterns of forest tree species. Spatial genetic variation, selective environmental neighbourhoods (SENs), phenotypic plasticity. In situ methods of forest tree genetic resources conservation (terms, information on species and populations). Priorities and selection of target species. Conservation strategies, monitoring and management of protected forest areas. Ex situ conservation methods (clonal archives, seed orchards, provenance/progeny tests, gene banks). Multiple population breeding system and conservation of forest trees genetic diversity, impact of various management systems on conservation of forest tree genetic resources (species genetic erosion indicators, potential threats for genetic diversity, natural and artificial regeneration, forest plantations).

Type of course:

Conservation of genetic diversity of forest trees (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Methods of studying the genetic variability of forest trees. Study of the variability of adaptive properties with the example. Variability of adaptive traits in the example of progeny tests. Selection for Resistance to Disease and Pollution.	Practise exercises, colloquia, knowledge test, final exam	B6
Apply basic principles of distribution of forest reproductive material on genetic backgrounds. Use seed stands as objects of forest reproductive material in the category selected. Re-examine genetic mapping and boundaries of provenance (seed regions and zones) according to recent research results.Use seed stands, regions and zones as a guarantee for genetic resources conservation.	Practise exercises, colloquia, knowledge test, final exam	B6
Suggest *ex situ* method for conservation of genetic diversity of a particular species of forests. Integrate the conservation of populations and other objects of genetic resources, their establishment and maintenance. Establish the conservation of genetic potential for adaptation of a particular tree species. Re-examine genetic conservation in forestry practice.Recommend the method of conservation of genetic material (seeds, pollen, cryopreservation, genetic bank, seed conservation, etc.)	Practise exercises, colloquia, knowledge test, final exam	B6
Predict the genetic lose assessment (genetic resource). Assess the relationship between population size and percentage of preserve additive genetic variability. Suggest a method for other goals in preserving genes, protecting and developing adaptability. Link the species grouping in genetic conservation to ecological characteristics and biological endangering. Suggest Renewal of Genetic Potential (Natural and Artificial Rejuvenation). Choose and create a conservation model for a particular tree species.	Practise exercises, colloquia, knowledge test, final exam	B6

General competences

Students acquire theoretical and practical knowledge of the principles and methods of conservation of genetic diversity and genetic resources of forest trees. Students are also acquainted with the goals of forestry policy, legislation and the economic aspect of conservation of genetic diversity as well as its importance and importance in the forest ecosystem (quantitative and qualitative genetic diversity estimates, in situ and ex situ methods, etc.).

Type of instruction

Lectures

Exercises

Students learn practically in the exercises to study the variability and inheritance of forest tree properties and methods of conservation (quantitative and qualitative genetic diversity estimates, *in situ* and *ex situ* methods, etc.).

Field work

1st day Field teaching is held in the area of Posavina. Students are introduced to the results of research conducted through molecular research in different populations of our economic species. The researches carried out in provenance tests (quantitative properties, phenological observations, etc.) have also been demonstrated for the purpose of studying genetic variability and conservation of the forest species evolutionary potential by *ex situ* method. They are introduced to the conservation of genetic diversity by in situ method using seed stands as conservation units and division into the seed area, zone and region.

Research on sperm testing from seed stands from the Croatian area has been demonstrated with the aim of preserving the seeds of our economic species. They are also introduced with different methods and vegetative propagation techniques (fixing of selected genotypes and preservation options).

For the *in situ* method, the seed stands and their role in the conservation of genetic diversity as well as the use of forest reproductive material in the changed ecological and climatic conditions have been demonstrated. They are known to preserve genetic diversity by using this method using seed stands as conservation units and dividing into the seed area, the zone and the region.

2nd day Field teaching is held in Gorski Kotar and Lika area. Students are demonstrating *ex situ* conservation facilities and are acquainted with the processes of establishing and maintaining clonal archives, clonal seed orhards, provenance tests, and semester nursing tests (Šumarija Čazma). Works on maintenance of ex situ facilities, biotechnical interventions, phenolic observations and research of other properties related to genetic structure conservation research are presented. The students were referred to the research results that were conducted through molecular research, genotyping of clones from seed plantations (seed region, zone). The students are familiar with the use of forest reproductive material and have also studied the aim of studying genetic variability and preserving the evolutionary potential of some species of forest trees.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards	Sufficient (2)	30	-	1
		Extended lectures with less than 10% of acceptable	Good (3)			

		disadvantages of the application of technical standards				
		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards	Excellent (5)			
Making excersies (E)	30%	Extended lectures with less than 15% of acceptable disadvantages of the application of technical standards	Sufficient (2)	30	30	1,5
		Extended lectures with less than 10% of acceptable disadvantages of the application of technical standards	Good (3)			
		Extended lectures with less than 5% of acceptable disadvantages of the application of technical standards	Very good (4)			
		Extensive lectures without any disadvantages of applying technical standards	Excellent (5)			
Field work (FW)	-	-	-	16	-	0,5
Genetic Structure and Conservation Strategy in situ (K1)	30%	60-70%	Sufficient (2)	2	13	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Reconstruction of the forest tree genetic potential ex situ (K2)	30%	60-70%	Sufficient (2)	2	13	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Total	**100%**	**(Px10+Vx30 + K1x30+K2x30)/100**		80	55	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1.5
TOTAL	**100%**	**(FEx60+PEGx30+Ex5+HWx5)/100**				
*** students who do not pass the course through two partial exams during the semester take the final exam that is 60% of the grade and is the same as the partial exam - angiosperms; the remaining 5% is the grade of the exercises, 5% is the grade of the homework and 30% of the partial exam - gymnosperms**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours. Student activity is recorded.	semester (45 hours of direct lecturer)	-
Making exercises	Exercises are attended by groups. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted in a probationary period (provided that the student does not leave the class more than allowed, that the average grade of all the lessons in the classroom is greater than enough.	15. week	
Colloquium from Genetic Structure and Conservation Strategy in situ (K1)	The first colloquium can be accessed by students who have a positive evaluation of the 1st Exercise and no less than 20% have abstained from teaching.		
Reconstruction of the forest tree genetic potential ex situ (K2)	Colleges can be accessed by students who have passed the 1st Colloquium. The two colleges are scored with a total of 70 points, each colloquium with 35 points. A total of 42 of 70 points are required for the passage (60%).Students who get enough points from both hands get a final score on the subject. The final grade is the average score from the exercise and the score by the points.		
Written exam	The written exam consists of six assignments.For the passage it is necessary to have 28 points out of a total of 47 points (60%).	Exam terms	
Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the university textbook) is checked. The final grade is obtained according to the formula		

Obligatory literature

1. D. Ballian, D. Kajba: OPLEMENJIVANJE ŠUMSKOG DRVEĆA I OČUVANJE NJEGOVE GENETSKE RAZNOLIKOSTI, Sarajevo-Zagreb, 2011, 299 str.
2. Vidaković, M., A. Krstinić: GENETIKA I OPLEMENJIVANJE ŠUMSKOG DRVEĆA, Liber, Zagreb, 1985, 505 str.
3. Kajba, D., D. Ballian: ŠUMARSKA GENETIKA, Zagreb-Sarajevo, 2007, 283 str.
4. FAO, FLD, IPGRI: FOREST GENETIC RESOURCES CONSERVATIONA AND MANAGEMENT, Vol. 1, Vol. 2, Vol. 3, IPGRI, Rome, 2004.
5. Geburek, T., J. Turok,:CONSERVATION AND MANAGEMENT OF FOREST GENETIC RESOURCES IN EUROPE. Arbora Publishers,Zvolen, 2005, 693 str.
6. Baradat, Ph., Adams, W.T., Müller-Starck, G.: POPULATION GENETICS AND GENETIC CONSERVATION OF FOREST TREES, Amsterdam, SPB Academic Publishing.
7. Publikacije EUFORGEN (www.euforgen.com)
8. Müller-Starck, G., M. Ziehe: GENETIC VARIATION IN EUROPEAN POPULATIONS OF FOREST TREES, J.D. Sauerländer's Verlag, Frankfurt am Main, 1991, 271 str.
9. Vidaković, M. i suradnici: GENETIKA, Šumarska enciklopedija I, JLZ, Zagreb, 1983, str. 614-638.
10. Borojević, K.: GENI I POPULACIJA. Forum. Novi Sad. 1986, 545 str.
11. Krstinić, A. i sur.: OPLEMENJIVANJE ŠUMSKOG DRVEĆA. U: Šume u Hrvatskoj. str. 109-121. 1992.

Recommended literature

1. Eriksson, G., I. Ekberg, D. Clapham: AN INTRODUCTION TO FOREST GENETICS. SLU Repro, Uppsala. 2007, 185 str.
2. Frankham, R., Ballou, J., Briscoe, D.: INTRODUCTION TO CONSERVATION GENETICS, Cambridge, 2002, 640 str.
3. Frankham, R., Ballou, J., Briscoe, D.: A PRIMER TO CONSERVATION GENETICS, Cambridge, 2002, 640 str.
4. Hattemer, Hans H., Bergmann, F., Ziehe, M.: EINFÜHRUNG IN DIE GENETIK, J.D. Sauerländer's Verlag, Frankfurt am Main, 1993, 492 str.
5. Namkoong, G., Kang, H. C., Brouard, J. S.: TREE BREEDING PRINCIPLES AND STRATEGIES, Springer Verlag, 1988, 345 str.
6. Paule, L.: GENETIKA A ŠL'ACHTENIE LESNÝCH DREVÍN, Príroda a.s., Bratislava, 1992, 304 str.
7. Richards, A.J.: PLANT BREEDING SYSTEMS, Second edition, Chapman & Hall, London, 1997, 539 str.

Perennial and Annual Ornamental Plants

PU4006

ECTS 4

English language R1

E-learning R1

Teaching hours 46
Lectures 30
Exercises 0

Lecturer
Prof. dr. sc. Jozo Franjić
Doc dr. sc. Daniel Krstonošić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to definitions and basic terms - horticulture, floriculture, perennial plants, annual plants.
Lectures encompass taxonomic status and systematic division of perennial and annual ornamental plants. Moreover, students are introduced to basic morphologic, biological, and ecological characteristics of the perennial and annual ornamental plants.
Students learn about general characteristics of plants in floriculture (life form, ecological characteristics, way of reproduction, ways of cultivation, ways of their use in landscape architecture, special forms of cultivation).
Also, students are introduced to cultivation of perennials and pot plants used in park design, to cultivation of annual flowers used for design of flower beds, and growing of cut flowers.
Introduction of students to techniques related to garden design using perennial plants, flower beds and edgings, together with quality of the soil, size of the areas, openess of the garden to the sides of the world, intensity of nurture, special wishes, vistas, scenery, specially designed garden parts with the perennials, shady places in parks, twining plants and trailing plants, water perennials, making of a design, planning of a mixed edging, garden regeneration, rock gardens, paths, solitary high perennials, house gardens, specific arrangements with the perennials, patio gardens, rose gardens, flower gardens, little garden or a jardiniere, combination of colours in a composition.
The course in based upon the principles of contemporary forestry and those of urban forestry.

Type of course:

Perennial and Annual Ornamental Plants (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To interpret the characteristics of ornamental herbaceous plants (taxonomy, morphology, life form, biological and ecological features, use of alohton species and wild and cultivated taxa, neophytes, conservation of rare and endangered species and development of new ornamental taxa).	Partial exam, final exam	B4
To analyze the most important taxa of ornamental annual plants (appearance, cultivars, ecological requirements, use, propagation, specific use).	Partial exam, final exam	B4
To analyze the most important ornamental perennials taxa (for use in: wet and humid habitats, shady and semi-shady habitats, open, sunny habitats, xeric rocky habitats and specific habitats).	Partial exam, final exam	B4
To interpret a choice of suitable ornamental herbaceous plants.	Partial exam, final exam	B4

General competences
Students are acquainted with morphologic and growing characteristics of annual and perennial floriculture plants.
Introduction of students to technology of cultivation of main floriculture plants in greenhouses and in the open.

Type of instruction

Lectures

Exercises

Field work
Field work takes place in nurseries where students are introduced to species and cultivators of ornamental herbaceous plants and on park areas where students learn about concrete examples of plant material selection for different purposes.

Working methods:

Teachers' obligations:
Performing original teaching - lectures, field works. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations: Regular attendance and active participation in lectures and field teaching, preparation and presentation of seminars. Passing the partial and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Field work (FW)	-	-	-	16	0	0,5
Plant identification (PI)	20%	60-70%	Sufficient (2)	-	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Seminar (SR)	40%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (PE)	40%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(PI*20+SR*40+PE*40)/100**		46	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		60	2
TOTAL	**100%**	**(FE*80+PI*20)/100**				
*** Students who do not pass through seminar and partial exam have to access the final exam that makes 80% of the grade, and the remaining 20% of the grade makes the plant identification**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures+Field work	The attendance of students is checked and recorded at the lectures and field work. The student can justifiably be absent with a maximum of 20% of the lecture. Field work must be done in 100% amount.	semester (46 hours of direct teaching) -	-
Partial exam - Plant identification (PI)	Students have to recognize plant species from photographs. The accuracy of the recognition and pronunciation of the Latin names of plants is evaluated.	according to agreed deadlines	
Seminar (SR)	The student prepares the seminar paper on the given topic and presents it orally. The quality of the seminar work is evaluated. The seminar is given in the form of presentations and in written form. Seminar work is not obligatory.	13th and 14th week	
Partial exam (PE)	The students answer the questions on previously printed exam. The partial exam is evaluated and participates in the final grade. Access to the partial exam is only possible for students who have submitted seminar work. If a student has a positive assessment of the seminar (SR) and the partial exam (PE), he or she is not required to pass the final exam. He/she is obligatory to pass the Plant identification (PI). The final grade is calculated according to the formula PI * 20 + SR * 40 + PE * 40	15th week	
Final exam (FI)	Students who fail to pass the Partial exam (PE) and do not have a positive evaluation of the Seminar work (SR) are obligatory to attend the final exam. The condition to access to the final exam is to pass the Plant identification (PI) . The final exam consists of a written and oral part. In a written part students answer the questions on previously printed exam. Students who pass a written exam are oraly asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula FI * 80 + PIx20	in accordance to the agreed deadline and exam schedule	

Obligatory literature

1. Krstonošić, D., Škvorc, Ž., Franjić, J. 2017: Parkovno perensko i jednogodišnje bilje. Interna skripta. Šumarski fakultet, Zagreb

Recommended literature

1. Borovac, I., 2008: Cvijeće i ukrasno bilje – Velika ilustrirana enciklopedija, Mozaik knjiga, Zagreb.
2. Crnetić, T., 1996: Moć boja u oblikovanju vrtnih prostora. Zrinjevac, Zagreb.
3. Dole, M. J., Wilkins, H. F., 1999: Floriculture, Principles and Species, Prentice Hall, New Jersey.
4. Franke, W., 2006: Vrt – Enciklopedijski priručnik. Veble Commerce, Zagreb.

Environmental protection

PU5001

ECTS 5

English language R1

E-learning R1

Teaching hours 68
Lectures 30
Exercises 30
Field work 8

Lecturer
Professor Željko Španjol
Professor Željko Španjol

Associate teacher for exercises
Associate Professor Damir Barčić
Assistant Professor Roman Rosavec

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the fundamental environmental definitions, environmental issues in Croatia and the world. Attention is focused on legislation and ecological policy, namely the achievement of sustainable sustainable development of society. Environmental protection instruments and monitoring instruments are also included. Environmental studies, pollution and contamination and Global Climate Change.

Type of course:

Environmental protection (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the issue of environmental protection and biodiversity in forest ecosystems and urban areas (environmental management and sustainable development, environmental problems, biodiversity protection in forest and urban ecosystems).	Partial exam , seminars, Final exam	C1
Respond to climate change and water protection in forestry, urban forestry and nature conservation (causes of climate change, adaptation measures, protection of water forests with forests).	Partial exam, seminars, Final exam	C4
Present the protection of air and forest soils (sources of atmospheric pollution, soil protection, use and preservation).	Partial exam, seminars, Final exam	C4
Improve adverse impacts on the environment (environmental pollution and legal issues of environmental protection, primary activity, energy production, heavy metals, organic matter, radiation, noise, fossil fuels, nuclear energy, radiation, renewable energy sources).	Partial exam, seminars, Final exam	C1
Improve environmental protection and waste management.	Partial exam, seminars, Final exam	C4, D1

Type of instruction

Lectures

Exercises
Seminars are conducted as part of the exercise. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is conducted in areas, locations where students are familiar with anthropogenic environmental impacts. Students are introduced to practical measures and the implementation of sustainable development in urban forestry and other activities related to environmental protection.

Working methods:

Teachers obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, written exams, oral exams and consultations. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	0	1
Field work (FW)	-			8	0	1
Exercises (E)	20%	50-70%	Sufficient (2)	26	22	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	40%	50-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	40%	50-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + P1x40 + P2x40)/100**		68	82	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			5
TOTAL	**100%**	**(Fex80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (60 hours of direct lecturer)	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Ex20)/100**		

Obligatory literature

1. Tikvić, I., Barčić, D., Španjol, Ž. 2017: Zaštita okoliša. Skripta za internu upotrebu, Zavod za ekologiju i uzgajanje šuma, Šumarski fakultet Sveučilište u Zagrebu, Zagreb.

Recommended literature

1. GLAVAČ, V. 1999: Uvod u globalnu ekologiju, Državna uprava za zaštitu prirode i okoliša i Hrvatske šume d.o.o. Zagreb.
2. CARTER, N. 2004: Strategije zaštite okoliša, Barbat, Zagreb.
3. ENGER, E., SMITH, B 2000: Environmental Science: a study of interrelationships, 7th edition. McGraw-Hill, Boston.
4. MARTINOVIĆ, J. 1997: Tloznanstvo u zaštiti okoliša, Državna uprava za zaštitu okoliša. Zagreb.
5. POTOČNIK, V., LAY, V. 2002: Obnovljivi izvori energije i zaštita okoliša u Hrvatskoj. Ministarstvo zaštite okoliša i prostornog uređenja RH i «Barbat». Zagreb.
6. Ekološki leksikon, 2001: Barbat i Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, Zagreb.
7. Climate Change 2001: The Scientific Basis, Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate change. Cambridge University Press, Cambridge and New York.

Environmental economics

PU5002

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
assoc. prof. Stjepan Posavec, PhD

Associate teacher for exercises
Karlo Beljan, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The development of natural resources economics immediately activates the question of the ability of the natural system to maintain the economy. Any sustainability strategy for the future will have to face the question of how much total population could increase to guarantee basic and sustainable survival. For many citizens, life must be maintained in a fragile environment which is marginal and vulnerable.
The sustainability of such existence can be improved by the policy that reduce vulnerability, eg. Flood protection from the sea level increasing, measures that will improve food production security and thus mitigate market failures, regulation interventions in the case of inappropriate resource prices and uncoordinated development policies.
Interaction of the economy, markets and environmental protection. Ecological damages and economic-ecological balancing. An overview of environmental and economic pollution problems
Interaction between economic policy and environmental policy. The role of state and companies in environmental protection, the management function in environment protection. The role of the state Institutions and environmental policy in developed countries.

Type of course:

Environmental economics (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret the environmental economics and economic consequences of natural resources pollution (basic methods of environmental economics, causes and economic consequences of pollution, impact of climate change, the benefits of forests in urban areas).	exercises, seminar papers, final exam	A1
Present types and methods of evaluating renewable and non-renewable energy sources.	exercises, seminar papers, final exam	A2
Interpret the economics of pollution (impact of natural resources on the pollution assimilation, economic instruments, methods and goals of forest management).	exercises, seminar papers, final exam	A2
Valorize environmental assessment methods (monetary environmental assessment methods).	exercises, seminar papers, final exam	A3, C5
Present the economics of sustainable development and sustainability strategy (environmental protection standards, international policies, goals and strategies of sustainable development, ecological crisis, global change, economic influence, economic-ecological balance and ecological accounting).	exercises, seminar papers, final exam	A3

General competences
Conventional approach to environmental economics and resources.
Normative environmental objective analysis.
An estimation of the ecological economics values with accent to the state's failure to control pollution.

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:
Teaching original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge exams and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Students' obligations:
Taking lessons and active participation in all segments (lessons, exercises). Individual preparation and exercise submission. Taking exam

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Regularly lessons attendance and activity	-	30	0	1
Exercises (E)	10%	Participation and regularly submitiom	-	15	0	1
Self-conducting seminar (presentation form) E_1	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)		15	0,5
		Proper, readable, with major corrections and on time	Good (3)			
		Proper, readable, with minor corrections and on time	Very good (4)			
		Proper, readable, accurate and on time	Excellent (5)			
Self-conducting seminar (presentation form) E_2	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)		15	0,5
		Proper, readable, with major corrections and on time	Good (3)			
		Proper, readable, with minor corrections and on time	Very good (4)			
		Proper, readable, accurate and on time	Excellent (5)			
Partial exam (PE)	50%	60-70%	Sufficient (2)		45	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E_1x15+E_2x15 + PEx70)/100**		45	45	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	45		4
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checking the attendance of students on lectures. Student can miss the lectures justifies no more than 15%	semester (45 hours of direct lecturer)	-
Exercise	Exercises are conducted individually. At the beginning of the first exercise, students receive task templates for all exercises, as well as all necessary info. Evaluation consist of accuracy and time frame in which in necessary to hand exercises.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student can miss the class
Paper work	during the semester Students are performing two seminars. The first work is done in pairs (two students prepare the default topic) and presents it in the form of a PowerPoint presentation. The second work is also done in pairs and submitted in writing form (Word). Instructions for the seminar papers are provided by the lecturer, and are entirely available on the Faculty web site.	1st seminar until January 15th 2nd seminar until June 15th	
Written exam	no	-	
Oral exam	Students who submit the exercises and do both seminar works have the right to access the exam. Exercises are not evaluated and have no impact on the final assessment. Seminar papers are evaluated and have an impact on the final assessment.	Exam terms	

Obligatory literature

1. Črnjar, M.: Ekonomija i zaštita okoliša, školska knjiga Zagreb, Ekonomski fakultet Rijeka, 1997.
2. Figurić, M.: Uvod u ekonomiku šumskih resursa, šumarski fakultet, Zagreb, 1998.
3. Sabadi, R.: Vrednovanje šuma u njihovoj ukupnosti, Hrvatske šume, Zagreb, 1997.

Recommended literature

1. Goodstein, E. S.: Ekonomika i okoliš, Prentice-Hall Inc., Mate d.o.o., Zagreb, 2003.

Silviculture of special purpose forests

PU5003

ECTS 5

English language R1

E-learning R1

Teaching hours 91
Lectures 45
Exercises 30
Field work 16

Lecturer
prof. dr. sc. Milan Oršanić
doc. dr. sc. Damir Drvodelić

Associate teacher for exercises
doc. dr. sc. Damir Drvodelić
doc. dr. sc. Vinko Paulić

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

During listening lessons as well as exercises, students are introduced to the management of special purpose forests. Special Purpose Forests include forests that are exempt from regular management and are under protection. Management with such stands as well as artificial plantations implies management according to the principles of sustainable management and maintenance of existing biodiversity. The subject will cover cases of forest breeding in protected natural facilities. Drying and decay of forests, as well as restoration in such cases. Urban forest ecosystems and issues of their renewal. Private Forests Management and Private Entrepreneurship Issues. High mountain forest ecosystems and renovation issues. Rainforests and special forest reserves, importance and study of the same. Ecological and biological conditions are essential for natural regeneration.

Type of course:

Silviculture of special purpose forests (compulsory course, 5th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain ways of regeneration and forest care of special purpose (characteristics, purpose and significance, sociological role and raising of special purpose forests, restoration and nursing methods).	Practicum, Preliminary exam, Final exam	B5, D1
Analyze the types and methods of regeneration of stands of special purpose (natural and artificial regeneration, generative and vegetative regeneration, advantages and disadvantages of choice and regeneration).	Practicum, Preliminary exam, Final exam	B1, B5, D1
Describe forestry procedures in the stands of the disrupted structure (in cases of drying and decay of whole stands after natural disturbances).	Practicum, Preliminary exam, Final exam	B5, D1
Present forest management planning and sustainable management practices in forests with a distinctive protective function and forests of special purpose (management, biodiversity of forests, sustainable management, sustainable development).	Practicum, Preliminary exam, Final exam	B5, D1
Analyze the characteristics of private forests management (management history, present state of the surface, ownership structure, stock and growth and future perspective).	Practicum, Preliminary exam, Final exam	B5, D1
Present the basics of forestry and seedlings (seed material and seeds, production facilities, livestock estimation, collection, storage and processing of seed, germination and evaluation of seed quality elements, nursery establishment, technical conditions and seedlings, planting material).	Practicum, Preliminary exam, Final exam	B1, B5, B8, D1

General competences

The aim of the course is to introduce students to the management of forests that have some form of protection and which they manage in a specific way. By listening to the subject, students gain knowledge of the management of the subject. Forests of special purpose are usually very valuable natural objects with significant general useful functions, which require specific interventions in management.

Type of instruction

Lectures

Exercises

During semester seven different exercises are performed which are an upgrade to knowledge adopted in lectures.

Field work

Field work is planned for 2 days, according to the curriculum:

1. Reconstruction of special purpose forests, lowland ecosystems.
2. Reconstruction of special purpose forests, mountain ecosystems.

Working methods:

Teachers' obligations:

Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, exercises and field sessions. A justified absence with a maximum of 20% of lectures and 10% of exercises is allowed. Creating and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	-	-	-	30	12	1,4
Field work (FW)	-	-	-	16	2	0,6
1. Partial exam (PE1)	50%	60-70%	Sufficient (2)	-	39	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2. Partial exam (PE2)	50%	60-70%	Sufficient (2)	-	36	1,2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+E+FW+PE1x50+ PE2x50)/100**		91	89	6

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4)	-	75	2,5

		Excellent (5))	
TOTAL	**100%**	**(FEx100)/100**	
***** Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 100% of the final grade			

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	The lectures are checked and the presence of students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours.	semester (45 hours of direct lectures)	-
Exercises (E)	Exercises are checked and students attend. Student may justifiably be absent with a maximum of 10% of direct teaching hours. At the end of the semester, the students submit their exercises based on the instruction given from the beginning of the course on the layout and content of the exercises.	After completing classes	-
Field work (FW)	On-site teaching is checked and the presence of students is recorded and no absences allowed. After completing each field course, the students are obliged to write and submit a report from the field teaching.	According to the field curriculum	-
1. Partial exam (PE1)	All students who have enrolled the subject for the first time in the current academic year can access the first queue. In the content of the 1st Column the first half of the tuition is entered. Colloquy is an oral test.	8. week	There is a possibility of a correction deadline for the colloquium.
2. Partial exam (PE2)	2. Colleges can be accessed by students who have passed the 1st Colloquium. The second half of the semester enters the second half of the tuition. Colloquy is an oral test. Students placing both oral colloquia get a final grade from a subject that is the arithmetic mean of the grades from the first and second colloquia.	15. week	There is a possibility of a correction deadline for the colloquium.
Written exam	Written exam consists of 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. For passage on a written exam, it is necessary to collect more than 60% of the points.	Exam terms	-
Oral exam	The requirement for the entrance to the oral exam is at least 60% of the points collected on the written part of the exam. The final grade is obtained according to the formula (ZIx100) / 100		-

Obligatory literature

1. Oršanić, M., 2004: Uzgajanje šuma posebne namjene. Skripta za internu upotrebu. Šumarski fakultet, Zagreb.
2. Anić, I., 2004: Uzgajanje šuma I. Skripta za internu uporabu. Šumarski fakultet, Zagreb.
3. Anić, I., S. Mikac, 2004: Uzgajanje šuma I – vježbe i terenska nastava. Skripta za internu uporabu. Šumarski fakultet, Zagreb.

4. Matić, S., I. Anić, M. Oršanić, 2003: Uzgojni postupci u bukovim šumama. U: S. Matić (ur.), Obična bukva (*Fagus sylvatica* L.) u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str. 340 – 369.
5. Matić, S., I. Anić, M. Oršanić, 2001: Uzgojni postupci u prebornim šumama. U: B. Prpić (ur.), Obična jela (*Abies alba* Mill.) u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str. 407– 460.
6. Matić, S., 1996: Uzgojni radovi na obnovi i njezi sastojina hrasta lužnjaka. U: D. Klepac (ur.), Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj, HAZU i Hrvatske šume, Zagreb, str. 167 – 212.

Recommended literature

1. Burschel, P., J. Huss, 1997: Grundriss des Waldbaus. Parey Buchverlag, Berlin, 487 str.
2. Matthews, J. D., 1991: Silvicultural systems. Clarendon press, Oxford, 284 str.
3. Korpel, Š., J. Penaz, M. Saniga, V. Tesar, 1991: Pestovanie lesa. Priroda, Bratislava, 465 str.
4. Matić, S., M. Oršanić, I. Anić, 2003: Uzgojni postupci u niskim i degradiranim bukovim sastojinama. U: S.Matić (ur.),Obična bukva (*Fagus sylvatica* L.) u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str 393 – 405.

Forest regulation of forest for special purposes

PU5004

ECTS 6

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 30
Field work 15

Lecturer
Prof. Jura Čavlović, PhD
Assist. prof. Krunoslav Teslak, PhD

Associate teacher for exercises
Assist. prof. Krunoslav Teslak, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The course contains next topics: Essentials of growth, development and increment of individual trees and stands; basis of regulation (principle of sustainability, forest normality, establishment of growing stock in even-aged and uneven-aged forests, spatial forest regulation, establishment of prescribed cut in even-aged and uneven-aged forests); basis for defining of manners and methods for forest planning and management as forest objects for special purposes, originating from the contents and the basic functions of individual forest objects for special purposes; definitions and meaning of special purpose forests, legal regulations referring to proclamation and management of special purpose forests, functions of special purpose forests, contents and area structure of strict reservations, national parks, important landscapes, nature parks, special reservations, forest parks and other park surfaces; in this subject principles of esthetic and recreational natural forests management, in which ecological and social criteria predominate, valorization of ecological, esthetic and recreational values of special purpose forests; spatial planning of special purpose forests, units of internal spatial division in special purpose forests, establishment of existing state of stands in special purpose forests, temporal management of special purpose forests, defining of guidelines for future management procedures, as a special part of special purpose forest management, are further addressed.

Type of course:

Forest regulation of forest for special purposes (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe, to recognize and to classify types of special purpose forests (content and meanings of special purpose forests, types of natural and build objects, categories of park objects)	computational and computer exercises, partial exams, knowledge tests, final	B5
Interpret and explain, and to design functions of special purpose forests (main functions of park objects, function mechanisms of park objects, building/trees relations aimed to save energy)	computational and computer exercises, partial exams, knowledge tests, final	C1
Analyse, to derive (draw) and to calculate elements of tree and stand growth as composition elements of park recreational objects (growth of tree height, dbh and volume; longitudinal tree cross section and growth curves; management systems; growth and volume increment of even-aged stand)	computational and computer exercises, partial exams, knowledge tests, final	B9
Explain and to calculate planning elements of economic forest functions in special purpose forests (elements of regulated even-aged and selection/uneven-aged forests; age-class and diameter-class structure of even-aged and uneven-aged forests; possible (theoretical) cut in regulated even-aged and uneven-aged forest)	computational and computer exercises, partial exams, knowledge tests, final	B5
Present and to explain planning elements of urban forests and special purpose forests (principles of sustainability; influential determinants on development of spatial usage; aims and management guidance according to categories of special purpose forests; spatial categories and zones of park recreational objects)	computational and computer exercises, partial exams, knowledge tests, final	B5
Explain, to analyse and to calculate elements of management plans of urban forests and special purpose forests (levels of management plans; structure and basic components of plans; characteristics of actual park objects; needs for building of new park objects)	computational and computer exercises, partial exams, knowledge tests, final	B5

General competences

Acquiring of basic knowledge in development, growth and increment of individual trees and stands. Acquiring of general knowledge in forest regulation as basis for spatial and temporal forest management planning. Acquiring of basic knowledge about approaches and methods in forest management planning of forest objects with special assignments.

Type of education

Lectures

Exercises

There are perform 5 computational, 2 computer and 2 project exercises which elaborate main topics of course based on actual examples, as upgrade on knowledge acquired on lectures.

Working methods:

Teachers' obligations:
Performing of primary education – lectures, exercises and field work; preparing of exercises, educational materials and knowledge tests; performing of consultations, partial and final exams.

Students' obligations:
Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45		1.5
Exercises (E)	10%	Partialy uncluttered, large correction and on time	Sufficient (2)	30	15	1.5
		Uncluttered, large correction and on time	Good (3)			
		Uncluttered, small correction and on time	Very good (4)			
		Uncluttered, corect and on time	Excellent (5)			
Field education (FE)	-	-	-	15		0.5
Partial exam 1 (PE1)	45%	60-70%	Sufficient (2)	2.5	35	1.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 1 (PE1)	45%	60-70%	Sufficient (2)	2.5	35	1.25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex10 + PE1x45-PE2x45)/100**		95	85	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	90 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	5	75	2.5
TOTAL	**100%**	**(FEx90+Ex10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Checking and evidence of student's attendance. Student is allowed exculpatory to absent of maximal 15% hours of direct teaching (10% of exercises and 20% of lectures)	semester (60 hours of direct teaching)	-
Field work	Checking and evidence of student's attendance and their activity. Field teaching is fully obligatory.	semester (15 hours of direct teaching)	Exceptionally, in a case of exculpatory absent student is obliged to prepare seminar or to pass partial exam related on topics of field teaching
Preparing of exercises	Exercises are performing in groups up to 20 students, depending on total enrolled students. There are perform 5 computational, 2 computer and 2 project exercises. At beginning of semester, students get instructions for preparing of files and covers for exercises, and templates which include explanation of topics and actual examples for each exercise. Evaluation include correct, uncluttered and regularity of preparing and delivery of exercise. Exam include	according to defined deadline	Exceptionally student is obliged to work of , in a case of exculpatory absent of several exercise
Written exam	Attendance to exam is allowed to student who regularly get done and complete all exercises and field teaching. Written exam is possible to pass by two partial exams, at the middle and end of semester, or on exam dates scheduled after semester. Student get in advance prepared knowledge test, which include 10 questions (9 questions are in essay form which can include graphs, and 1 question relate on solving of problem example). Exam include testing and evaluation of knowledge and skills gained on lectures, exercises and field teaching. Attendance to the second partial exam is allowed to student who passed the first partial exam. Written exam is evaluate and contribute in final grade of the course.	defined deadlines of partial exams during semester, schedule of exam dates	
Oral exam	Prerequisite for oral exam is sufficient grade achieved on written part of partial exam or exam within scheduled exam date. Theoretical knowledge (from book) and		

	understanding of teaching topics within exercises and field teaching are evaluate. The finish grade is get according to equation: **(WIx40+OIx50+Ex10)/100**		

Obligatory literature

1. Čavlović, J., 2005: Uređivanje šuma posebne namjene, Prezentacija, 276 slds
2. Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 322 str.
3. Klepac, D. Rast i prirast šumskih vrsta drveća i sastojina. Znanje, Zagreb 1963.
4. Klepac, D., 1965: Uređivanje šuma, Znanje, Zagreb.
5. Davis, L.S. & Johnson, K.N.: Forest Management. Mc Graw-Hill Book Company, New York, 1987.
6. Meštrović, Š. 1987. Uređivanje šuma s posebnom namjenom. Glas. šum. pok. 3.

Recommended literature

1. Forest management plans, books, regulations and articles related on special purpose forests

Technical components of park design

PU5005

ECTS 4

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Doc.dr.sc. Hrvoje Nevečerel
Doc.dr.sc. Kruno Lepoglavec

Associate teacher for exercises
Doc.dr.sc. Hrvoje Nevečerel
Doc.dr.sc. Kruno Lepoglavec

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject Technical components of park design give students knowledge about the park techniques and park equipment. Technical features, valid standards, and regulations in civil engineering are considered. Scales and plans in civil engineering are described. Surveying necessary in making designs of physical planning is explained. Procedures in making project documentation are defined with a special emphasis on the use of a personal computers.
Basic building materials are analysed: building stone, concrete, wood, binding materials, lime, cement, paint and varnish. Students get knowledge about garden communications and parking lots. Stairs, their basic types and dimensions are also dealt with, then basic types of bridges with the principles of statistical calculation and dimensioning of wooden bridges. Fences, retaining and revetment walls, objects of surface and underground drainage are also the subjects of study.
Students learn about various park equipment (tables and benches, children's playing equipment, sheds, canopies, signpost, etc). They are also taught about swimming pools and water park elements. Systems of irrigation and regulation of soil humidity, park lighting, and light effects are also dealt with. Field terrains for individual and team sports, trim tracks and golf courses are also discussed.

Type of course:

Technical components of park design (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the basic building materials for the construction of park elements or devices (technical features, valid standards and regulations in civil engineering, use of construction stone, concrete, wood and metal, use of organic and inorganic binders).	Exercises, Colloquium, Final exam	C1
Observing park communications (complete design process (planning and production) and conservation of park and garden communication).	Exercises, Colloquium, Final exam	B4
Display the types, functions and features of various park equipment and garden accessories.	Exercises, Colloquium, Final exam	B10
Present water surfaces and sports facilities in parks.	Exercises, Colloquium, Final exam	C3
Analyse the conversion of brownfield areas into the park/garden area.	Exercises, Colloquium, Final exam	B4

General competences
The basic objective and task of the subject Technical components of park design is to inform students about the technical component of the landscape and park design. Students obtain theoretical and practical knowledge and skills necessary for planning, designing and performance of technical components of garden and park objects.

Type of instruction

Lectures
Lectures cover 6 methodical units according to the teaching plan.

Exercises
Exercises are performed in the form of designing exercises and computer exercises. In the design exercises, students independently carry out drafting and sketching and data processing and interpretation of results. Computer exercises include drawing in specialized programs, and exercise scores are based on actual measured data. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 2 days according to the teaching plan.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures, exercises and field work. Proposing and conducting topics for seminar papers, compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, designing and developing seminar work. Passing the colloquium, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	15%		0-15 points	30	-	1
Exercises (E)	15%	Partially untended and incomprehensible, with major corrections and on time	1-3 points	14		0,5
		Orderly, readable, with major corrections and on time	4-8 points			
		Orderly, readable, with minor corrections and on time	9-12 points			
		Orderly, readable, accurate and on time	13-15 points			
Seminar Work (SW)	10%	Bad topic, partially untended and incomprehensible, with major corrections and on time	1-2 points	1	30	1
		Good topic, partially untended, with major corrections and on time	3-5 points			
		Very good topic, orderly, with minor corrections and on time	6-8 points			
		Great current topic, orderly and readable, accurate and on time	9-10 points			
Partial exam (PE)	60%		0-60 points		45	1,5
TOTAL	**100%**	**(Lx15 + Ex15 + SWx10 + PEx60)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	60 %	60-70% 71-80% 81-90%	Sufficient (2) Good (3) Very good (4)			1,5

	91-100%	Excellent (5)
TOTAL	**100%**	**(Lx15 + Ex15 + SWx10 + FEx60)/100**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Fieldwork and exercises are mandatory. The student doesn't have to participate in lectures and exercises, but for each one he/she gets points for attendance.	semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended by groups. At the beginning of the first exercise, students will receive templates with exercise assignments, as well as the appearance of the folder, wrapper, and worksheet in which they will respond to the set tasks in printed form. The accuracy, regularity, and regularity are evaluated (time-honoured exercises).	in accordance with the agreed terms	-
Partial exam	The colloquiums are available to students who have regularly attending direct lectures. The students who pass the exam will receive a final grade from the subject that is awarded according to the formula: **(Px15 + Vx15 + Sx10 + Kx60)/100**	in accordance with the agreed terms	-
Written exam	Exams can be taken by students who did not attend the colloquium. The written exam is evaluated and participates in the final grade of the subject. **(Px15 + Vx15 + Sx10 + PIx60)/100**	Exam terms	-

Obligatory literature

1. Barth, U., Rogers, G. 2004: Design in the garden (Inspiration, planting, structure), David & Charles Books, London, p. 1-134.
2. Bird, R. 2002: Garden Answers Ponds, Hamlyn, p. 1-144.
3. Bridgewater, A., Bridgewater, G. 2003: Stonework. New Holland Publishers (UK) Ltd, London, p. 1-96.
4. Hawthorne, L. 2000: Walls & Fences, Dorling Kindersley Limited, London, p. 1-72.
5. Swift, P., Szymanowski, J. 2001: Paths, steps & patios, New Holland Publishers (UK) Ltd, London, p.1-64.
6. Vojvoda, D., 1972: Vrtni uređaji, Zrinski, Čakovec, s. 1-196.
7. Williams, R. 1995: The garden designer, Frances Lincoln Limited, London, p. 1-207.

Recommended literature

1. Alexander, R., Batstone, K. 1994: A handbook for garden designers, Ward Lock, Cassel Ilustrated, p. 1-136.
2. Anon. 1999: Paths and Paving, Dorling Kindersley Limited, London, p. 1-72.
3. Bridgewater, A., Bridgewater, G. 2003: Step by step garden diy (50 simple projects using wood, stone, water), New Holland Publishers (UK) Ltd, London, p. 1-382.
4. Blizzard, R. 2002: More garden woodwork in a weekend, A David & Charles Book, p. 1-128.
5. Grupacija javnog zelenila Hrvatske, 1986: Norme za uređenje i održavanje zelenih površina, Zagreb, s. 1-109.
6. Hirst, B. 2004: Garden ponds, New Holland Publishers (UK) Ltd, London, p. 1-96.
7. Jones, L. 2003: Reinventing the garden, Thames & Hudson, p. 1-192.

8. Kawaguchi, Y. 2001: Serene gardens, New Holland Publishers (UK) Ltd, London, p. 1-144.
9. Prošić, B., 1973: Moj vrt, Nolit, Beograd, s. 1-310.
10. Sweetinburgh, R. 2002: Small garden planner, Chancellor Press, p. 1-144.
11. Stillman, J., Gitlin, J. 2003: Deck & patio – idea book, The Taunton Press, p. 1-172.
12. Swift, P., Szymanowski, J. 2001: Ponds, pools and rockeries, New Holland Publishers (UK) Ltd, London p. 1-96.

Nature protection

PU5006

ECTS 5

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Professor Željko Španjol
Associate Professor Damir Barčić

Associate teacher for exercises
Assistant Professor Roman Rosavec

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the historical development of ideas and activities in the field of nature protection in our country and in the world. The introduction introduces topics related to the factors that influence nature, the organization of nature protection in our country and in the world, the most important laws, documents and conventions in the field of nature protection. Particular attention is focused on the categories of protected natural values, their basic characteristics and the state of tendency of the movement of nature protection in our country and in the world. The lectures also cover issues of sustainability, sustainable development in the management of natural resources.

Type of course:

Nature protection (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compute the analysis and interpretation of biological and landscape diversity and the classification of protected forest areas.	Partial exam, seminars, Final exam	B1
Present spatial plans and management plans in protected areas, structure, division, structure, features and evaluation of national parks and nature parks.	Partial exam, seminars, Final exam	B3
Analyze the protection of flora and fauna, the endangerment of plant species and habitats, the evaluation of protected areas (National Habitat Classification and European Ecological Network - NATURA 2000, habitat fragmentation and protected area evaluation).	Partial exam, seminars, Final exam	B13

General competences

Overview of Forms and Methods of Institution Management in Protected Areas. Methods of public institutions for the protection of natural values. Understanding of documents and conventions related to nature protection and their application in the field. Analysis of basic monitoring and inventory methods. Knowledge of the organization of protection, establishment and functioning of institutions for the protection of natural values.

Type of instruction

Lectures

Exercises

Seminars are conducted as part of the exercise. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is conducted in the areas of county public institutions for protected areas of nature, and in the areas of public institutions of National Parks and Nature Parks in Croatia.

Working methods:

Teachers obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, written exams, oral exams and consultations. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30	0	1
Exercises (E)	20%	50-70%	Sufficient (2)	11	10	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	40%	50-70%	Sufficient (2)	2	20	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	40%	50-70%	Sufficient (2)	2	20	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + P1x40 + P2x40)/100**		45	50	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			5
TOTAL	**100%**	**(Fex80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyzes and interpretations of the teaching units in the exercises.	semester (45 hours of direct lecturer)	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Ex20)/100**		

Obligatory literature

1. Barčić, D., Španjol, Ž. 2017: Zaštita prirode. Skripta za internu upotrebu, Zavod za ekologiju i uzgajanje šuma, Šumarski fakultet Sveučilište u Zagrebu, Zagreb.
2. Rauš, Đ. 1991*:* Zaštita prirode i čovjekova okoliša**.** Šumarski fakultet, Sveučilište u Zagrebu, Zagreb

Recommended literature

1. Španjol, Ž., 1994: Problematika nacionalnih parkova u svijetu i u Republici Hrvatskoj. Glas.šum. pokuse 30: 61-94, Zagreb.
2. Španjol, Ž. 1993**:** Uloga posebno zaštićenih objekata prirode u turizmu**,** Glas. šum. pokuse, posebno izdanje 4: 231-242, Zagreb.
3. Pregled stanja biološke i krajobrazne raznolikosti Hrvatske sa strategijom i akcijskim planovima zaštite, 1999, Državna uprava za zaštitu prirode i okoliša. Zagreb.
4. Crveni popis ugroženih biljaka i životinja Hrvatske, 2004: Državni zavod za zaštitu prirode, Zagreb.
5. Crvena knjiga vaskularne flore Hrvatske, 2005: Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode, Zagreb.
6. Ekološki leksikon**,** 2001: Barbat i Ministarstvo zaštite okoliša i prostornog uređenja RH. Zagreb.
7. World Resources 2000-2001: People and Ecosystems: The Fraying Web of life**,** 2000: Elsevier Science. Oxford.

Arboriculture

PU6001

ECTS 5

English language R1

E-learning R1

Teaching hours 76
Lectures 30
Exercises 30
Field work 16

Lecturer
doc.dr.sc. Vinko Paulić
doc.dr.sc. Damir Drvodelić

Associate teacher for exercises
doc.dr.sc. Vinko Paulić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The subject aims to acquaint students with theoretical knowledge and skills in managing plantations and trees. Due to urbanization and wish of city inhabitants for recreation as well as rising awareness of the important role of trees and greenery for the quality of life there is a need to take better care of city greenery. In a broad sense, the subject comprises all types of growing plants whether of artificial or natural origin. Because of the very difficult conditions in which trees are planted in city or suburban areas, much attention is focused on establishing and maintaining favourable conditions for growth and development of city greenery. Special emphasis will be put on pruning of branches and whole tree crowns with the purpose of damage prevention and control of potential danger to people. Another subject matter to be taught is estimation of the value of trees, as well as their cataloguing. The outline of the subject follows the principles of modern forestry science. It is comprised of lectures, practice, field classes, and seminars. Modern teaching aids are used during classes.

Type of course:

Arboriculture (compulsory course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret basic principles of arboriculture (arboriculture and urban forestry, selection of tree species and influence on tree care operations, analysis of desirable tree characteristics from arboriculture point of view, selection of quality plants for planting, basic types of planting material)	Practicum, Preliminary exam, Final exam	B1, B6
Explain planting of trees and shrubs (basic types of planting techniques for trees and shrubs in urban areas, planting of seedlings, trees, shrubs and transplanting large trees in urban surroundings) and mulching of plants (use of mulch, mulch materials selection, advantages and disadvantages of certain mulch materials, mulch application and decontamination)	Practicum, Preliminary exam, Final exam	B4, B6
Interpret pruning of trees and shrubs (reasons for pruning, pruning effects and reaction of plants, formative pruning of young trees, pruning of old trees, shrubs, hedges, etc.)	Practicum, Preliminary exam, Final exam	B4, B6, B10
Explain fertilization and irrigation of urban trees (types, way and time of tree fertilization, use of antitranspirants, difference in irrigation systems for urban greenery)	Practicum, Preliminary exam, Final exam	B4, B6, B10
Interpret root system of urban trees (trees in pavement, soil and other factors that influence growth of trees in urban areas, influence of root growth on infrastructure, remedial treatment for root-pavement conflicts)	Practicum, Preliminary exam, Final exam	B4, B6
Explain hazardous trees in urban areas (hazard form tree failure, biomechanics in arboriculture, optimization of tree form, tree defects and symptoms, tree static, tree vitality, arboricultural instruments for hazardous tree assessment)	Practicum, Preliminary exam, Final exam	A1, A3, B2, B4, B6
Interpret management and inventory of urban greenery (care and management schedule of urban trees, tree sanitation plan, methods for tree inventory and tree cadastre)	Practicum, Preliminary exam, Final exam	B4, B6

General competences

The aim of this subject is to acquaint students with methods of tree management and tending of trees and small groups of trees. By taking this course student would acquire knowledge about habitats suitable for planting, estimation of value of newly planted trees, selection of planting stock, modification and repairing of habitats, silvicultural techniques, and specific economic situations in tree management in urban environments.

Type of instruction

Lectures

Exercises

During semester seven different exercises are performed which are an upgrade to knowledge adopted in lectures.

Field work
Field work is planned for 2 days, according to the curriculum:
1. Visit to urban greenery in the City of Zagreb, hazardous trees assessment and tree care operations for mitigation in case of tree failure
2. Visit to Maksimir urban forest and demonstration of tree pruning work.

Working methods:

Teachers' obligations:
Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams. Student can be absent with a reason from 20 % of lectures and 10 % of exercise. Students need to submit exercises work for check in given deadline. Passing the partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	30	15	1,5
Field work (FW)	-	-	-	16	2	0,6
1. Partial exam (PE1)	50%	60-70%	Sufficient (2)	-	30	1,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2. Partial exam (PE2)	50%	60-70%	Sufficient (2)	-	27	0,9
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(P+V+TN+K1x50+K2x50)/100**		76	74	5

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	57	1,9
TOTAL	**100%**	**(FEx100)/100**				
***** Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 100% of the final grade						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	The attendance of students is checked and recorded at the lectures. The student can justifiably be absent with a maximum of 20% of lectures and 10% of the exercises. Field work must be done in 100% amount.	semester (30 hours of direct lectures)	-
Exercises (E)	The attendance of students is checked and recorded at the exercises. The student can justifiably be absent with a maximum of 10% of the exercises. At the end of semester students submit exercises in arrangement to instruction from start of semester about content and form of submitted exercises.	At the end of semester	-
Field work (FW)	The attendance of students is checked and recorded at the field work. Students need to write and submit report paper after the field work is completed.	According to field work plan	-
1. Partial exam (PE1)	1st partial exam is available to all students who have been signed first time in this course. The content of 1st partial exam is the first half of direct classes during of the semester. The partial exam is written test with 20 questions. Correct answer is valuated with one point, partially correct with 0,5 point and incorrect of empty answer with 0 points. To pass partial exam students need to have more than 60 % correct answers.	8. week	Students which do not collect enough points to pass partial exam have possibility of correction exam available.
2. Partial exam (PE2)	2nd partial exam is available to students who have passed the first partial exam. The content of 1st partial exam is the second half of direct classes during of the semester. The partial exam is written test with 20 questions. Correct answer is valuated with one point, partially correct with 0,5 point and incorrect of empty answer with 0 points. To pass partial exam students need to have more than 60 % correct answers. Students which collect enough points from both partial exams get final grade from this course which is mean of points from first and second partial exam.	15. week	Students which do not collect enough points to pass partial exam have possibility of correction exam available.
Written exam	The written exam is test with 20 questions. Correct answer is valuated with one point, partially correct with 0,5 point and incorrect of empty answer with 0 points. To pass	Exam terms	-

	partial exam students need to have more than 60 % correct answers.		
Oral exam	Precondition for oral exam from this course is enough points from written exam. The final grade of the subject is obtained according to the formula: **(FEx100)/100**		-

Obligatory literature

1. Oršanić, M., D. Drvodelić, 2005: Arborikultura (interna skripta), 86 str.
2. Grey, G. W., 1996: The Urban Forestry: Comprehensive Management. Wiley. New York.
3. Harris, W. R., J. R. Clark, N. P. Matheny, 2004: Arboriculture, Integrated management of Landscape Trees, Shrubs, and Vines. Prentice Hall. Fourth edition.
4. Brown, G, E., 2004: The Pruning of trees, Shrubs and Conifers. Timber press Oregon.
5. Shigo, A. L., 1991: Modern Arboriculture. Shigo and Trees Associates.
6. Gilman, E, F., 2002: Illustrated Guide to Pruning. Second Edition.Delmar Cengage Learning.
7. Badler, H., 1998: Die Wurzeln der Stadtbäume. Ulmer Verlag. Berlin.

Recommended literature

1. Miller, R. W., 1997: Urban forestry: Planing and Managing Urban Green Spaces, 2nd ed. Upper Saddle River, NJ: Prentice Hill.

Environmental microbiology

PU6002

ECTS 4

English language R2

E-learning R2

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof. Anđelka Plenković-Moraj, PhD

Associate teacher for exercises
Ass. prof. Marija Gligora Udovič, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

General properties and functional diversity of microorganisms (producers, consumers, reducers) in ecosystems (air, soil, water). Influence of physicochemical factors on the growth and physiological activity of microorganisms. Circulation of elements in nature: carbon, sulfur, phosphorus, silicon, and calcium. The Ecological Significance of Microorganisms in Food Chains. The Principles of Systematics and Taxonomy of Monera together to Autotrophic and Heterotrophic Protists. Interaction of microorganisms with other populations in the ecosystem. Microbial lup. The role of microorganisms in eutrophication. Methods of field microbial research (field equipment and method of applications, field diary, sampling of plankton, benthos, bacteriology, measurement of basic physical and chemical parameters of water) and in the laboratory (isolation, microscopy, and determination). Application of computer programs (Omidia, Primer, and Statistics) in results analyzing, and interpretation of the achieved knowledge and skills.

Type of course:

Environmental Microbiology (compulsory course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate basic biological structures, functions, and organization of unicellular and multicellular microorganisms	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Explore the properties of microorganisms and interpret their role in living processes	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Link the microorganism life form of a with the energy flux efficiency utilization	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Compare the causal consequences of the structure and function of microorganisms in response to different living conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1,
Apply tools for study the structures and functions of microorganisms	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Analyze transformation processes of biogenic elements and of conversion energy flux at the ecosystem level	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Investigate abiotic living conditions and microorganisms' spread	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Compare energy flux relations and Circulation in different ecosystems with Analysis of functionality nutrition net	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Understand biotic interactions by arguing the causal relationships of individuals, species, and ecosystems	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Assess the success of organism survival in relation to specific environmental conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Significant adaptations to the life cycle or behavior of microorganisms due to changes under environmental conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Establish a widespread distribution of microorganisms with habitat types and ecosystems	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Discuss the linkage between biodiversity and environmental conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Analyze the link between receiving information, responding to information and regulating the response of organisms to changes in environmental conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Highlights of adaptations in life or behavior to organisms due to changes in environmental conditions	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Apply properly research principles (field, data, laboratory) of microorganisms	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1
Discuss the positive and negative impacts of applying technological processes and preparations to different ecosystems and forms of life	Continuously through written/oral practical work (laboratory exercises, project assignment, homeworks)	B1, B2, B3, C1, D1

General competencies
Adopt basic university education in the field of biology/microbiology (viruses, bacteria, algae, protozoa, mycota).
Link the energy flow through the ecosystem and the circulation of main biogenic elements in terms of ecosystem conditions, analyzing the roles and interdependencies ecosystem members, understanding the process of transformation of biogenic elements and conversion of energy on the organism and ecosystem.
Explore abiotic and biotic conditions; assess biodiversity as a heritage resource and the main base for survival on Earth through the analysis of collected data.
Develop the ability to set, understand, and creatively solve simple problems, principles, and theoretic.
Interpret scientific and professional literature in the field of microbiology in Croatian and English and apply organizational, presentation and communication skills.
Demonstrate self-indulgence for further training through the abundance of practical and generic skills.
Encourage teamwork and networking, apply moral and ethical principles and rules of the profession, and act in accordance with social responsibility and civic awareness, while respecting diversity and multiculturalism.

Type of instruction

Lectures
Interactive lectures, with the active students' participation (inquiries, discussions), provide insight into the general characteristics, functional diversity and ecological importance of microorganisms within ecosystem services and sustainable development.

Exercises
As part of the laboratory exercises, which upgrading the knowledge gained in the lectures, methods of active acquisition of skills for each individual student are carried out through individual tasks in field sampling, laboratory processing and interpretation of collected data.

Fieldwork

Working methods:

Teachers' obligations:
Creating a sovereign education material with regular lectures maintenance and exercises with the aim of acquiring knowledge through classroom teaching and e-learning system integration. During the semester obligatory follows the individual students' progress. Conducts students during their assignments and evaluates the regularity and quality of performing the required obligations in accordance with the approved Teaching Plan and the Lecture Line for the current academic year. Prepares written tests for checking the knowledge and evaluating them. Maintains partial exam (colloquia), oral exams, and consultations. Analyzes the outcomes for each student based on the accomplished tasks, the results of the colloquia and the success achieved on the exam.

Student's obligations:
Students are required regularly, and actively participate in all teaching forms, and to perform previously announced assignments in agreed terms. Students must respect the principles of academic congeniality regulated by the Code of Ethics of the University of Zagreb.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30		1
Laboratory Exercises (LE)	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15		0,5
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and on time	Excellent (5)			
Project assignment and seminar (PA&S)	25%	The student interprets with great help and patience	Sufficient (2)		45	1,5
		The student interprets with the help of the examiner	Good (3)			
		independently and logically interprets with little help	Very good (4)			
		Self-explanatory and logically interprets without any help	Excellent (5)			
Partial exam (PE)	60%	60-64%	Sufficient (2)		30	1
		65-74%	Good (3)			
		75-84%	Very good (4)			
		85-100%	Excellent (5)			
UKUPNO	**100%**	**(LEx15 + PA&S x25 + PEx60)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3 Very good (4)) Excellent (5)		30	1

LE+ PA&S	40%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3 Very good (4)) Excellent (5)	15	45	2
TOTAL	**100%**	**(FEx60+ LEx15 + PA&S x25)/100**				

***** students who do not pass through the semester during the semester will approach the exam period, which represents 60% of the grade, and the remaining 40% make a grade of laboratory exercises and project assignments.

A detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lecture+ exercises	Records of students' presence especially at LE. The student may justifiably be absent with a maximum of one time during the direct tuition associated with laboratory exercises.	semester (45 hours of direct lecturer)	-
Laboratory exercise	Laboratory exercises are performed in turnovers. At the beginning of the first exercise, students receive all the necessary tutorials and materials necessary for conducting practical classes. Homework assignments are required for students to pass through the e-learning courses. Evaluation of accuracy, orderliness, and regularity (tasks submitted on time)	in accordance with the agreed terms	Exceptionally, for a justified reason for another absence, a student may perform a missed exercise
Project assignment and seminar	Each student, at the beginning of the laboratory exercise, gets a project assignment and a title of a short seminar. The student is obliged to hold a short oral presentation (PPT + written text/word format) and to prepare an agreed project assignment. These are an integral part of course content and final record cannot be achieved without it.	in accordance with the agreed terms	-
Partial Exam (colloquium)	During the course, students have two written colloquia according to the pre-agreed and published deadlines. At each of the colloquia (Partial Exam), it is necessary to achieve pre-agreed passage, and as the result obtained it is used a mean of both successes. Students who did not meet the passage in one of the colloquies write the entire content according to the schedule of exams. In case the student is not satisfied with the success achieved through the colloquium, he/she retains the entire contents according to the schedule of exams.	7^{th} & 15^{th} week	Students passing the partial exam can directly access the oral exam
Written exam (WE)	WE could be accessed after completed exercises, seminars, homework's, and project assignment. In this part of the exam, students in writing form answer the questions (fex: complement the required data, round out the exact answers, describe the images, etc.). An evaluated written exam is an integral part of the final grade of the subject.	Exam terms	-
Oral exam (OE)	After passing the WE, students answering questions from the course program content in the form of the discussion. Achieved success for final grade (in respect of the above rules) is obtained according to the formula **(LEx15 + PA&S x25 + PEx60)/100 or**	Exam terms	-

	(FEx60+ LEx15 + PA&S x25)/100 In the case, if student is not satisfied with the success achieved is obliged to request a written exam within 24 hours.		

Obligatory literature

1. Biological Section e-Learning System (https://nastava.biol.pmf.unizg.hr) Microbiology of ecosystems: teaching materials
2. Madigan, M.T., Martinko, J.M., & Parker, J. 2003. Brock Biology of Microorganisms, 10th edition. Prentice Hall, Inc., Englewood Clifs, NJ 07632.
3. Duraković, S, 1996: Primijenjena mikrobiologija. Prehrambeno tehnološki inženjering, Zagreb.
4. Campbell, R., 1977. Microbial ecology, Vol. 5, In Wilkinson, J.F. (ed.) Basic microbiology. Blackwell Sci. Publ., Oxford.

Recommended literature

1. Carpenter, P.L., 1977. Microbiology. Saunders, Philadelphia.
2. Lynch, J.M., Hobbie, J.E., 1988: Microorganisms in action. Concepts and applications in microbial ecology. Blackwell Sci. Pub., Oxford.
3. Viličić, D., 2002: Fitoplankton u ekološkom sustavu mora. Školska knjiga, Zagreb
4. Leboffe MJ & Pierce BE (Microbiology - Laboratory Theory & Application. Fourth ed. Montor publishing.

Protected areas management and supervision

PU6003

ECTS 5

English language R1

E-learning R1

Teaching hours 69
Lectures 30
Exercises 15
Field work 24

Lecturer
Prof. Ivan Martinić PhD.

Associate teacher for exercises
Prof. Mario Šporčić PhD.
Assist. Prof. Matija Landekić, PhD.
Matija Bakarić PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction - theoretical basis of protected areas management. Main aspects and management development in protected areas. Role and significance of protected areas. General concept of management in protected area. Legislative framework and statistics of protected areas in the Republic of Croatia. Categorization of protected areas. IUCN management categories. Evaluation of protected areas. Professional backgrounds and databases in evaluation. Evaluation of goods and services in protected area. Cost and benefit analysis method. Planning in protected areas. General planning scheme. Phases when establishing new protected areas. Key planning criteria: area size, usage patterns, special international criteria (IUCN, UNESCO) Spatial planning in protected areas. Spatial plan for national park. Linkage and differences between the spatial plan and the management plan. Fundamentals of Protected Areas Management. IUCN matrix goals in the management of ZP. International standards of management. Principles of successful management: adaptive management, participation and sustainability. Expected mismatches, conflicts and management risks. Participating in management.
Zoning of protected areas. Types of zones, principles and zoning criteria. The basics of phase in zoning process. Management plans for protected areas. Elements of plan. Phases in the design of the management plan. Analytical and project phase in preparation of plan. Guidelines for developing a Croatian park management plans. Action plans for implementing management plans. Protected area management in Croatia. The role and activities of the management institution. Structure of management institutions, sources and models of financing. Monitoring and evaluation of performance efficiency: METT Method, RAPPAM Questionnaire. Financing of protected areas. Revenues of protected areas. Using your own revenue. Cost of management. Benefits of management for regional and local communities. Ecological education and interpretation. Educational content and target groups. Principles of interpretation. Guided activities. Visitor centers.

Surveillance in protected areas of nature. Legislative position, tasks and authorizations of nature guardian/ ranger. Tasks for monitoring the ecological network. Prescribed measures in monitoring implementation.
Touristic function of protected areas. Significance of tourism for protected areas. Tourism risks in protected areas. Visiting protected areas. Carrying capacity of protected area. Visitor risk management. Projects in protected areas. Types of intervention and special conditions of performance. Criteria and assessment of acceptability of project for protected area and for ecological network.

Type of course:

Protected areas management and supervision (compulsory, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain role and significance of protected areas in nature protection, ways of valorisation (bio-ecological, spatial and economic evaluation), planning models and principles of spatial planning in protected areas.	practice exercises, partial exam, knowledge test, final exam	C1, C2, C3
Define basics of protected area management through international standards and management principles - adaptive management, participation, sustainability.	practice exercises, partial exam, knowledge test, final exam	C1, C2, C3
Interpret management documents (management plan, spatial plan, annual program) and protected areas financing (types and sources of income, general cost structure, tourist user fees, concession permits).	practice exercises, partial exam, knowledge test, final exam	C1, C2, C3
Analyse monitoring of protected areas (authorizations, tasks and qualifications of nature guardians, legislative framework of supervision, prescribed conservation measures, participation in visitor management, educational tasks and partnership development with stakeholders).	practice exercises, partial exam, knowledge test, final exam	B1, C1, C2
Interpret function of tourism in protected areas (types and intensity of tourism, financial effects and risks, tourism management, visiting systems, protected area reception capacity).	practice exercises, partial exam, knowledge test, final exam	C1, C2, C4
Analyse the role and significance of ecological education and interpretation in protected areas (education themes, target groups, content and principles of interpretation, plan, means and methods of interpretation).	practice exercises, partial exam, knowledge test, final exam	B1, C2

General competences
Ability to independently perform various activities related to the activities of nature protected areas.
Develop skills in preparation and implementation of annual operational management documents.
Mastering engineering knowledge for planning and carrying out expert tasks in conservation and surveillance of protected area values and implementation of educational and other programs.

Type of instruction

Lectures

Exercises
Within the auditorial (10) and methodical (4) exercises, 14 units are provided, which include group analyses and critical reviews, as well as individual measurement and / or computer tasks related to operational operations in management and surveillance of protected areas. Exercises are the upgrading of knowledge adopted in lectures and field teaching.

Field work
Within the field course (3 days), protected areas are visited in the category of national park, nature park, protected areas of nature and ecological network area at the state and regional level, with presenting issues in categories of specificities of management, organization and activity; examples critically consider tourism, education, supervision, spatial planning, co-operation with local communities and other management areas.

Working methods:

Teacher's obligations:
Maintaining original teaching – lectures, exercises, field work. Compiling group seminars, partial exams, knowledge tests and evaluating them. Maintenance of partial exams, written and oral exams and consultation. Creating teaching materials.

Studenat's obligations:
Regular attendance and active participation in lectures, exercises and field work. Taking partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,5
Exercises (E)	10%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	14	-	0,5
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			
Field work (FW)	10%	Present, participates passively	Sufficient (2)	24	0	1,5
		Presents, cares closely and participates	Good (3)			
		Presented, includes questions and comments	Very good (4)			
		Presented, suggests concrete suggestions related to the theme of teaching	Excellent (5)			

Partial exam (PE)	10%	60-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Ex10 +FWx10 + PEx10 + FEx70)/100		69	45	**5**

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
TOTAL	**100%**	**(FEx90+Ex10+FWx10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked, and the attendance of students is recorded. A student may justifiably be absent with a maximum of 15% direct teaching hours.	semester (45 hours of direct lecturer)	-
Making exercise	14 exercises are performed within the exercise. Before starting each individual exercise, students will receive materials related to exercise issues and task templates. Accuracy, neatness and regularity is evaluated (exercise submitted on time).	15. week	
Field work	Within field course (3 days), protected areas (NP / PP, protected parts of nature at the county level and ecological network area visited, which are concerned with organization and management specificities.) Attention is paid to the type and level of participation in teaching.	Exam terms	
Partial exam	Students in pre-printed exam answer questions they are asking and round out the exact answers. The partial exam is evaluated and participates in the final grade of the subject.	11. week	Students who pass the exam can access the exam.
Final exam	Exams can be accessed by students who have completed all exercises and passed the exam. The students in the pre-printed exam answer the questions they are asking and round out the exact answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula (Ex10 +FWx10 + PEx10 + FEx70)/100		

Obligatory literature

1. Martinić, I.: Upravljanje zaštićenim područjima prirode – planiranje, razvoj i održivost, Šumarski fakultet u Zagrebu, Zagreb 2010.
2. Zakon o zaštiti prirode, NN 80/13, 15/18
3. Smjernice za planiranje upravljanja zaštićenim područjima i/ili područjima ekološke mreže, MZOE/HAOP, Zagreb 2018
4. Zakon o ustanovama; NN 76/93, 29/97, 47/99, 35/08
5. Pravilnik o zaštiti i očuvanju (za pojedino zaštićeno područje)

Recommended literature

1. Martinić, I., Dekanić S.: Rendžerske službe u nacionalnim parkovima Europe. MZOPU RH, 1-60, Zagreb 2001.
2. Martinić, I., Sladonja, B., Zahtila, E.: Development Prospects of the Protected Areas System in Croatia. In: Protected Area Management, InTech, ur. B. Sladonja, ISBN 978-953-51-0697-5, Rijeka, 2012.
3. Zbornik radova "Vizija i izazovi upravljanja zaštićenim područjima prirode u Republici Hrvatskoj - Aktivna zaštita i održivo upravljanje u Nacionalnom parku "Krka" / Marguš, D. (ur.)., JU "Nacionalni park Krka", 2017.
4. Izvješće o stanju prirode u R. Hrvatskoj 2008-2012, Min. zaštite okoliša i prirode, Zagreb, 2014.
5. Müller, H., Turizam i ekologija. Povezanost i područja djelovanja. Masmedia, Zagreb, 2004
6. Schroder, W., Lhota, S., Gugić, G.: Priručnik za nadzornike i vodiče. JU PP Lonjsko polje, 2004.

Introduction to Physical Planning

PU6004

ECTS 4

English language R1

E-learning R1/R2

Teaching hours 45
Lectures 15
Exercises 30
Field work 0

Lecturer
Assist.prof. Lea Petrović Krajnik, PhD

Associate teacher for exercises
Assist.prof. Lea Petrović Krajnik, PhD

Grading
Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Physical planning definition. Man and space. Functional characteristics and processes in space.
Primary and secondary urban development. Geographical conditions determining position and development of towns. Transport and geography related conditions of positioning of towns. Urban functions of town settlements. City agglomeration, conurbation and megalopolis. Region. Basic generators of contemporary area structure. Opening up of traffic, industrial areas, tourist regions, agricultural areas. Landscape and area identity. Effects of human activity on landscape appearance with important conservation principles. Endangerment of natural environment and area protection. Special characteristic areas: nature reserves, nature and memorial parks. Methods and technologies in project engineering of physical plans. Physical plans and practical issues related to design and implementation of physical plans.

Type of course:

Introduction to Physical Planning (compulsory course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe the spatial planning basics and the relationship between man and space (functional characteristics and processes in space).	Exercises and final exam	B9
Interpret urbanization (basic generators of contemporary area structure, urban agglomeration, conurbation and megalopolis, village and region, opening up of traffic, industrial areas, tourist regions and agricultural areas).	Exercises and final exam	B9
Interpret the landscape and area identity (consequences of human activity, endangerment of the natural environment, natural reserves, national and memorial parks).	Exercises and final exam	B9
Present physical planning documentation.	Exercises and final exam	B9

General competences
Introduction to the basics of physical planning.
Introduction to physical planning theory, practical issues related to physical planning and landscape architecture of larger areas.

Type of instruction

Lectures

Exercises
Exercises on the subject of specific thematic units serve to deepen the knowledge gained in the lecture. Block exercises have the purpose of deepening and practical application of gained knowledge during lectures. During the semester, students prepare seminar paper and presentation for the purpose of deepening knowledge on selected topics, as the basis for the exam.

Working methods:

Teachers' obligations:
Direct teaching - lectures and exercises. Designing and planning exercises, devising knowledge tests and grading them. Administering written and oral exams and holding consultations if necessary. Creating teaching materials.

Students' obligations:
Regularly attending and actively participating in lectures and exercises, creating and submitting the exercises in the given period. Taking exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	-	0,5
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	30	2
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible, correct and on time	Excellent (5)			
Final exam (FE)	80%	51-70%	Sufficient (2)	-	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + FE/80)/100**		45	75	4

Detailed description of rules for preparing, implementing and taking midterm exams, seminar papers, partial exams and written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	Students' attendance is checked and recorded in classes. Student can be absent with a reason from 15% of direct classes at the most.	Semester (45 hours of direct teaching)	-
Creation of exercises	Exercises are designed to follow the lectures thematically. Students make short presentations in consultation with the teacher. During the semester there are also blocks of exercises that serve to deepen the knowledge gained in the lecture and its practical application. Students prepare a seminar paper on a selected topic where they analyse the chosen spatial problem in the context of the role of urban forestry, that is being presented to colleagues.	According to the arranged schedule	Exceptionally, in case of a valid reason, a student can compensate for being absent in the second term.
Final exam	The exam can be taken by students who have completed the exercises. The written exam consists of the 10 theoretical questions. Each task is scored with 10 points (100 points). To pass the exam it is necessary to have 51 points out of 100 points (51%). Students get questions from different parts of the course content.	Exam period	-

	Final grade for the course is calculated based on the following formula: **(FEx80+Ex20)/100**		

Obligatory literature

1. Uvod u prostorno planiranje / „Introduction to Physical Planning“, e-course in the Merlin System
2. Marinović-Uzelac, A.: Prostorno planiranje / „Physical Planning“. Zagreb, 2001.

Recommended literature

1. Marinović-Uzelac, A.: Naselja, gradovi, prostori / „Settlements, Towns, Areas“. Tehnička knjiga, Zagreb, 1986.
2. Mc Laughlin, J.B.: Urban and Regional Planning. Faber & Faber, London, 1960.
3. Šimunović, I.: Grad i regija / „City and Region“. Pogledi, Split, 1986.
4. Vresk, M.: Grad i urbanizacija / „City and Urbanisation“. Školska knjiga, Zagreb, 2002.
5. Vresk, M.: Grad u urbanom i regionalnom planiranju / „ City in Urban and Regional Planning“. Školska knjiga, Zagreb, 1990.

Ecology of Forest Tree Species

PU6005

ECTS 3

English language R1

E-learning R1

Teaching hours 30
Lectures 15
Exercises 15
Field work 0

Lecturer
Prof. dr. sc. Ivica Tikvić
Izv. prof. dr. sc. Damir Ugarković

Associate teacher for exercises
Izv. prof. dr. sc. Damir Ugarković

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:

The course Ecology of Forest Tree Species covers the ecological and biological ties between the main forest tree species, the habitat conditions required for tree development, natural ecological and other characteristics, an overview of the climate, relief, geology and soils in Croatia, demands of forest tree species for light, temperature, water, relationships between chemical and mechanical factors, morphological constitution of forest tree species, dependence of germination, growth and development of the below-ground and above-ground components and seed yield on ecological conditions, negative impact of biotic factors on the development and survival of forest trees, negative impacts of abiotic factors on forest trees, drought and high temperatures, frost and snow, ice and low temperatures, floods, wind, pollution, insects, mushrooms and higher plants, animals. Ecological relationships of common beech, English oak, sessile oak, narrow-leaved ash, black alder, downy oak, evergreen oak, European chestnut, elm, linden and maple in Croatia. Ecological relationships between common fir, common spruce, aleppo pine and black pine in Croatia. Ecological relationships between alochthonous tree species, green Douglas fir, American white pine, European larch, Scotch pine, sea pine, Atlas cedar, plantain, hackberry, white cedar and cypress.

Type of course:

Ecology of forest tree species (compulsory course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify tree species on the basis of morphological features, identify tree parts and shapes, and apply theoretical and practical knowledge of economically important indigenous and alohton species of trees and shrubs.	practical exercises, written tests, oral exam	B1
Conduct biological and technical works on park and green landscaping.	practical exercises, written tests, oral exam	B4
Conduct professional field work on plant protection in urban areas.	practical exercises, written tests, oral exam	B7
Conduct environmental monitoring.	practical exercises, written tests, oral exam	C1

General competences
Complete qualifications for management of forest ecosystems in every sense. Keeping all jobs in forestry. Prepared for professional and scientific training through various educational forms and postgraduate studies.

Type of instruction

Lectures
As part of the lectures, students are introduced to theoretical and practical knowledge from individual thematic units.

Exercises
As part of the exercise, 10 exercises from the ecology of forest tree species are performed. Exercises are an upgrading of the knowledge gained in lectures.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing written tests, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (La) attendance	5%	100% 90% 80%	Excellent (5) Very good (4) Good (3)	15	-	0.5

		70%	Sufficient (2)			
Exercises (Ea) attendance	5%	100% 90% 80%	Excellent (5) Very good (4) Good (3)	15	-	0.5
Writing exercises (E)	40%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	-	30	1
		In order, easy, with bigger corrections and on time	Good (3)			
		In order, easy, with minor corrections and on time	Very good (4)			
		In order, easy, accurate and timely	Excellent (5)			
Partial exam (PE)	40%	50%-62.5%	Sufficient (2)	4	17	0.7
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam (OE)	10%	50%-62.5%	Sufficient (2)	0.5	8.5	0.3
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(Ex0,4)+(PEx0,4)+(OEx0,1)**		34.5	55.5	3

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Lectures - attendance (La)	*5%*	*70-100%*	*2-5*	*15*	*15*	*0,5*
Exercises - Attendance (Ea)	*5%*	*80-100%*	*3-5*	*15*	*15*	*0,5*
Exercises reports (E)	*40%*	*50-100%*	*2-5*	-	*30*	*1*
2 written tests or 1 final test (PE)	*40%*	*50-100%*	2-5	*4*	*21*	*0,7*
	10%			*0,5*	*9*	*0,3*

Oral Exam (OE)					
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(Ex0,4)+(PEx0,4)+(OEx0,1)**	34,5	90	3

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and of 20 % of exercises. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (34,5 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	Exam terms	The student has the right three times to go to the exam.
Oral exame	Students who pass a written test and who receive passive grades from lectures and exercises attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(Lax0,05)+(Eax0,05)+(Ex0,4)+(PEx0,4)+(OEx0,1)**	Exam terms	The student has the right three times to go to the exam

Obligatory literature

1. Matić, S., Prpić, B. POŠUMLJAVANJE, Savez inženjera i tehničara šumarstva i drvne industrije Hrvatske, 1-79., Zagreb 1983.
2. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.
3. OBIČNA JELA U HRVATSKOJ, 2001., Akademija šumarskih znanosti, Hrvatske šume,p.o. Zagreb, ISBN 953-98571-0-4, str. 5-895.
4. OBIČNA BUKVA U HRVATSKOJ, 2003., Akademija šumarskih znanosti, Hrvatske šume,d.o.o., Grad Zagreb, Gradski ured za poljoprivredu i šumarstvo, ISBN 953-98571-1-2, str.5-855.
5. HRAST LUŽNJAK U HRVATSKOJ, 1996, HAZU, Hrvatske šume, p.o. Zagreb, ISBN 953-154-079-9, str. 9-559.

Recommended literature

1. M. Vidaković, 1993., Četinjače. Grafički zavod Hrvatske, «Hrvatske šume» Zagreb, str. 741.
2. J. Herman, 1971., Šumarska dendrologija. Stanbiro, Zagreb, str. 470.

Forest mushrooms

PU6006

ECTS 1

English R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. dr. sc. Danko Diminić

Grading system
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Course goal is to introduce students with basic of fungi (macro fungi), group which produces characteristic fruiting bodies (size from few up to several dozen centimetres) on various substrates in forest ecosystems. Most of these fungi are saprotrophs or mycorrhizal fungi and their fruiting bodies are interesting from the human consummation point of view.
Course covers following topics: position of macro fungi in Fungi kingdom, systematics of macro fungi, structure, reproduction and nutrition of macro fungi.
Role of mycorrhizal fungi is specially covered. Students get acquainted with morphological features of fungal fruiting bodies and with identification key for species identification. They also get acquainted with most common fungal species from Basidiomycotina and Ascomycotina ad their role in the forest ecosystems.
Examples of species from genera: *Agaricus, Amanita, Armillaria, Bjerkandera, Boletus, Cortinarius, Fomes, Ganoderma, Hypoxylon, Inonotus, Lactarius, Laetiporus, Macrolepiota, Phellinus, Pleurotus, Polyporus, Russula, Stereum, Trametes, Xylaria*. In the end students learn about chemical and healing properties of fungi and fungal toxins according to effects and possibilities of treatment.

Type of course:

Forest mushrooms (elective course, 6th. semester, 3rd. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe fungi as eukaryotic organisms. Explain role and systematics of fungi. Explain mycorrhizae (ecto and endomycorrhizae). Describe and connect fungal habitats and substrates.	Separate fungi from other organisms in land ecosystems.	B2
Describe, list and differentiate among fungal fruiting bodies characteristics significant for identification. Describe and recognize characteristics of cap and hymenophore. Describe and recognize characteristics of stipe (stalk) and volva and their origin. Explain importance of spore colour in a mass for the identification. Describe and recognize characteristics of hymenium and spores in ascomycetes and basidiomycetes. Describe and recognize importance of sterile elements of hymenium in basidiomycetes. Explain, describe and list anatomical and histological characteristics of fruiting body. Explain other characteristics and chemical reactions in fungi and their importance for identification.	List, describe and explain basic morphological and microscopic features of macro fungi.	B2
Describe chemical structure of fungi. Describe and list medical properties of fungi. List and explain fungal toxins, their harmful impact on human health, symptoms they cause and possible medical treatments.	List, describe and explain other features of macro fungi.	B2

General competences

Basics of knowing land ecosystem macro fungi.

Application of modern science principles which encompass precise knowledge of fungi and their role in land ecosystems.

Type of instruction

Lectures

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures. Taking written and oral exams and seminar preparation.

Methods of grading

Elements for assessment	Grade percentage	Grading scale	Grade	Hours of direct teaching	Work hours of an average student outside direct teaching	ECTS
Lectures	-	-	-	15	0	0,5
Seminar (S)	35%	-	-	0	7,5	0,25
Exam (PUI)	65%	60-70%	sufficient (2)	0	7,5	0,25
		71-80%	good (3)			
		81-90%	Very good(4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Sx35 + PUIx65)/100**		15	15	1

Elements for assessment	Maximum credits or grade percentage	Grade scale	Grade	Hours of direct teaching	Total number of work hours of an average student	ECTS
Final exam (ZI)*		*60-70% 71-80% 81-90% 91-100%*	*sufficient (2) good (3) very good(4) excellent (5)*	*0*	*15*	*0,5*
TOTAL	**100%**	**(ZIx100)/100**				

*** students who do not pass the midterm exams during the semester shall take the final exam that makes up 100 % of the grade.**

Detailed explanation of rules for preparing and taking midterm exams, seminars, partial exams, written and oral exams:

Elements for assessment	Description	Term	Compensation for absence
Lectures	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching.	semester (15 direct teaching hours)	-
Seminar	Seminar presentation is graded and the grade influences on the final course grade.	after 3rd week	-
Oral exam	Students are asked question from different parts of the program. The following formula is used to calculate the final grade for this course: **Sx35+PUIx65/100**	Exam terms	

Obligatory literature

1. Na internetskoj stranici Merlin sustav za e-učenje Sveučilišta u Zagrebu (https://moodle.srce.hr/2018-2019/?redirect=0) pod predmetom Osnove poznavanja gljiva studentima su dostupna sva predavanja u formi prezentacija (MicrosoftPowerPoint).
2. Usčuplić, M., 2004: Svijet gljiva. Akademija nauka i umjetnosti Bosne i Hercegovine, Sarajevo, 243 str.
3. Božac, R., 1989: Gljive naših krajeva. Grafički zavod Hrvatske, Zagreb, 399 str.
4. Garnweidner, E., 1990: Gljive - džepni gljivarski vodič. Cankarjeva založba, Ljubljana - Zagreb, 255 str.

Recommended literature

1. Breitenbach, J., Kränzlin, F., 1984: Fungi of Switzerland Volume 1: Ascomycetes, Edition Mykologia, Luzern, Švicarska, 313 str.
2. Breitenbach, J., Kränzlin, F., 1986: Fungi of Switzerland Volume 2: Non Gilled Fungi, Edition Mykologia, Luzern, Švicarska, 412 str.
3. Breitenbach, J., Kränzlin, F., 1991: Fungi of Switzerland Volume 3: Boletes and Agarics (1 st part). Edition Mykologia, Luzern, Švicarska, 359 str.
4. Breitenbach, J., Kränzlin, F., 1995: Fungi of Switzerland Volume 4: Agarics (2 nd part). Edition Mykologia, Luzern, Švicarska, 370 str.
5. Breitenbach, J., Kränzlin, F., 2000: Fungi of Switzerland Volume 5: Agarics (3 rd part). Edition Mykologia, Luzern, Švicarska, 342 str.
6. Kränzlin, F., 2005: Fungi of Switzerland Volume 6: Russulacceae. Edition Mykologia, Luzern, Švicarska, 317 str.

Tree measurement

PU6007

ECTS points 1

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Professor Mario Božić

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:

Introduction. Masures and measurement system. Measurement errors (precision, accuracy, bias, significant digits). Display of measured data. Tree measurement Diameter, brest height diameter, circumference. Tree crown measurement. Measurement of unattainable diameters. Errors in diameter and circumference measurement. Height measurement, hypsometers, Bitterlich mirror relascope (standard and CP). Ultrasound and laser hypsometers, Blume-Leiss, Suunto. Height measurement errors and instrument errors. Height curves. Tree volume. Tree sectioning method. Log volume stock determination. Tree shape coefficient. Determination of tree voulme with volume tables. Dendrochronology.

Type of course:

Tree measurement (elective course, 6. semestar, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Specify measurement variables, terms precision and accuracy for measurement and ways to display measured data	Final proof	B5, C4
Interpret measurement of diameter, circumference and tree height. (instruments and errors).	Final proof	A1, B5, C1, C4, D1
Interpret definition and calculation of voulume (volume of cut and standing trees, tree sectioning method, single entry and two entry volume tables).	Final proof	B5, B9

General competences
Obtaining skills of gathering tree atribute data for both tree and stand level (sample).

Type of instructions

Lectures
Classes are partially held in the field (Maksimir) with presentation and acive use of measurement equipment.

Working methods:

Teachers obligations:
Holding teaching lectures. Creating exam tests and performing the validation. Carrying out written and oral exams and consultations. Writing teaching material.

Students obligations:
Continuous attending and active engagement in lectures. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15		0,5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam* (FE)	100 %	(60-70%) (70-80%) (80-90%)	Sufficient (2) Good (3) Very good (4)	15		0,5

		(90-100%)	Excellent (5)
TOTAL	**100%**	**(FEx100)/100**	

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student presence is recorded. Maximum lecture absence of 20% is tolerated.	Semester (15 hours of classes)	-
Written exam (We)	The exam comprises of 10 questions. To pass the exam student needs to achieve minimum of 60% of exam points.	Exam scedule defined on the beginning of semester	-
Oral exame (Oe)	Requirement for approaching an oral exam is passed written exam within timeframe of registrated exam date Theoretical knowledge with subject understanding of lectured classes is checked. Final grade is calculated according to following formula **(Wex50+Oex50)/100**		-

Obligatory literature

1. Božić, M.: Izmjera stabala, Prezentacije s predavanja
2. Pranjić, A., Lukić, N., 1997.: Izmjera šuma. Šumarski fakultet Sveučilišta u Zagrebu, 410 pp., Zagreb.

Recommended literature

1. Bitterlich, W., 1984: The Relascope Idea. CAB, pp.242, London
2. Loetsch, F., Zöhrer, F., Haller, K.E., 1973: Forest Inventory. pp.467, BLV München.
3. Šmelko, Š. & kolektiv, 2003: Meranie lesa a dreva. LVH SR, pp.239, Zvolen.
4. Zöhrer, F., 1980: Forstinventur, pp.202, Pareys, Hamburg
5. West, P.W., 2004: Tree and Forest Masurement. Springer V, pp.167, Berlin.

Floriculture

PU6008

ECTS 1

English language R1

E-learning R1

Teaching hours 15
Lectures 15

Lecturer
Prof. dr. sc. Jozo Franjić
Doc dr. sc. Daniel Krstonošić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Students are introduced to the use of flowers through the past and the features of flower production in Croatia and in the world
The course also covers the taxonomic status and systematic distribution of cut flowers (geophytes, flower plants, foliage plants) and potted plants (flowering potted plants, foliage potted plants, succulents). Furthermore, students learn about their basic morphological, biological and ecological features.
The student becomes acquainted with the general characteristics of plants in floriculture (life form, ecological features, cultivation, uses in space shaping, special forms of cultivation)
Outdoor and indoor factors that affect the growth and flowering of cut flowers and pot plants.
Generative propagation of flowers. Propagation by cuttings, stolons, splitting, grafting, etc. Propagation by cell and tissue cultures.

Type of course:

Floriculture (elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain the ways of ornamental plants propagating and factors that influence their growth and flowering.	Seminar, partial exam	B4
To present the most important taxa of cut flowers and their characteristics (geophytes, flower species, foliage species, species for outdoor cultivation).	Seminar, partial exam	B4
To present the most important potted plants and their characteristics (flowering potted plants, foliage potted plants, succulents)	Seminar, partial exam	B4

General competences
Understanding the factors that influence the growth and development of ornamental cut flowers and potted plants.
Knowing the great variety of ornamental cut flowers and potted plants and their biological and ecological features.

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Performing lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures, preparation and presentation of seminars. Passing the partial exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Seminar (SR)	80%	60-70%	Sufficient (2)		15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam – Plant	20%	60-70%	Sufficient (2)			
		71-80%	Good (3)			

identification (PI)		81-90%	Very good (4)		30	1
		91-100%	Excellent (5)			
TOTAL	**100%**	**(SR*80 + PI*20)/100**		15	45	2

Detailed description of the rules for the preparation, execution and submission of partial exams and seminar:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance of students is checked and recorded at the lectures and field work. The student can justifiably be absent with a maximum of 20% of the lecture.	semester (15 hours of direct teaching)	-
Seminar (SR)	The student prepares the seminar paper on the given topic and presents it orally. The quality of the seminar work is evaluated. The seminar is given in the form of presentations and in written form. Seminar work is obligatory.	in accordance to the agreed deadline	-
Partial exam – Plant identification (PI)	Students have to recognize plant species from photographs. The accuracy of the recognition and pronunciation of the Latin names of plants is evaluated. The partial exam is obligatory. The final grade of the subject is obtained according to the formula **SR*80 + PI*20**	in accordance to the agreed deadline	-

Obligatory literature

1. Karlović, K., Pagliarini, N., Vrdoljak, A.Vršek, I.: Sobno i balkonsko cvijeće, Gospodarski list, Zagreb, 1999.
2. Maree, J., Wyk, B.: Cut Flowers of the World. Timber Press, London, 2010.

Recommended literature

1. Dole, M. J., Wilkins, H. F., 1999: Floriculture, Principles and Species, Prentice Hall, New Jersey.
2. McHoy, P., 2000: Kućne biljke. Leo commerce, Rijeka
3. Parađiković, N., 2014: Osnove florikulture – interna skripta, Poljoprivredni fakultet Osijek
4. Vincelj, M. (1995): Cvjećarstvo, Agronomski fakultet Zagreb
5. Vinceljak-Toplak, M.: Cvjećarstvo, interna skripta, Agronomski fakultet, Zagreb
6. Vinceljak-Toplak, M.: Lončanice, interna skripta, Agronomski fakultet, Zagreb

Exotic Woody Plants

PU6009

ECTS 1

English language R1

E-learning R2

Teaching hours 15
Lectures 15

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

The economical importance, morphological characteristics and distrbution of selected species and genera of gymnosperms and angiosperms. The subject covers exotic woody species which are important for wood production, use of bark, plant fibers, edible plant parts, essential oil, honey, various industrial products etc. Medicinal herbs are not included. The genera belong to the following families: *Aceraceae*, *Agavaceae*, *Anacardiaceae*, *Apocynaceae*, *Araliaceae*, *Araucariaceae*, *Arecaceae*, *Asparagaceae*, *Asteraceae*, *Betulaceae*, *Bombaceae*, *Buddlejaceae*, *Burseraceae*, *Buxaceae*, *Caesalpiniaceae*, *Capparaceae*, *Caprifoliaceae*, *Caricaceae*, *Celastraceae*, *Cornaceae*, *Cupressaceae*, *Cycadaceae*, *Ebenaceae*, *Elaeagnaceae*, *Ericaceae*, *Euphorbiaceae*, *Fabaceae*, *Fagaceae*, *Ginkgoaceae*, *Grossulariaceae*, *Hamamelidaceae*, *Juglandaceae*, *Lamiaceae*, *Lauraceae*, *Meliaceae*, *Mimosaceae*, *Moraceae*, *Musaceae*, *Myrtaceae*, *Oleaceae*, *Pinaceae*, *Poaceae*, *Punicaceae*, *Rhamnaceae*, *Rhizophoraceae*, *Rosaceae*, *Rubiaceae*, *Ruscaceae*, *Rutaceae*, *Salicaceae*, *Santalaceae*, *Simaroubaceae*, *Smilacaceae*, *Sterculiaceae*, *Styracaceae*, *Taxaceae*, *Thymelaeaceae*, *Ulmaceae* and *Verbenaceae*.

Type of course:

Exotic Woody Plants (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To learn botanical and common names and distribution of exotic fruits, nuts and citrus species, species used for spices, beverages and syrups, species important for wood production, use of bark, plant fibers, resins, gum and oil;	exam	B5
To identify and describe exotic fruits, nuts and citrus species;	exam	B5
To describe which plant parts of exotic woody species are used for spices, beverages and syrups;	exam	B5

General competences
Students acquire basic knowledge about economically important exotic woody plants. Theoretical knowledge encompasses morphological characteristics, economic importance and distribution. Particularly emphasized is the use of certain plant parts.

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Giving lectures. Holding consultations, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material.

Students' obligations:
Regular attendance at lectures. Passing final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15		0.5
TOTAL				15		0.5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	0.5
TOTAL	**100%**	**(FEx100)/100**				
*** students take the final exam that is 100% of the grade**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is recorded. Student may not be absent more than 20% of lectures.	VI semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures).	Exam terms	
Oral exam	Access requirement: positively graded written exam. The final grade is obtained according to the formula: (FEx100)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
2. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.
3. Šumarska enciklopedija Vol. I–III, 1980-1987. JLZ Miroslav Krleža, Zagreb.

Recommended literature

1. Duarte, O., Paull, R.E., 2015. Exotic fruits and nuts of the New World. CABI, Wallingford.
2. Farjon, A., 2010. A handbook of the world's conifers. Vol. I-II. Brill, Leiden.
3. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim.
4. Hu, S., 2005. Food plants of China. The Chinese University Press, Hong Kong.
5. Janick, J., Paull, R.E., 2008. The encyclopedia of fruits and nuts. CABI International, London.
6. Krüssmann, G., 1972: Handbuch der Nadelgehölze. Verlag Paul Parey, Berlin und Hamburg.
7. Krüssmann, G., 1976: Handbuch der Laubgehölze. Band I-III. Verlag Paul Parey, Berlin und Hamburg.
8. Louppe, D., Oteng-Amoako, A.A., Brink, M. (Eds.), 2008. Plant resources of tropical Africa 7(1). Timbers 1. PROTA Foundation, Wageningen, Backhuys Publishers, Leiden, CTA, Wageningen.
9. Lyle, S., 2007. Discovering fruit and nuts. David Bateman Ltd., Auckland.
10. Morton, J., 1987: Fruits of warm climates. Florida Flair Books. 505 pp.
11. Roloff, A., Bärtels, A., 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart.

Applied technical graphics

PU6010

ECTS 1

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Anka Ozana Čavlović, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to computer drawing program AutoCAD. Orthogonal and 3D projection of simple geometric models with features of horticultural elements. Situation draft. Creating text, single-line and multi-line. Dimensioning in AutoCAD. 3D projection. Isometric drawing of simple and complex models in AutoCAD. Central projection. Drawing a perspective of exteriors in AutoCAD.

Type of course:

Applied technical graphics (elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the basics of drawing AutoCAD (item drawings, layers of drawings, basic drawing tools for orthogonal drawing, modifying, writing and printing).	Exercises in a computer classroom, correction and evaluation of exercises, final exam	A3
Explain the elements of interior design drawing and the situation draft drawing.	Exercises in a computer classroom, correction and evaluation of exercises, final exam	A3

General competences
Students acquire basic knowledge of orthogonal and 3D projection. This course offers all elements of technical drawing and geometrical basics needed for the use of the AutoCAD drawing computer program.

Type of instruction

Lectures
Lectures in a computer classroom are conducted so that students acquire practical computer skills by getting the task of checking and determining the learning outcomes.

Working methods:

Teachers' obligations:
Holding lectures and exercises. Designing exercises and evaluating them. Help students in mastering the skills of drawing using computer. Maintenance consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures. Making a drawing at home in a given period. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	50%	Drawing with less than 15% of the eligible weaknesses of the application of technical standards	Sufficient (2)	15	6	0,7
		Drawing with less than 10% of the eligible weaknesses of the application of technical standards	Good (3)			
		Drawing with less than 5% of the eligible weaknesses of the	Very good (4)			

		application of technical standards				
		Drawing without any weaknesses of the application of technical standards	Excellent (5)			
Final exam (PE)	50%	60-70%	Sufficient (2)	2	7	0,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx50+FEx50)/100**		17	13	1

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The presence of students on the class is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. The student activity is recorded by checked and corrected drawing made in class.	semester (15 hours of direct lecturer)	-
Written and oral exam	Written and oral exam are held in a computer classroom. The exam consists of one task to check all the elements of the course learning outcomes. One task has 40 points. It is necessary to have more than 24 points (60%) for a positive rating. Verification of theoretical knowledge (from scripts), understanding of projections and drawing in AutoCAD. The final grade is obtained according to the formula **(Lx50+FEx50)/100**	Term before exam/Exam terms	

Obligatory literature

1. Koludrović, Ć.: Osnovne vježbe iz tehničkog crtanja s kompjutorskim aplikacijama. Udžbenici Sveučilišta u Rijeci, 1990.
2. Opalić, M.: Tehničko crtanje. Udžbenici Sveučilišta u Zagrebu, 2003.
3. Uvod u AutoCAD 2019 (interna skripta)
4. Risović, S., Čavlović, A.O.: Primijenjena tehnička grafika (interna skripta)

Recommended literature

1. Lipošinović, L.: Nacrtna geometrija. Element, Zagreb, 2003.

Graduate university study
E. Urban Forestry, Nature Conservation and Environmental Protection

In the graduate program of Urban forestry, nature conservation and environmental protection students are trained in the management of forest ecosystems, protected nature areas and urban green zones from a biological-ecological, technical, and economic aspect. The study is based on upgrading and improving the basic knowledge in the field of urban forestry, nature conservation and environmental protection acquired in undergraduate studies with directing students to highly professional forestry work in urban areas and protected nature areas and guidance on further education at the doctoral and specialist studies. Students gain the necessary knowledge and skills to solve the most complex tasks in urban forestry, nature conservation and environmental protection and for coping with the constant technological change, innovation and knowledge. The program is designed so that students are led in a logical sequence from the basic biological and technical disciplines, through disciplines in which they are introduced to the components of forest ecosystems and to techniques that enable the implementation of programs to manage protected nature areas, to those that embrace knowledge of the management of the environment and of forests and forest lands.
Through fieldwork students acquire necessary practical experience they are acquainted with the practical application of acquired knowledge. Students acquire conditions for performing the most complex jobs in urban forestry, nature conservation and environmental protection and for continuation of education in graduate studies by individual making of bachelor thesis. Defending the bachelor thesis is requirement for study conclusion.
Master Engineering of urban forestry, nature conservation and environmental protection with the knowledge gained by the completion of graduate study are completely qualified for individual and team work in the fields of urban forestry, nature conservation and environmental protection.

List of compulsory and elective courses

I. YEAR

Code	Course	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
1. semester					
	Compulsory courses				
UD1001	WATER MANAGEMENT AND PROTECTION	3	0	1	6
UD1002	SOIL PROTECTION AND SOIL MANAGEMENT	3	1	1	6
UD1003	COMPUTER-BASED DESIGN OF PARKS AREAS	1	2	1	6
UD1004	PHYTOPHARMACY IN URBAN AREAS	2	2	1	6
	Elective courses				
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
UD1005	APPLIED PHOTOINTERPRETATION				
UD1007	LABORATHORY METHODS IN PHYTOPATHOLOGY				
UD1008	APPLIED ZOOECOLOGY				
UD1009	BREEDING OF ORNAMENTAL TREES AND SHRUBS				
UD1010	BIRDS OF URBAN FORESTS AND PARKS				
UD1011	ETHOLOGY				
ŠDU1007	SYNMORPHOLOGY AND MAPPING OF FOREST VEGETATION				
ŠDU1011	METHODS OF PLANT TAXONOMY				
Total		**12**	**5**	**4**	**30**
2. semester					
	Compulsory courses				
UD2001	HORTICULTURAL DENDROLOGY	2	1	3	5
UD2002	ENVIRONMENTALLY SOUND TECHNIQUES AND TECHNOLOGIES	2	2	3	5
UD3003	WILDLIFE MANAGEMENT	1	1	2	4
UD2004	STATISTICAL METHODS AND MODELLING IN FORESTRY	1	2	0	4
UD2005	KNOWLEDGE OF VEGETATION	2	1	2	4
	INTRODUCTION TO MASTER THESIS I				2
	Elective courses				
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
UD2006	FOREST MYCORRHIZAE				
UD2007	MEDICINAL PLANTS				
UD2008	WASTE MANAGEMENT				
UD2009	ZOONOSES IN FOREST ECOSYSTEMS				
ŠDU2007	FOREST TYPOLOGY				
ŠDU2008	WILDLIFE FEEDING				
ŠDU2016	BIOTECHNOLOGY OF FOREST TREES				
Total		**11**	**7**	**10**	**30**

II. YEAR

Code	Course	Lectures (hours)	Exercises (hours)	Field work (days)	ECTS
3. semester					
	Compulsory courses				
UD3001	RECOVERY OF DEGRADED TERRAINS	2	1	2	5
UD3002	SPATIAL ANALYSIS AND VALORIZATION	2	1	0	4
UD2003	ECO-TOURISM	2	0	2	4
UD3004	NURSERY PRODUCTION OF ORNAMENTAL PLANTS	2	1	2	5
	INTRODUCTION TO MASTER THESIS II				6
	Elective courses				
	ELECTIVE COURSE 1	1	0	0	2
	ELECTIVE COURSE 2	1	0	0	2
	ELECTIVE COURSE 3	1	0	0	2
UD3005	ENVIRONMENTAL PEDAGOGY				
UD3006	PREPARATION AND MANAGEMENT OF ECOLOGICAL PROJECTS				
UD3007	PROTECTED NATURAL VALUES				
UD3008	VIRGIN FORESTS AND FOREST RESERVES				
UD3009	UTILIZATION OF FOREST BIOMASS				
UD3010	ORGANIZATIONAL CULTURE				
Total		**11**	**3**	**6**	**30**
4. semester					
	Compulsory courses				
UD4001	INTEGRATED FOREST PROTECTION IN PROTECTED AREAS	2	0	2	4
UD4002	ECOLOGICAL MONITORING	1	2	2	4
	MASTER THESIS				22
Total		**3**	**2**	**4**	**30**

Learning outcomes of the study program

Graduate university study Urban Forestry, Nature Conservation and Environmental Protection

A - general engineering competences
- A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways
- A2. explain position and trends of urban forestry, nature conservation and environmental protection in the country and worldwide
- A3. apply simpler methods of operation research

B - focused engineering competences
- B1. organise and perform the most complex jobs all forms of organizing the protection of nature areas and the most complex forestry works in urban areas
- B2. manage and make independent professional (business) decisions form the field of urban forestry, nature conservation and environmental protection
- B3. establish and implement programs for the management of forest ecosystems in protected natural areas as well as management programs in specific urban forest ecosystems
- B4. organise and manage professional works on improvement of degraded habitats
- B5. apply knowledge related to horticultural dendrology and recommend and choose tree species in urban areas
- B6. organise and manage professional works on the production of decorative plants
- B7. organise and manage professional works on the soil and water management and protection
- B8. organise and manage wildlife management in protected natural areas
- B9. organise and manage integrated protection of plants and trees in urban areas and protected natural areas
- B10. prepare ecological studies and forestry parts of spatial plans
- B11. apply knowledge related to ecologically friendly techniques and technologies of forestry works used in urban areas and protected natural areas
- B12. manage forest, human resource, and technical potential during performance of forest works in urban areas and protected natural areas
- B13. conduct ecological monitoring, area analysis and spatial evaluation as well as design of park areas
- B14. develop current technologies as well as implement new technologies

C - organizational engineering competences
- C1. manage most complex tasks in all forms of organizing the protection of nature areas; national, county, and municipal administration, including advisory services and inspection supervision
- C2. perform and manage works in horticultural and communal services
- C3. perform jobs of professional manager and supervisor in environment and nature protection areas

D - developing engineering competences
- D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of urban forestry, nature conservation and environmental protection
- D2. conduct courses in professional secondary and other similar schools
- D3. conduct businesses and tasks in publicist writing and media connected with urban forestry, nature conservation and environmental protection
- D4. professionally and scientifically upgrade through different educational ways and postgraduate study
- D5. gather, process and interpret reference sources and prepare simple written professional or scientific paper

Connection of the courses learning outcomes with the study program learning outcomes

Course	General engineering competences			Focused engineering competences														Organizational engineering competences			Developing engineering competences				
	A 1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	C1	C2	C3	D1	D2	D3	D 4	D5
UD1001	+									+		+	+			+									
UD1002	+	+			+					+			+	+		+					+				
UD1003	+							+									+								
UD1004												+													
UD1005	+					+							+				+							+	
UD1007												+													
UD1008					+	+	+														+	+			
UD1009									+												+	+		+	+
UD1010	+		+	+							+		+			+	+								
UD1011					+																				
ŠDU1007	+				+	+							+			+					+	+		+	+
ŠDU1011	+												+								+	+			+
UD2001								+								+			+		+	+	+	+	+
UD2002														+											
UD3003											+														
UD2004	+															+					+				
UD2005	+												+			+						+		+	+
UD2006												+													
UD2007				+	+	+																			
UD2008					+																				
UD2009		+										+					+	+	+						
ŠDU2007	+		+			+						+					+				+	+		+	+
ŠDU2008											+														
ŠDU2016						+			+								+				+			+	
UD3001		+					+			+									+						
UD3002	+												+			+	+							+	
UD2003	+				+	+										+									
UD3004									+								+		+						
UD3005	+	+	+																						
UD3006	+																				+		+		+
UD3007				+	+	+																			
UD3008						+									+										
UD3009														+					+						
UD3010					+										+			+		+					
UD4001												+													
UD4002	+					+				+			+			+									

Water Management and Protection

UD1001

ECTS 6

English language R1

E-learning R1

Teaching hours 53
Lectures 45
Exercises 0
Field work 8

Lecturer
Prof. dr. sc. Ivica Tikvić
Izv. prof. dr. sc. Damir Ugarković

Grading
Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:
The curriculum of this course covers several thematic units related to the cycle of water circulation on Earth in the classification of freshwater ecosystems. Physical relationships in water systems: thermal, convection, conduction, radiation, light and motion of water. Chemical properties of water: water as a solvent, solubility of gases and mineral salts, organic solids and suspended matter. Circulation of matter and flow of energy through biological systems in the hydrosphere. Life forms of aquatic biota. Biocenoses and their classification methods in liquids and stalls. Structural features and functional organization of aquatic biocenosis. Ecological and biotic factors responsible for the development and survival of aquatic biocenosis. Energy relations in freshwater ecosystems. Trophic levels (primary producers, consumers and destructors). Primary and Secondary Production. Different aspects of anthropogenic influences in freshwater ecosystems. Classification of waste water and biological valorisation of water. Valorisation of space and aquatic resources in the sustainable technological development of Croatia. Water resource management and defining their protection measures. Development of programs and study plans on water protection and defining protection measures. Water treatment and reconstruction.

Type of course:
Water Management and Protection (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
1. Independently collect data, statistical processing, display and analyse the collected data, discuss and draw conclusions based on the analysed data and discern the possibility of different interpretations of the same problems analysed in different ways.	written tests and oral exam	A1
2. Organize and implement works of management and protection of soil and water.	written tests and oral exam	B7
3. Implement integrated tree protection in urban areas and protected nature facilities.	written tests and oral exam	B9
4. Develop ecological studies and forestry parts of spatial plans.	written tests and oral exam	B10
5. Organize and implement environmental monitoring, analysis and valorisation of space and the design of park spaces.	written tests and oral exam	B13

General competences
Ability to create ecological studies
Planning and management of forest ecosystems in nature protected area
Analysis and valorisation of space
Integrated protection in nature protected area
Environmental monitoring
Management and protection of soil and water protected area

Type of instruction

Lectures
As part of the lectures, students are introduced to theoretical and practical knowledge from individual thematic units.

Field work
On the field work, students are introduced with practical examples of the application of knowledge of the water management and protection in urban forestry and nature protection area. Practitioners take part in it.

Working methods:

Teachers' obligations:
Maintaining lectures. Design and compiling tests and their evaluation. Providing written tests, oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures and field work, preparation of field work report. Laying the tests and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (La) attendance	7%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	45	-	1,5
Field work (FWa) attendance	3%	100%	Excellent (5)	8	-	0,5
Partial exam (PE)	60%	50%-62.5%	Sufficient (2)	4	98	3,1
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam (OE)	30%	50%-62.5%	Sufficient (2)	0.5	25	0,9
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lax0,07)+(FWax0,03)+(PEx0,6)+(OEx0,3)**		57.5	123	6

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked, and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and 20% exercises and cannot be absent from the field work. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (57 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures or field work
Exercises and reports from the field work	Exercises are attended by groups. As part of the exercise is carried out 15 practical exercises in forest ecology. At the beginning of each exercise, students receive task templates and the layout of exercise reports in printed form. Estimated accuracy, neatness and regularity (exercise submitted on time). From each exercise, the student gets a grade and the average of all grades in the exercise is taken when calculating the final score from the subject.	In accordance with the agreed terms.	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	Exam terms	The student has the right three times to go to the exam.
Oral exam	Students who pass a written test and who receive passive grades from exercises, and have passive grades from lectures, exercises, and field work attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(Lax0,07)+(FWax0,03)+(PEx0,6)+(OEx0,3)**	Exam terms	The student has the right three times to go to the exam

Obligatory literature

1. Bojčić, C. et al., 1982: Slatkovodno ribarstvo, Jumena, Zagreb.
2. Botkin, D., Keller, E. A., 2003: Environmental Science, John Wiley & Sons, Sanata Barbara.
3. Dodds, W. K., 2002: Freshwater Ecology, Academic Press, London.
4. Tedeschi, S., 1997.: Zaštita voda, HDGI, Zagreb, 1-287.
5. Treer, T., Safner, R., Ančić, I., Lovrinov, M., 1995.: Ribarstvo, Globus, Zagreb.

Recommended literature

1. Krebs, Ch. J., 1999.: Ecological Methodology, Addison Longman, Inc, New York, Harlow.
2. Odum, E. P., Barrett, G. W., 2005.: Fundamentals of Ecology, Thomson Brooks/Cole, Belmont, USA.

Soil Protection and Soil Management

UD1002

ECTS 6

English language R1

E-learning R1

Teaching hours 68
Lectures 45
Exercises 15
Field work 8

Lecturer
Prof. dr. sc. Nikola Pernar
Prof. dr. sc. Darko Bakšić
Doc. dr. sc. Ivan Perković

Associate teacher for exercises
Prof. dr. sc. Darko Bakšić
Prof. dr. sc. Nikola Pernar
Doc. dr. sc. Ivan Perković

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:
The curriculum of the course Soil Protection and Soil Management in Natural Resources Management serves as the upgrading of soil knowledge that students acquire on the Faculty of Forestry within the framework of the curriculum of Soil Science. It elaborates issues of soil protection in various fields of human activities. The aim is to provide a student, after acquiring general knowledge of Soil Science, with a complete picture of soil role in the ecosystem, soil valorisation in the ecosystem management, damage resources and possibilities and protection methods and opportunities. The program is realized through lectures, practical part and field courses, and includes 6 basic units: Soil Characteristics and Functions, Soil Inventory as a Precondition of its Protection, Soil Evaluation (soil survey, valorisation), Changes in Soil and Soil Damages, Soil Improvement, Soil Protection. In the first part students get more detailed knowledge of soil characteristics and functions. This unit is to a particular degree the synthesis of the material of Soil Science, elaborated here for the purpose of better understanding the soil function. The second unit elaborates bases of soil inventory, as a precondition of sustainable soil management and elaborates soil systematics with emphasis on the international classification system. It includes a review of information soil system, information system establishment, soil inventory technique and creation and opportunities for using soil maps. Such knowledge is needed for soil evaluation (valorisation, soil survey) in integral environmental management. The third part elaborates mapping, inventory and geography of soil. The fourth unit introduces students to the methods of evaluation of the soil, focusing on the American method, FAO method and method applied in Croatia. The fourth unit acquaints students with changes in soil in relation to its initial

condition. This unit defines terms such as harmful material and soil damage and provides systematic overview of various kinds and degrees of damage and their causal connection with various activities. The sixth unit elaborates issues of soil protection: legal framework; protection from various kinds of damages; soil monitoring as one of the important conditions of system and efficacious soil protection.

Type of course:
Management and soil conservation (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
The role of the soil. Critically evaluate the role of soil. Identify the importance of soil in forestry.	partial examination, laboratory exercises, full examination	A2
Soil classification system. Compare the soil to the national and WRB classification system. Comparative the properties of different type of soils. Evaluate the properties essential to the fertility and key properties of the soil.	partial examination, laboratory exercises, full examination	B2, B10, D1
Soil mapping. Application of soil mapping in forestry. Compare examples of land map using	partial examination, laboratory exercises, full examination	A1, B10, D1
Evaluate of soil in the soil value system. Select methods for increasing productivity of soil in forestry. Chemical soil melioration.	partial examination, laboratory exercises, full examination	B10, B11, D1
The role of soil in integral management of terrestrial ecosystems. Compare the geogenic and limit values in the soil. Soil damage valorisation. Analyse harmful effects on soil (economic impacts, forest fires, conversion of forest) and regulations to soil protection.	partial examination, laboratory exercises, full examination	B7, B10, D1
Suggest application for soil monitoring. Monitoring of forest soil. Organize forest monitoring. Compare the state of soil protection at a global, regional and national level. The implementation and regulations on the soil protection	partial examination, laboratory exercises, full examination	B7, B10, B13

General competences
The role of soil in a terrestrial ecosystem
Valorisation of soil in management of terrestrial ecosystems.
Assessment of potential soil degradation
Forest soil protection and soil amelioration.

Type of instruction

Lectures
The lectures are realized in blocks-hours in one of the major classrooms. They are based on PP presentations and correspond to a material in the textbook.

Exercises
Exercises are the upgrading of knowledge adopted in lectures and there are platforms for understanding individual chapters, e especially from the aspect of nutrients in the soil, soil pollutants and soil consistency as a factor of its degradation. Exercises are performed in the Ecological-Pedologycal laboratory in small groups (8 students in group).

Field courses
Field course is maintained by the multipurpose use of land (forestry, agriculture, tourism, water management, etc.).

Working methods:

Teachers' obligations:
Teaching - lectures, exercises, field courses. Designing topics for seminar task, compiling knowledge tests and evaluating them. Observations of written and oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation on lectures, exercises and field courses; preparation of exercises report and preparation and presentation of seminar work (possibly). Partial and/or full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	15	2
Laboratory Exercises (LE)				15	15	1
Field courses (FC)				8	1	0,3
Exam (E)	100 %	50-60 %	Sufficient (2)	4	77	2,7
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			72	108	6

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	On the lectures is checked the students' presence. The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	Semester (45 hours of direct teaching)	-
Laboratory Exercises (LE)	Exercises are attended by groups. Four practical exercises are performed (soil nutrients, harmful substances, micro aggregate stability, consistency)	According syllabus and agreement with the students	In the case of a justified reason, the student draws up absence from the particular exercise term
Field courses (FC)	Field course is performed as complex field course, and the terms are published at the beginning of the semester.	Second half of the semester.	-
Partial exam (PE)	Students can take the exam in two parts (partial). The first part takes place after ~ 50% of theoretical teaching, and the term is agreed with the students. The exam consists of a written and oral part (the written part of the exam must be passed for oral instruction), and it is about 50% of the subjects provided by the theoretical program. Partial exams can be accessed by students who have no more than one absence from the lectures. Those students who take the first partial exam will also take the second part of the exam on some of the regular test terms by the end of the current academic year. The arithmetic mean of the two grades represents the grade of the exam that) gives the final grade	Agreement with the students in second half of the semester.	
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade	Published test deadlines.	

Obligatory literature

1. Pernar, N., 2017: Tlo; nastanak, značajke, gospodarenje. Šumarski fakultet, Zagreb, XVIII + 799 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Osman, K. T., 2013: Soils; Principles, Properties and Management. Springer, 295 p.

Computer-based Design of Parks Areas

UD1003

ECTS 6

English language R1

E-learning R1

Teaching hours 53
Lectures 15
Exercises 30
Field work 8

Lecturer
Prof. Bojan Baletić, PhD

Associate teacher for exercises
Prof. Bojan Baletić, PhD
Assist. Prof. Kristina Careva, PhD
Assist. Prof. Rene Lisac, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Syllabus:
Overview of contemporary computer technologies
Using 2D CAD, 3D modelling and visualization software
Complex modelling and building information management software
Digital fabrication technologies
Fundamentals of computational visualization
Development of computer graphics
Complex systems based on data and knowledge
Development of intelligent environments and smart cities
Participative approach to design of green areas
Overview of good practices in design of green areas
Impact of new technologies on the development of society

Type of course:
Computer-based Design of Parks Areas (mandatory course, 1st term, 1st year)

Learning outcomes and assessment methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Independently collect data, process the statistics, present and analyse the collected data, discuss and draw conclusions based on analysed data, as well as distinguish various possibilities of interpretation of the same issue analysed in different ways	lab assignments	A1
Apply the knowledge of horticultural dendrology and recommend and choose woody plants for urban areas	lab assignments, final presentation	B5
Perfect the existing technologies as well as introduce new technologies	lab assignments, final presentation and exam	B14

General competences
Knowledge on urban forestry, protection of nature and environment, both on national and on global level.
Skills for creation of ecological studies, analyses and valorisation of space.
Analysis, valorisation and design of park areas.
Planning and management of forestry business in urban environments.

Teaching methods

Lectures
The lectures will provide students with a wider overview of the development of contemporary computer technologies and the influence they have on the design of space and on the changes in society. Students will acquire practical knowledge on computer tools used for design of public green areas, which will enable them to prepare projects and create the basis for successful dialogue with the users.

Labs
During the computer labs a simple assignment is being developed, whereby students need to give their propositions for usage and planting vegetation in an urban area. In this assignment students need to acquire the knowledge on three levels of representation. The exercises represent the upgrade of knowledge acquired through lectures.

Field trips
Students learn about the challenges of a specific assignment through a field trip and analysis of the terrain.

Methods of work:

Lecturers' Responsibilities:
Delivering the original course – lectures, labs and field trips. Preparation of topics for the assignment and preparation of basis for work. Consultations on the report and assignments, guidance for team work. Conducting final exams and providing consultations. Creation of teaching materials.

Students' Responsibilities:
Regular attendance and active participation in lectures and labs, creation and presentation of the report and the final paper. Passing the final exam.

Grading system =Taking the exam

Assessment elements	Percentage in the grade	Grading scale	Grade	Number of hours of direct teaching	Number of hours for a student in addition to direct teaching	ECTS
Lectures	-	-	-	15	0	1
Exam (E)	20%	60-70%	sufficient (2)	0	30	1
		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
Field trip	-	-	-	8	22	1
Preparation of assignments (Lab)	70%	Partially sloppy and difficult to understand, requiring significant corrections and on time	sufficient (2)	30	60	2,5
		Orderly, readable, requiring significant corrections and on time	good (3)			
		Orderly, readable, requiring smaller corrections and on time	very good (4)			
		Orderly, readable, accurate and on time	excellent (5)			
Presentation (P)	10%	60-70%	sufficient (2)	0	15	0,5
		71-80%	good (3)			
		81-90%	very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Ex20 + Labx70 + Px10)/100**		53	127	6

Detailed guidelines for preparation and taking the midterm exams, papers, partial exams, written and oral exams:

Assessment elements	Description	Deadline	Extension
Lectures + labs	Students' attendance is checked and recorded. For justified reasons, students are allowed to miss up to 15 % of direct lessons.	term (60 hours of direct lessons)	-
Fulfilment of assignments	Students are divided into groups for labs. After the simple introductory assignment which is to be done within two weeks, students are given a layered assignment in three different programmes (AutoCAD, SketchUp and Artlantis) which they present at the end of the term. Students are graded for their precision, logic, order and regularity in attendance (assignments need to be handed in on time).	on a specified date	Exceptionally, when there is a justified reason, student can re-take certain labs to compensate for his/her absence
Exam	Students are required to prepare written papers of 1000 words on a subject covered during the lectures. Final grade for this course is based on the following formula **(Ex20 + Labx70 + Lect.x10)/100**		

Mandatory reading

1. ACAD textbook
2. SketchUp textbook
3. Artlantis textbook
4. K. Careva (et al.) 2014: City Acupuncture - Improving the City Life Quality Through Small and Precise Interventions in Urban Structures, Zagreb Society of Architects
5. A. Zimmermann (et al.) 2008: Constructing Landscape, Birkhauser, Basel

Phytopharmacy in urban areas

UD1004

ECTS 6

English R1

E-learning R1

Teaching hours 68
Lectures 30
Exercises 30
Field work 8

Lecturer
Prof. Danko Diminić

Associate teacher for exercises
Jelena Kranjec Orlović, PhD

Grading system
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Purpose of course is to get students acquainted with specifics of plant protection measures in urban areas. Possibilities of use and effects of preventive and curative protection measures. Basic groups of chemical formulations
Classification regarding group of organisms they act against. Method of entrance in organism. Toxicity. Classification regarding developmental stage of biotic agent they act against. Classification regarding chemical structure. LD50 and other indices of toxicity.
Plant protection products. Registration of plant protection products. Residues and time-to-harvest waiting period. Procedure in case of poisoning. Resistance of harmful treated organisms. Shape and formulation of products. Combined products. Mixing of products. Preparation of products. Application of plant protection products. Calculating concentration and dosage of products for treatment in urban areas.
Protection products regarding harmful organisms. Insecticides. Acaricides. Nematocides. Fungicides. Herbicides. Rodenticides.
Methods of plant protection products application. Classification of methods regarding the physical state of products and their properties. Spraying and spraying machines. Dispersing and dispersing machines. Mist spraying and machines for mist spraying (fogging machines). Electrostatic dispersing and spraying.
Methods of tree injection, endotherapy of trees in urban areas.

Course category:
Phytopharmacy in urban areas (obligatory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present legislative and basic terms in phytopharmacy (plant protection products, laws, active substance, concentration, dosage, phytotoxicity)	List legislation which refers to plant protection products, explain registration of plant protection products and general instructions which regulate plant protection.	B9
Valuate different plant protection products – zoocides, biotechnical insecticides, fungicides, herbicides, acaricides, limacides, Rodenticides, pheromones). Monitor and repress harmful organisms with pheromones, biotechnical insecticides, repellents, classify plant protection products.	Estimate and explain efficiency, and predict possible unwanted effects of usage of plant protection products on plants and environment.	B9
Present endotherapeutical methods of tree protection in urban areas (macro and micro injection, efficiency, advantages and disadvantages, BITE tool method).	Compare and estimate efficiency of micro and macro injection method.	B9
Recommend ecologically acceptable plant protection measures (possibilities, limitations, mechanical, physical, biological and quarantine measures).	Identify ecologically acceptable plant protection measures and list their possibilities and limitations of their use.	B9
Present instructions for safe handling and transport of pesticides and measures of emergency help in case of contamination with pesticides (instructions for safe handling and transport of pesticides, measures for safe manipulation of pesticides, storage, instructions for giving emergency help persons contaminated with pesticides).	Analyse implementation of measures for safe pesticide manipulation and their storage.	B9

General competencies

Basic knowledge in area of phytopharmacy, that is, of protective measures for urban trees and shrubs which include use of different chemical formulations.
Practical knowledge and skills in manipulation of chemical formulations and in methods of their application.

Type of instruction

Lectures

Practical exercises

Students get acquainted with instructions for plant protection products application, safety measures for pesticide handling, preventive-curative protection measures, machines for product application, methods of tree endotherapy, means elimination and control for harmful organisms, diseases and weed plants. The exercises build on the knowledge acquired in lectures.

Field classes

Field classes are carried out in urban areas with examples of protective measures application for trees.

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures, practical exercises and field classes. Taking partial exams, written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Practical exercises (V)	-	-	-	30	0	1
Field classes and field class seminar (TN)	-	-	-	8	8	0,5
Midterm exam on basics of phytopathology (K)	20%	60-70%	sufficient (2)	0	35	0,5
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
Exam (PUI)	80%	60-70%	sufficient (2)	0	100	3
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Kx20 + PUIx80)/100**		68	143	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (ZI)		60-70% 71-80% 81-90% 91-100%	sufficient (2) good (3) very good (4) excellent (5)	0	135	3,5
TOTAL	**100%**	**(ZIx100)/100**				

*** students who do not pass the midterm exams during the semester shall take the final exam that makes up 100 % of the grade.**

Detailed explanation of rules for preparing and taking midterm exams, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + practical exercises	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (60 direct teaching hours)	-
Completion of practical exercises	Students attend practical exercises in groups. Practical exercises with examples of preparation and usage of pesticides and application machines are carried out	semester (30 direct teaching hours)	In case of justified reason student can additionally compensate for the absence from the exercise.
Midterm exam on basics of phytopathology	All students can take the first midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written midterm exam is graded and taken into account for the final grade of this course.	From 15th week	Students who passed midterm exam can take written exam.
Written exam	The exam can be taken by students who attended practical exercises and passes the midterm exam. Students provide answers to pre-printed test questions, they round the correct answers, describe pictures. The written exam is graded and taken into account for the final grade of this course	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **Kx25+PUIx75/100**		

Obligatory literature

1. Maceljski, M., 1992: Metode i aparati za primjenu pesticida. Sveučilište u Zagrebu, Agronomski fakultet, Zagreb.
2. Maceljski, M., B. Cvjetković, J. Igrc Barčić i Z. Ostojić, 1997: Priručnik iz zaštite bilja, Zavod za zaštitu bilja u poljoprivredi i šumarstvu RH, Tiskara MD, Zagreb, 187 str.
3. Glavaš. M., 2004: sredstva za zaštitu bilja u šumarstvu. Zavod za zaštitu šuma i lovstvo, interna skripta, 54 str.
4. Na internetskoj stranici Merlin sustav za e-učenje Sveučilišta u Zagrebu (https://moodle.srce.hr/2018-2019/?redirect=0) pod predmetom Primijenjena fitopatologija studentima su dostupna sva predavanja u formi prezentacija (MicrosoftPowerPoint).

Recommended reading

1. Bohmont, B.L., 1981: The New Pesticide User's Guide. B & K Enterprises, Inc., Fort Collins, Colorado, USA, 170 str.
2. Igrc-Barčić, J. & M. Maceljski, 2001: Ekološki prihvatljiva zaštita bilja od štetnika. Zrinski d.d., Čakovec, 247 str.

Applied photointerpretation

UD1005

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof.dr.sc. Renata Pernar

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:
The lectures include the following thematic wholes: Fundamentals of photointerpretation; Methods of photointerpretation; Interpretation of various types of aerial photographs in terms of photointrepretation with the emphasis on identification of types of vegetation, tree species and assessment of health condition in vegetation (individual trees). Instruments of photointerpretation; Picture components of importance for photointerpretation; Procedures of picture analysis; Types and characteristics of the photointerpretation keys, Assessment of classification accuracy; Success in photointerpretation and possible errors; Applications in forestry, nature conservation and environment protection.

Type of course:
Applied photointerpretation (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of photo interpretation. Explain the visual, measured and digital interpretation. Observe the influence of individual factors on the readability of the images.	comprehensive exam	D4
Prepare and describe the image components. Present procedures for image analysis.	comprehensive exam	A1, B3, B10, B14, D4
Describe the types and characteristics of the Photo Interpretation Keys. Describe the application of CIR images to monitor vegetation damage Analyse the possibilities of applying photointerpretation in urban forestry, nature protection and the environment.	comprehensive exam	A1, B3, B10, B14, D4
Specify types and conditions for stereoscopic observation of images. Define scale of aerial photographs. Show aerial photographs orientation. Explain the methods of measurement interpretation to determine the constituent and structural parameters.	comprehensive exam	A1, B3, B10, B14, D4
List the methods of digital image processing Explain the digital interpretation Identify and compare a controlled and uncontrolled classification Explain the accuracy of the classification	comprehensive exam	A1, B3, B10, B14, D4

General competences

Students will get to know the latest achievements in the field of photointerpretation in our country and in the world, theoretical fundamentals, types of photographing systems and methods of photographing, and possibilities for application of aerial and satellite images in forestry, nature conservation and environment protection.

Type of instruction

Lectures

Lectures are performed with computer presentations. Within the course, with regular attendance, seminar work is being done during the semester.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures, production and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
Comprehensive exam (CE)	100%	60-70%	Sufficient (2)	7,5	37,5	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(CEx100)/100**		22,5	37,5	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	The student work off for absence from the individual lectures term
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures).	Published examination deadlines.	-

Obligatory literature

1. Oluić, M. (2001): Snimanje i istraživanje Zemlje iz svemira, HAZU, Zagreb, 580 str.
2. Tomašegović, Z. (1986): Fotogrametrija i fotointerpretacija u šumarstvu, Zagreb, 154 str.
3. Pernar, R.: Prezentacije s predavanja

Recommended literature

1. Huss, S. (ed.) (1984): Luftbildung und Fernerkundung in der Forstwirtschaft, Karlsruhe, 375 str.
2. Tomašegović Z. (ed.) 1973: Fotointerpretacija, American Society of Photogrametry; 924 str.

Laboratory methods in phytopathology

UD1007

ECTS 2

English R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof.dr.sc. Danko Diminić

Grading system
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Course content is to get students acquainted with basic methods of fungal isolation from trees and shrubs. Students get to know: methods of isolation from seeds; methods of isolation from leaves and needles; methods of isolation from shoot, branch, stem and root wood and bark. Examples of isolation of most common causative agents of tree and shrub diseases are shown. Students get to know basic methods of growing pathogenic fungi in laboratory conditions, growth media, procedures for obtaining pure cultures, fungal sporulation in laboratory conditions and identification of pathogenic fungi.
Microscopic analysis of samples taken in field and microscopic analysis of samples obtained in laboratory are also part of the program.
Students get acquainted with methods of plant inoculation in order to confirm pathogenic ability of target organism, that is, is it capable of causing pathological changes in a host plant.

Course category:
Laboratory methods in phytopathology (elective course, 1st semester, 1st year)

Learning outcomes and assessment

Learning outcome (LO)	Evaluation methods	Connection with the study program LO
List and explain importance of laboratory methods in phytopathology from urban forestry and nature and environment point of view.	List basic laboratory methods used in phytopathology. Explain purpose of application of different methods of pathogen identification.	B9
Plan, prepare and lead procedures and evaluate results of conducted method for pathogen identification in plant organs.	List and describe procedures of collecting, preparing and analysing samples of diseased plant organs or tissues. Determine cause of particular pathological change / disease based on conducted identification.	B9
Plan, prepare and lead procedures and evaluate results of conducted method of identification of pathogens by isolation. Describe and explain preparation of nutrition media for isolation and growth of pathogens. Describe, explain and differentiate procedures of organs and tissue samples preparation for the purpose of pathogen isolation from diseased cells/tissues.	List and explain procedures for pathogens growth and sporulation. Grade and present results of conducted identification of pathogens by isolation and inoculation and evaluate obtained results.	B9
List basic procedures of pathogen identification by molecular methods. Recognize and choose cases in which these methods of pathogen identification are necessary.	List advantages and disadvantages of pathogen identification by molecular methods.	B9

General competencies

Students gain basic knowledge on different methods of manipulation with pathogenic fungi in laboratory conditions, from isolation from diseased cells to their identification and pathogenicity confirmation.

Type of instruction

Lectures

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	20%	-	-	15	0	0,5
Exam (PUI)	80%	60-70%	sufficient (2)	0	15	0,5
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
UKUPNO	**100%**	**(Px20 + PUIx80)/100**		15	15	1

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (15 direct teaching hours)	-
Written exam	The exam can be taken by students who attended lectures. The written exam is graded and taken into account for the final grade of this course	Exam terms	-
Oral exam	Students who pass the written exam are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **PUIx100/100**		

Obligatory literature

1. Johnston, A. i Booth, C., 1983: Plant Pathologist Pocketbook. Second Edition. CAB, Kew, Surrey, 439 str.
2. Glavaš, M., 1999: Gljivične bolesti šumskoga drveća. Sveučilište u Zagrebu, Šumarski fakultet, 281 str.

Recommended reading

1. Carlile,M.J, Watkinson, S.C., Gooday, G.W., 2001: The fungi. Academic Press, San Diego, London, 588str.
2. Strouts, R.G. & Winter, T.G., 1994: Diagnosis of ill-health in trees. HMSO, London, 307 str.
3. Diminić, D., Kajba, D. & Bezjak, J., 2002: Gljive uzročnici hipertrofija i rak-rana na topolama u klonskom arhivu "Podturen". Rad. Šumar. inst. 37(2): 169–183.
4. Diminić, D., van Dam, B. C. & Hrašovec, B., 2004: Sphaeropsis sapinea: The Cultural Characteristics of Isolates in Relation to Various Impacts on Pines in Croatia. Acta Phytopathologica et Entomologica Hungarica, 39(4): 383–397.

Applied zooecology

UD1008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Josip Margaletić, PhD
Asst. prof. Marko Vucelja, PhD

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:
Students are acquainted with the basic ecological factors which lead to the excessive reproduction of certain animal species which can result in significant damage in forest ecosystems. They are acquainted with ecological valences and ways in which a certain pest reacts to specific ecological factors, with the objective of successfully eliminating pest species and preventing damages which they can cause in forests.

Type of course:
Applied zooecology (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Presenting analytical zooecology (ecological factors affecting the dynamics of animal populations in urban forests and protected forest areas, homotypic and heterotypic relationships within animal populations, animal population dynamics and methods determining abundance (primary, secondary, tertiary), spatial (micro distribution and macrodistribution) distribution of animal populations in urban forests.	Colloquium exam and written and oral exam	B2, B3, B4, D1, D2
Determining the dynamics of animal populations (oscillations and fluctuation types, spatial aspect of population dynamics, population theory, sinocology, zoocenosis - species and dynamics, biological equilibrium ecosystem succession and equilibrium, animal population structural changes)	Colloquium exam and written and oral exam	B2, B3, B4, D1, D2

General competences
The course is designed on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures. Writing a seminar, taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	-	0,5
Seminar	-	-	-	-	2,5	0,08
Colloquium exam 1	25%	60-74%	Sufficient (2)	-	5,0	0,17
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Colloquium exam 2	25%	60-74%	Sufficient (2)	-	7,5	0,25
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Exam	50%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Writing seminar	Students write and present their seminar work related to relevant topics	semester	-
Colloquium exam 1 Colloquium exam 2	Colloquium exam is evaluated and participate in the final assessment of the subject	8th week 15th week	Students passing a colloquium can take the exam
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam.	Exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	-

Obligatory literature

1. Androić, M. 1970. The basics of zooecology with a special emphasis on entomofaunus. Publishing-printing company 'A.G. Matoš ', Samobor. 152 p.

Recommended literature

1. Elton, C. 1968. Animal Ecology, Metheun&Co. Ltd and Science Paperbacks, London, 207 pp.
2. Stoddart, D.M. 1979. Ecology of small mammals. Chapman and Hall Ltd., London. 279 pp.
3. Flowerdew, J.R., Gurnell, J., Gipps, J.H.W. 1985. The Ecology Woodland Rodents, Bank Voles and Wood Mice. The Zoological Society of London, Clarendon Press, Oxford. 409 pp.
4. Zabel, C.J., Anthonz, R.G., 2003. Mammal Community Dynamics, Cambridge University Press, 709 pp.

Breeding of ornamental trees and shrubs

UD 1009

ECTS points 2

E-learning R2

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturers
Prof. dr. sc. Saša Bogdan
Doc. dr. sc. Ida Katičić Bogdan

Grading
Adequate (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Polygenic inheritance, quantitative properties and environment; Modifications, mutations, extranuclear inheritance; Genetic tests; General settings and development of breeding of ornamental trees and shrubs; Phenotypic variability and its use in breeding of trees and shrubs; Creation of initial plant material (core population), pedigree; Breeding by selection; Crossing methods in breeding populations; Hybridization; Breeding for resistance to biotic and abiotic factors; Macro-propagation methods of ornamental woody species; Methods of micropropagation of ornamental woody species; Biotechnology in breeding of ornamental trees and shrubs; Breeding by mutations; Conservation and domestication of decorative cultivars.

Type of course:
Breeding of ornamental trees and shrubs (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain different models of inheritance of ornamental phenotypic properties; To explain basic epigenetic mechanisms in the context of ornamental properties; To explain the notion of mutations and their role in the inheritance of ornamental properties.	Final Exam	B6, D1, D2
To explain basic traditional as well as contemporary methods and techniques of cloning of forest tree species; To compare different methods or cloning techniques; To identify appropriate cloning methods for particular types, needs and conditions; To describe the necessary equipment and accessories for the application of various cloning methods.	Final Exam	B6, D1, D2, D4, D5
To explain the procedures of classical breeding; To explain contemporary breeding methods with the aim of producing ornamental tree and shrub cultivars; To describe valid procedures for recognizing new ornamental cultivars of trees and shrubs.	Final Exam	B6, D1, D2, D4, D5

General competences

Interpretation of theoretical settings of inheritance of ornamental phenotypic traits in forest woody species.
Selection of methods in ornamental breeding.
Selection of propagation methods of ornamental cultivars.
Knowing the procedures for recognizing ornamental cultivars

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Examination and consultation. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	0.5
Final exam (ZI)	100%	60-70% 71-80% 81-90% 91-100%	sufficient (2) good (3) very good (4) excellent (5)	0	45	1.5
TOTAL	100%			15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Tracking elements	Description	Deadline	Compensation
Lectures	The attendance of students is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct teaching)	-
Written exam	Exams can be taken by students who regularly attended lectures. The students answer the questions from the entire course content, rounding out the exact answers. The written exam is evaluated and participates in the final grade of the course.	examination deadlines	-
Oral exam	Students who pass a written exam are being asked questions from different parts of the entire course content.	examination deadlines	-

Obligatory literature

1. Bogdan, S., I. Katičić Bogdan, 2015. Genetika s oplemenjivanjem drveća i grmlja. Interna recenzirana skripta. 224. str. (Nastavni materijal pozitivno ocijenjen od strane stručnog povjerenstva i objavljen na web stranici Šumarskog fakulteta Sveučilišta u Zagrebu) http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=109.
2. Jelaska, S., 1999. Kultura biljnih stanica i tkiva, Školska knjiga. 398 str.
3. Međedović, S. i Dž. Ferhatović, 2003. Klonska proizvodnja sadnica drveća i grmlja. Sarajevo. 216 str.

Recommended literature

1. Li, Y., Pei, Y., 2006. Plant biotechnology in ornamental horticulture. Haworth Press. 517 str.
2. Callaway, D.J., Callaway, M.B. (eds.).2000. Breeding Ornamental Plants. Timber Press, Portland, GB.

Birds of urban forests and parks

UD1010

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Doc.dr.sc. Kristijan Tomljanović

Associate teacher for exercises

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Through the program content of this course, students are introduced to the basics of ecology of urban forests and parks. One of the main themes is research methods such as bird communities, nesting, birding etc. In addition, students learn about the basic ecological principles of urban ornithology. Following are the bird's behaviour, migration, and the impact of humans on birds in urban areas. There will be discussions on climate change and bird relations and finally on climate change. It will end with bird protection.

Type of course:
Birds of urban forests and parks (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Students are introduced to the issue of ornithology within the urban environment. Monitoring and taking measures to protect the urban environment.	final exam	A1, A3, B13.
Getting acquainted with ecology, biology, the ethology of birds that habitats find within urban environments, their demands and limiting factors of adherence	final exam	B1, B8, B14
Drawing up an elaborate. Study, risk assessment, etc. related to orphan fauna within the urban environment and protected nature facilities.	final exam	A1, B3, B10,

General competences
Students learn about the most important segments of bird ecology, and the relation of ornithophones to relevant abiotic and biotic ecological factors. Teaching is performed using modern sources of knowledge (original reality, multimedia, video, etc.).

Type of instruction

Lectures
Teaching is performed using modern sources of knowledge (original reality, multimedia, video, etc.).

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures. Maintenance of oral exams and consultations. Preparation and preparation of teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures and exercises. Examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	15	1,0
Partial exam (PE)	100%	60-70%	Sufficient (2)	-	30	1,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L+PE)/100**		15	45	2,0

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Checks and records attendance of students. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Oral exam	Students are asked questions from different parts of the program content. **(FEx100)/100**	Exam terms	-

Obligatory literature

1. Dolenec, Z. 2009: Ptice tu oko nas (priručnik). Školska knjiga, Zagreb.
2. Gill, F. 2000: Ornithology. W. H. Freeman and Company, New York.

Recommended literature

1. Sutherland, W.J., Newton, I, Green, R. E. 2008: Bird Ecology and Conservation. Oxford University Press, Oxford.
2. Sterry, P. 2004: Birds of Mediterrean. C. Helm, London.
3. Perrins, C.M., Birkhead, T. R. 1983: Avian Ecology. Chapman and Hall, New York.

Ethology

UD1011

ECTS 2

English language R3

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Josip Margaletić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
The course is planned in a way to cover the central features of ethological studies. Emphasis will be put on species behaviour according to its own environment. Different behavioural mechanisms which determine survival of species as well as continuous adaptations of behaviour will be handled with emphasis on learning in animals. Course should also provide an insight into importance of human behaviour and its impact on natural ecosystems and urban environment.

Type of course:
Ethology (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the main scientists and their work that set the foundations of ethological research.	Written and oral exam	B2
Identify the difference between the ultimate and proximal causes of animal behaviour.	Written and oral exam	B2
Identify innate behaviours in animals.	Written and oral exam	B2
Identify different animal learning mechanisms.	Written and oral exam	B2
Identify examples of natural and sexual selection and the impact of both on the development and behaviour of animal species.	Written and oral exam	B2
Link the behaviour of animals in nature depending on their reproduction or survival.	Written and oral exam	B2
Classify different reproductive strategies of animals with emphasis on monogamy and polygamy.	Written and oral exam	B2
Identify sexual dimorphism and identify intrasexual and intersexual selection.	Written and oral exam	B2
Identify various mechanisms in females and males responsible for their own offspring.	Written and oral exam	B2
Recognize different types of animal behaviour in nature depending on their habitats.	Written and oral exam	B2
Recognize relationship between the importance of habitat adaptation and the protection of animal species.	Written and oral exam	B2
Summarize the main hormones with an emphasis on sex hormones and their role in animal behaviour.	Written and oral exam	B2

General competences

This course should familiarize the students with central features of animal behaviour and importance of different behavioural patterns in different environments. The course should provide students with sufficient knowledge for better understanding the importance of behaviour in wildlife management and species conservation.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	-	0,5
Exam (PE)	100%	60-70%	Sufficient (2)		30	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			15	35	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam..	Exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	-

Obligatory literature

1. Alcock J. Animal Behavior: An Evolutionary Approach. Seventh Edition. Sunderland (MA): Sinauer Publishers, 2001.

Recommended literature

1. Bolton, M. Conservation and the Use of Wildlife Resources. Chapman & Hall, 1997.
2. Caro, T., ed. Behavioral ecology and conservation biology. Oxford University Press, New York, 1998.

Synmorphology and mapping of forest vegetation

ŠDU1007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Dario Baričević, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Plant community. Floral composition. Vegetation structure. Significance of species. Phytocenological recording on the field. Methodology and assessment dynamics. Field data. Forest cover. Sociability. Layers. Phenology. Vitality. Processing field data. Phases of synthetic classification. Creation of final phytocenological tables. Biological form. Determining geo-elements. Eco-indicator characteristics of plant species and characterizing habitats. Numerical multivariate analysis. Cluster analysis. Multidimensional scaling. Application of results in practice. Mapping forest vegetation. Types and measures of vegetation maps. Colour and depicting units. Field work in mapping and data compilation. GIS and new mapping technology. Remote sensing. Air photos. Satellite photos. Sensors for vegetation photography. Application of vegetation mapping.
The course is based on the classic assumptions of the Braun-Blanquet approach, but also uses the most up-to-date information and technological aids. The course also relies on the principles of naturalness, sustainable forest management and bio-diversity. The course is comprised of lectures using modern teaching aids.

Type of course:
Synmorphology and mapping of forest vegetation (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret the application of vegetation research (synecological and vegetation research and their interpretation - identification and description of forest communities, systematic position, change in floral composition and surface, stability of phytocoenoses).	Seminar, Final exam	A1, B2, B3, B10, B13, D1, D2, D4, D5
Valorise the floral composition as an indicator of the disturbance of forest ecosystems (phytocenological recording, biodiversity index, creating an eco-diagram, analysis of the obtained results and making detailed conclusions).	Seminar, Final exam	A1, B2, B3, B10, B13, D1, D2, D4, D5
Present the mapping of forest vegetation (mapping, technical preparation, field work, processing of collected data, creation of a vegetation map).	Seminar, Final exam	A1, B2, B3, B10, B13, D1, D2, D4, D5

General competences

The objective of the course is for students to become acquainted with the basic concepts of synmorphology and mapping forest vegetation, and to prepare students for independent phytocenological assessment, processing and interpretation of the same, as well as creation of vegetation maps and interpretation of the same, in a classical way, as well as through use of the most up-to-date information, methods and aids.

Type of instruction

Lectures
Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:
Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams. Creating teaching materials.

Studenats obligations:
Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100	Exam terms	

Obligatory literature

1. Horvat, I. i sur., 1950: Priručnik za tipološko istraživanje i kartiranje vegetacije. Ministarstvo šumarstva FNRJ, 227 str.
2. Podani, J., 1994: Multivariate data analysis in Ecology and Systematics. SPB Academic Publishing bv. Den Haag.
3. Šegulja, N. & V. Hršak, 1988: Priručnik za fitocenološka i ekološka istraživanja vegetacije. Mala ekološka biblioteka, knjiga 1, HED, 91 str.
4. Vukelić, J. & Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski
   a. fakultet Sveučilišta u Zagrebu, 310 str.
5. Vukelić J. i sur. 2008: Šumska staništa i šumske zajednice u Hrvatskoj. Nacionalna ekološka mreža. DZZP, 263 str.

Recommended literature

1. Digby, P.G.N., R.A. Kempton, 1987: Multivariate Analysis of Ecological communities. Chapman and Hall Ltd.
2. Ellenberg, H., 1979: Zeigerwerte der Gefässpflanzen Mitteleuropas. Verlag E. Goltze KG, Göttingen.
3. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
4. Kachigan, S.K., 1991: Multivariate Statistical Analysis. Radius Press, New York.
5. Oberdorfer, E., 1983: Pflanzensoziologische Exkursions flora. Verlag Eugen Ulmer Stuttgart, 1051 str.

Methods of plant taxonomy

ŠDU1011

ECTS 2

English language R3

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. PhD Jozo Franjić
Prof. PhD Željko Škvorc

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Taxonomy definition - the relationship between taxonomy and other scientific disciplines, basic taxonomic terminology. Phylogeny. Nomenclature, understanding of the taxon concept. Taxonomic ranks (above and below the rank of species). The process of speciation, apomixis, hybridization, introgression, polyploidy. Identification of plants, usage of plant identification keys and floristic handbooks. Significance of herbarium collections. Methods of collecting and processing various types of taxonomic data - comparative morphology, paleobotany, geography, cytology, serology, biochemistry, molecular taxonomy and systematics, cladistics. Statistical analysis methods of taxonomic data from various sources. Data analysis software.

Type of course:
Methods of plant taxonomy (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To explain basic principles and terminology in plant taxonomy (phylogeny, plant nomenclature, understanding of the taxon concept, evolution, speciation)	Seminar presentation, written exam	D1, D2
To use plant identification keys, floristic handbooks, herbarium collections and herbarium material for plant identification.	Written exam	A1, B10
To define taxonomic problems and to recommend appropriate methods of collecting and processing suitable types of taxonomic data (morphology, anatomy, cytology and biochemistry, phytogeography, paleobotany, molecular taxonomy).	Seminar presentation, written exam	A1, D5
To analyse taxonomic data and to interpret the obtained results.	Seminar presentation, written exam	A1, D5

General competences

In this course students gain an understanding of the basic principles, key concepts and available methods in plant taxonomy. This allows them to define and interpret taxonomic problems correctly as well as to collect and process required plant material.

They get acquainted with the latest methodologies and tools for the analyses of various types of taxonomic data, including molecular tools which are becoming widely accessible due to rapid development of science and technology.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Lecturing. Helping students with defining taxonomic problems and topics for their seminars. Preparation of exams and their grading. Organising consultations. Preparation of lecture material.

Studenats' obligations:

Regular attendance and activity during the lectures, preparation and presentation of the seminars. Attending the written exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	14	0	0,5
Seminar (S)	50%	Seminar delivered on time	Sufficient (2)	1	15	0,5
		In addition to prior, student follows the given topic and guidelines, seminar is written clearly.	Good (3)			
		In addition to prior, student gives an oral presentation of the seminar. Seminar content reflects student's effort and interest for a given topic.	Very good (4)			
		In addition to prior, seminar reflects deep understanding of the topic.	Excellent (5)			
Partial exam (PE)	50%	55-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx50 + PEx50)/100**		15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	50 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	**100%**	**(Fex50+Sx50)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Attendance of the lectures is recorded. Students can be excused from 20% of the total lecture hours.	Semester (14 hours)	-
Seminar	Individual student seminars in which they present a minor taxonomic problem (oral student presentations). Quality of the seminar contributes to the final grade.	15. week or according to defined term.	written seminars
Written partial exam	Students who presented their seminar are allowed to approach the partial written exam. The exam has a total of 100 points, 55% of which are needed for a positive grade. Final grade according to: (Sx50 + Pix50)/100	During the semester	-
Written final exam	Students who presented their seminar are allowed to approach the final written exam. The exam content is composed of the whole course material and has a total of 100 points, 60% of which are needed for a positive grade. Final grade according to: (Fex50+Sx50)/100	Exam terms	-

Obligatory literature

1. Vidaković, M., J. Franjić, 2004: Golosjemenjače. Sveučilište u Zagrebu-Šumarski fakultet. Zagreb
2. Franjić, J., Ž. Škvorc, 2010: Šumsko drveće i grmlje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 432 str. Zagreb.
3. Franjić, J., Ž. Škvorc, 2014: Šumsko zeljasto bilje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 626 str. Zagreb.
4. Judd, W. S., C. S. Campbell, E. A. Kellogg, P. F. Stevens 2007: Plant Systematics. A Phylogenetic Approach. 3rd edition. Sinauer Associates. Sunderland.

Recommended literature

1. Stuessy, T. F. 2009: Plant taxonomy: The systematic evaluation of comparative data. 2nd edition. Columbia University Press, New York.
2. Nikolić, T., 1996: Herbarijski priručnik, 1-167. Zagreb.
3. Nikolić, T., 2013: Sistematska botanika - Raznolikost i evolucija biljnog svijeta. Alfa d.d., 882 str. Zagreb.
4. Domac, R., 1994: Flora Hrvatske, priručnik za određivanje bilja. Školska knjiga, Zagreb.
5. Singh, G. 2016: Plant Systematics, 3rd edition: An Integrated Approach. CRC Press.
6. Besse, P. (ur.) 2014: Molecular plant taxonomy: methods and protocols. Humana Press.
7. Winston, J.E. 1999: Describing Species, Practical Taxonomic Procedure for Biologist. Columbia University Press, New York
8. Clive, S., 2005: Plant taxonomy and biosystematics-does DNA provide all the answers? Taxon 54: 999-1007.

Horticultural Dendrology

UD2001

ECTS 5

English language R1

E-learning R2

Teaching hours 69
Lectures 30
Exercises 15
Field work 24

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Associate teacher for exercises
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:
International Code of Nomenclature for Cultivated Plants. The horticultural importance of particular genera of gymnosperms and angiosperms, with their biological features, morphological characteristics, number of species and distribution is taught in the course of Dendrology. For genera not included in the Dendrology course learning biological features, morphological characteristics, number of species and distribution. The genera belong to the following families: *Ginkgoaceae*, *Araucariaceae*, *Pinaceae*, *Taxodiaceae*, *Cupressaceae*, *Cephalotaxaceae*, *Taxaceae*, *Cycadaceae*, *Magnoliaceae*, *Calycanthaceae*, *Lauraceae*, *Ranunculaceae*, *Berberidaceae*, *Lardizabalaceae*, *Cercidiphyllaceae*, *Platanaceae*, *Hamamelidaceae*, *Ulmaceae*, *Moraceae*, *Juglandaceae*, *Fagaceae*, *Betulaceae*, *Nyctaginaceaee*, *Chenopodiaceae*, *Polygonaceae*, *Paeoniaceae*, *Theaceae*, *Actinidiaceae*, *Clusiaceae*, *Tiliaceae*, *Sterculiaceae*, *Malvaceae*, *Cistaceae*, *Tamaricaceae*, *Passifloraceae*, *Salicaceae*, *Ericaceae*, *Ebenaceae*, *Styracaceae*, *Pittosporaceae*, *Hydrangeaceae*, *Grossulariaceae*, *Rosaceae*, *Mimosaceae*, *Caesalpiniaceae*, *Fabaceae*, *Elaeagnaceae*, *Lythraceae*, *Thymelaeaceae*, *Myrtaceae*, *Punicaceae*, *Nyssaceae*, *Cornaceae*, *Celastraceae*, *Aquifoliaceae*, *Buxaceae*, *Rhamnaceae*, *Vitaceae*, *Sapindaceae*, *Hippocastanaceae*, *Aceraceae*, *Anacardiaceae*, *Meliaceae*, *Rutaceae*, *Araliaceae*, *Apocynaceae*, *Asclepiadaceae*, *Solanaceae*, *Verbenaceae*, *Lamiaceae*, *Buddlejaceae*, *Oleaceae*, *Scrophulariaceae*, *Bignoniaceae*, *Caprifoliaceae*, *Asteraceae*, *Arecaceae*, *Dracaenaceae*, *Ruscaceae*, *Aloaceae*, *Agavaceae*. Cultivars of species whose morphological characteristics, natural range, special features, economic and ecological importance the students have been taught in the course of Dendrology. For species not included in the Dendrology course learning the morphological characteristics, distribution and cultivars. The course covers autochthonous and allochthonous tree and shrub species which are important for urban forestry in Croatia, and the topics of the lectures follow a systematic order.

Type of course:
Horticultural Dendrology (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To use International Code of Nomenclature for Cultivated Plants;	exam	B5
To define and explain horticultural importance, biological features and morphological characteristics of the genera of gymnosperms and angiosperms important for urban forestry in Croatia;	exam	B5
To identify and describe the ornamental species and cultivars of gymnosperms and angiosperms important for urban forestry in Croatia according to: habit, bark, twigs in winter, leaves, flowers, cones and fruits;	exam	B5
To categorise gymnosperms and angiosperms important for urban forestry in Croatia according to ornamental and phenological features;	exam	B5
To identify and determine the applicability of ornamental gymnosperms and angiosperms important for urban forestry in Croatia in particular examples;	exam	B5, B13, C2, D1, D2, D3, D4, D5
To identify and distinguish ornamental gymnosperms and angiosperms important for urban forestry in Croatia in certain vegetation period; to identify, recognise and determine the ornamental value of taxa in different vegetation periods;	exam	B5, C2
To choose ornamental gymnosperms and angiosperms important for urban forestry in Croatia for various purpose in urban forestry;	exam	B5, B13, C2, D1, D2, D3, D4, D5
To argue the choice of ornamental taxa important for urban forestry in Croatia for horticultural use in urban forestry, especially in planning urban green spaces, taking into account the optimal variety of ornamental plants;	exam	B5, B13, C2, D1, D2, D3, D4, D5

General competences
Students acquire theoretical and practical knowledge about ornamental woody taxa (genera, species, hybrids and cultivars) important for urban forestry in Croatia. Theoretical knowledge encompasses biological features, morphological characteristics, variability (with special emphasis on cultivars), distribution, special characteristics, as well as the horticultural importance of taxa. Students acquire practical skills to recognize ornamental woody taxa on the basis of different morphological characteristics: habit, bark, leaves, twigs of deciduous species in winter, flowers, cones and fruits. Students acquire skills to recognise the ornamental value of woody taxa in different vegetation periods and different ecological conditions. They also gain knowledge on the practical use of ornamental trees and shrubs in urban forestry.

Type of instruction

Lectures

Exercises
The practicum exercises enable students to acquire practical skills to recognize ornamental woody taxa on the basis of different morphological characteristics: habit, bark, leaves, twigs of deciduous species in winter, flowers, cones and fruits. The students use plant material and digital photos.

Field work
Field work is held for three days in parks, botanical gardens and arboreta in the continental and Mediterranean regions of Croatia. During field work students collect learning material.

Working methods:

Teachers' obligations:
Giving lectures, exercises and field teaching. Holding consultations, partial exams, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material. Preparation of new and maintenance of existing herbarium specimens in the scientific herbarium of the Faculty of Forestry. Digitising herbarium specimens and entering data into the database of scientific herbarium.

Studenats' obligations:
Regular attendance at lectures, exercises and field work. Writing exercise and field work reports. Collecting learning material. Doing and submitting homework. Passing final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30		1
Exercises (E)	5%	60-70%	Sufficient (2)	15		0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Homework (HW)	5%	70-80%	Sufficient (2)		15	0.5
		81-89%	Good (3)			
		90-94%	Very good (4)			
		95-100%	Excellent (5)			
Field work reports (FWR)				24		0.5
Learning material collection (LM)					15	0.5
Final exam (FE)	90%	60-70%	Sufficient (2)		60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**10%**	**(Fex90+Ex5+HWx5)/100**		69	90	5

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures, exercises and field work	Student attendance is recorded. Student may not be absent more than 20% of lectures and 10% of exercises.	II semester	
Exercises (E)	The exercises are attended in groups. The students use plant material and digital photos. The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: habit, bark, leaves, twigs of deciduous species in winter, cones and fruits. At the end of each exercise the accuracy of determination is evaluated, and the evaluation affects the final grade.	II semester	
Homework (HW)	After each lecture and practicum exercises, the students do their homework and submit it via the Herbarium DEND application. The homework is evaluated and affects the final grade.	II semester	
Field work reports (FWR)	After field work students prepare reports. Professor's signature confirms the accuracy of the report.	II semester	
Learning material collection (LM)	On field work students collect learning material. Professor's signature confirms the accuracy of the material.	II semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures, exercises and field work; positively graded all exercises and homework; signed field work reports; collected and signed learning material).	Exam terms	
Oral exam	Access requirement: positively graded written exam. In the oral part, apart from theoretical knowledge, students have a practical determination of ornamental woody species according to different morphological characteristics. The final grade is obtained according to the formula: (FEx90+Ex5+HWx5)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2005: Listopadno drveće i grmlje u zimskom razdoblju. Šumarski fakultet Sveučilišta u Zagrebu. 256 pp.
2. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
3. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.

Recommended literature

1. Bärtles, A., Schmidt, P.A., 2014: Enzyklopädie der Gartengehölze. Verlag Eugen Ulmer, Stuttgart.
2. Brickell, C. (Ed.), 2003: RHS A-Z encyclopedia of garden plants, Vol. I-II. Dorling Kindersley, London.
3. Cullen, J., Knees, S.G., Cubey, H.S. (Eds.), 2011: The European garden flora flowering plants: a manual for the identification of plants cultivated in Europe, both out-of-doors and under glass. Vol. I-V. Second edition. Cambridge University Press.
4. Dirr, M.A., 2011: Dirr's encyclopedia of trees and shrubs. Timber Press.

5. Farjon, A., 2010: A handbook of the world's conifers. Vol. I-II. Brill, Leiden.
6. Fiala, J.L., 2008: Liliacs – a gardener's encyclopedia. Timber Press, Portland, London.
7. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim.
8. Fryer, J., Hylmö, B., 2009: Cotoneasters: a comprehensive guide to shrubs for flowers, fruit, and foliage. Timber Press, Portland & London.
9. Galle, F.C., 1997: Hollies: the genus *Ilex*. Timber Press, Portland.
10. Gooch, R., Gooch, J., 2011: *Clematis* – an essential guide. The Crowood Press Ltd., Wiltshire.
11. Krüssmann, G., 1972: Handbuch der Nadelgehölze. Verlag Paul Parey, Berlin und Hamburg.
12. Krüssmann, G., 1976: Handbuch der Laubgehölze. Band I-III. Verlag Paul Parey, Berlin und Hamburg.
13. Lis-Balchin, M. (Ed.), 2002: Lavender: The genus *Lavandula*. Taylor & Francis, London.
14. Quest-Ritson, C., Quest-Ritson, B., 2003: The Royal Horticultiral Society encyclopedia of roses. Dorling Kindersley Ltd., London.
15. Roloff, A., Bärtels, A., 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart.
16. van Gelderen, D.M., de Jong, P.C., Oterdoom, H.J., 1994: Maples of the world. Timber Press, Portland, Oregon.
17. van Gelderen, D.M., van Hoey Smith, J.R.P., 1996: Conifers: The illustrated encyclopedia. Timber Press, Portland, Oregon.
18. Vertrees, J.D., 2001: Japanese maples. Timber Press, Portland.

Environmentally sound techniques and technologies

UD2002

ECTS 5

English language R1

E-learning R1

Teaching hours 84
Lectures 30
Exercises 30
Field work 24

Lecturer
Prof. dr. sc. Tomislav Poršinsky
Prof. dr. sc. Marijan Šušnjar
Doc. dr. sc. Kruno Lepoglavec

Associate teacher for exercises
Prof. dr. sc. Tomislav Poršinsky
Prof. dr. sc. Marijan Šušnjar
Doc. dr. sc. Kruno Lepoglavec
Doc. dr. sc. Andreja Đuka
Doc. dr. sc. Dinko Vusić
Marin Bačić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
After having worked out basic methods of wood logging, the task of the subject is to inform about the efficient and environmentally acceptable machine methods of building forest roads and wood logging. Risk factors and factors of ecologically acceptable methods of work in wood logging are discussed. In this, students are taught in details about the various kinds of damaging forest soil, trees and second growth during the work with classical forest technologies as well as with consequences of the use of environmentally acceptable technologies. Procedures of decreasing the degree of damaging (choice of technology, organisation of work, choice of a machine, planning method, etc.) as well as a method of rehabilitation make a significant component of the subject.
One of the tasks of the course is to inform students about the basic features of force transmission from the movement system to the soil, tensile features of a vehicle and consequences of a vehicle activity on the soil by normal and tangential forces. The course includes basic analysis of forest vehicles, their dimensional and mass features (morphological analysis). Evaluation methods of a tensile feature and soil compaction are dealt with. Students learn about the measuring equipment for the estimate of soil compaction.
The subject Environmentally acceptable techniques and technologies informs students about forest roads and their significance for the whole forest management. It also deals with the classification, definitions and technical features of primary, secondary and special forest communications. Advantages and shortcomings of a forest road infrastructure realisation in the natural environment are emphasised. Basic stages of establishing the optimum forest road network

on the terrain with the presentation of legal base are defined. The stage of a forest road planning is discussed, as well as various systems of forest opening, methodological studies of primary and secondary opening.
The subject includes lectures, field classes, exercises, computer exercises and seminar papers conceived in a contemporary way and with the use of contemporary teaching methods. Students will be assessed through colloquiums, written and oral part of the examination.

Type of course:
Environmentally sound techniques and technologies (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse felling and tree processing (limiting and influencing factors of harvesting operations, procedures and phases of timber production, influence of society, terrain characteristics, harvesting mechanisation level, theory and procedures during tree felling, methods of timber processing, machines for mechanised felling and processing and their purpose, wood defects and irregularities, quality assortment structure of broadleaved and conifer timber for with respect to JUS and EN standards).	Exercises, Final exam	B11
Presentation of timber transport (division of timber transport, division of timber extraction in terms of mechanisation level and load-ground contact, limitations and suitability of individual timber transporting vehicles with regard to field and stand conditions, timber extraction distance and environmental acceptability, division and features of long distance timber transport, types of landing sites, features of timber transport by waterways and railway, long distance timber transport by trucks.	Exercises, Final exam	B11
Definition of forest road design process, primary and secondary forest opening (significance of forest traffic infrastructure for overall forest management, grading criteria and classification of forest roads, establishment and management of optimal forest road network, parameters of estimation of quantity and quality of forest roads network, primary and secondary opening forest - theoretical models, constructive elements of forest road, forest road design - basic phases of work)	Exercises, Final exam	B11
Present the construction and maintenance of forest roads (road construction process - basic phases of work, construction technology of forest roads in the lowland and steep terrain, maintenance of forest roads, causes of forest roads damages)	Exercises, Final exam	B11
Determine the damage of forest soils and stands by forest machines (wheel ruts, measurement methods, estimation models for depth of ruts, soil layer transfer, soil disturbance area, soil compaction, methods for determining soil compaction due to forest vehicle passage, natural soil recovery, technical solutions for reduction of weight of forest machinery and vehicles, problem, knowledge and consequences of damage and actions for reduce the level of damaging trees)	Exercises, Final exam	B11
Analyse actions to reduce environmental pollution by exhaust gases and harmful substances from forest machinery (harmfulness of exhaust gases, technical actions to reduce the amount of harmful exhaust gases, remote monitoring systems for forest machinery and vehicles, biofuels, ecological properties of fuels and lubricants, energy consumption of forest vehicles, development of forest machinery)	Exercises, Final exam	B11

General competences
The development of competent knowledge for carrying out complex operative and environmentally acceptable professional solutions, independent decision-making and involvement in research tasks.

Type of instruction

Lectures
Lectures cover 15 units according to the teaching plan.

Exercises
10 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Field work
Field work is scheduled for 3 days. Three themes are discussed.

Working methods:

Teachers obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.

Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,5
Exercises (E)	20%	60-70%	Sufficient (2)	54	30	2,0
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	30	2,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + FEx80)/100**		84	60	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2,5
TOTAL	**100%**	**(Fex80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (84 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. CD s predavanjima u "Windows Power Point" prezentaciji te ispis istih. Studenti koji nemaju osobno računalo mogu ga rabiti u računalnoj učionici Šumarskoga fakulteta i u knjižnici Zavoda za iskorištavanje šuma.
2. Anon., 1966: Šumarsko-tehnički priručnik. Nakladni zavod Znanje, Zagreb, 1-568.
3. Bekker, M., G., 1956: Theory of land locomotion, The University of Michigan Press, 1 – 499.
4. Bekker, M., G., 1960: Off-the-road locomotion, The University of Michigan Press, 1 – 215.
5. Bekker, M., G., 1969: Introduction to Terrain-Vehicle Systems, prijevod Mašinostroenije 1973., 1 – 520.
6. Conway, S., 1976: Logging practices., Principles of timber harvesting systems. Miller Freeman Publications, 1 – 432.
7. Jeličić, V. 1983: Šumske ceste i putevi, SIZ odgoja i usmjerenog obrazovanja šumarstva i drvne industrije SRH, Zagreb, Palmotićeva 17a, s. 1-193.
8. Krpan, A.P.B., Zečić, Ž., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1 – 98.
9. Nonveiler, E., 1979: Mehanika tla i temeljenje građevina. Školska knjiga Zagreb, 1 – 780.
10. Pičman, D., Pentek, T., Poršinsky, T. 2003: Prilog istraživanju oštećivanja stabala mehanizacijom za gradnju šumskih putova, Strojarstvo vol. 45 (4-6), Zagreb, Hrvatska, s. 149-157.
11. Pentek, T. 2002: Računalni modeli optimizacije mreže šumskih cesta s obzirom na dominantne utjecajne čimbenike, Disertacija Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, s. 1-271.
12. Ronai, Đ. M., 1983: Teorija kretanja van tvrdih puteva. Fakultet tehničkih nauka Univerziteta u Novom Sadu, 1 – 324.

13. Ronai, Đ. M., 1986: Sabijanje zemljišta kao posledica kretanja točka. Fakultet tehničkih nauka Univerziteta u Novom Sadu, 1 – 227.
14. Racz, Z., 1986: Agrikulturna mehanika tla. Fakultet poljoprivrednih znanosti Sveučilišta u Zagrebu, 1 – 57.
15. Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.
16. Staff, K.A.G., Wiksten, N.A., 1984: Tree harvesting Techniques. Martinus Nijhoff/DR W. Junk Publishers, Dodrechts/Boston/Lancaster, 1 – 371.
17. Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219.
18. Šikić, D. i drugi 1989: Tehnički uvjeti za gospodarske ceste, Znanstveni savjet za promet JAZU, Zagreb, s. 1-40.
19. Ugrenović, A., Benić, R., 1957: Eksploatacija šuma. Grafički zavod Hrvatske, 1 – 481.
20. Izabrani stručni i znanstveni članci objavljeni u časopisu "Mehanizacija šumarstva" koji su na raspolaganju studentima knjižnicama Šumarskoga fakulteta i Zavoda za iskorištavanje šuma

Recommended literature

1. Anon. 2002: Forest Road Engineering Guidebook, British Columbia, Ministry of Forests, p. 1-208.
2. Arnup, R.W., 1999: The extent, effect and management of forestry-related soil disturbance, with reference to implications for the Clay Belt: a literature review. Ontario Ministry of Natural Resources, Northeast Science & Technology, TR-37, 1 – 30.
3. Brukner, M., 1994: GIZIS – osnove, INA-INFO, Zagreb, s. 1-204.
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6. Dvorščák, P., Hríb, M. 1994: Lesné cesty (Návody na cvičenia), Tehnická univerzita vo Zvolen, p. 1-128.
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13. Hori,T., Y. H. Li, 1990: Terrain classification for forest road network planning by using slope gradient distribution. II. Supplementary investigation of terrain indices and slope gradient percentages, Journal of the Japanese Forestry Society. 1990, 72: 2, p. 151-153.
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24. Saarilahti, M., 2002C: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 1: WES mobility models. Soil interaction model, Appendix Report No 2, 1 – 39.
25. Saarilahti, M., 2002D: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 2: Comparison of the different WES-models. Soil interaction model, Appendix Report No 3, 1 – 28.
26. Saarilahti, M., 2002E: Evaluation of the WES-method in assessing the trafficability of terrain and the mobility of forest tractors – Part 3: Interpretation and application of results. Soil interaction model, Appendix Report No 4, 1 – 15.
27. Saarilahti, M., 2002F: Modelling of the wheel and tyre, 1. Tyre and soil contact – Survey on tyre contact area and ground pressure models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 5,1 – 43.
28. Saarilahti, M., 2002G: Modelling of the wheel and tyre, 2. Tyre stiffness and deflection – Survey on tyre deflection models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 6, 1 – 15.
29. Saarilahti, M., 2002H: Modelling of the wheel and tyre, 3. Tyre/soil models for predicting rut formation and soil compaction – Survey on soil deformation models for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 7, 1 – 19.
30. Saarilahti, M., 2002I: Modelling of the wheel and soil, 4. Forest soil properties – Survey on forest soil properties and soil compaction for studying the mobility of forest tractors. Soil interaction model, Appendix Report No 8, 1–37.

Wildlife Management

UD3003

ECTS 4

English language R1

E-learning R1

Teaching hours 46
Lectures 15
Exercises 15
Field work 16

Lecturer
Prof Krešimir Krapinec
Prof Marijan Grubešić
Ass Prof Kristijan Tomljanović

Associate teacher for exercises
Prof Krešimir Krapinec
Ass Prof Kristijan Tomljanović

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Students will get to know animal species in the Republic of Croatia whereby forest animals are emphasized. An overview of the manners for harmonization of fauna management in the Republic of Croatia and the international legal provisions regarding fauna is given. The aim is the manner of fauna management as a part of an integral forest management. Since today the opinion of the public is asked for more and more, students will also be acquainted with the manner for harmonization of management plans with other interest groups in a certain area. Therefore, an overview of the consensus with other groups interested in nature protection and use of space - organizations, agencies, bio-politics, planning – professional organizations, representing organizations, state agencies, committees is given.

Type of course:
Wildlife management (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Organisation and conduction wildlife management in nature protection areas.	Oral exam	B8

General competences
Perfecting in observing of details required for identification of individual animal species. Development of inductive and deductive abilities required for better knowledge of circumstances in the field (habitat and social). Up-to-datedness in the work, systematism and effectiveness in data compiling. Ability to use the acquired information to resolve practical problems encountered by a contemporary space-managing expert.

Type of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:
Direct lessons. Keeping writing and oral exam, consultations, teaching material making.

Studenats' obligations:
Regularity at teaching and active participation teaching. Passing the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	0	1
Exercises (E)	-	60-70%	Sufficient (2)	30	0	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	30%	60-70%	Sufficient (2)		60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		60	60	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	
Partial exam	-	-	
Written exam	Exceptionally (f.e. for students with speech disorder)	Exam terms	
Oral exam	Asks from different parts of course content	Exam terms	

Obligatory literature

1. Degraaf, R.M.; Miller, R.I., 1996: Conservation of Faunal Diversity in Forested Landscapes. Chapman and Hall, London, 648 p.
2. ***, 1999: The Atlas of European Mammals; Academic Press; London; 484.
3. Scalet, C.G., Flake, L.D., Willis, D.W., 1996: Introduction to Wildlife and Fisheries: An Integrated Approach; W.H. Freeman and Company; New York; 512 pp.
4. Wildlife and Game Acts, Rules, Conventions.

Recommended literature

1. Williams, B. K.; Nichols, J. D.; Conroy, M. J. 2001: Analysis and Management of Animal Population-modelling, estimating and decision making. Acadmic Press. 817 p.
2. Bolton, M., 1997: Conservation and the use of wildlife resources; Chapman & Hall; London; 278 pp
3. Schwartz, M.W., 1997: Conservation in highly fragmented landscapes; Chapman & Hall; New York; 436 pp.
4. Garms, H., Borm,L., 1981: Fauna Europe; Mladinska knjiga, Ljubljana, 550 pp
5. Harrison, C.; Castrell, P., 2002: Collins Field Guide Bird nests, eggs and nestling of Britain and Europe. HarperColinsPublishers. London.

Statistical Methods and Modelling in Forestry

UD2004

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 15
Exercises 30
Field work 0

Lecturer
Prof. Anamarija Jazbec, PhD

Associate teacher for exercises
Assistant professor Mislav Vedriš, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Questionnaire. Sampling methods. Choosing the sample size. Analysis of contingency tables. ANOVA (analysis of variance): requirements and assumptions. Multiple comparisons. Correlation analysis. Linear regression: Least squares method, parameter estimation, determination coefficient. Univariate and multivariate models. Model building methods (*Forward, stepwise, backward*). Testing model goodness of fit. Modelling interactions. Choice of optimum model. Nonlinear models. Growth models.

Type of course:
Statistical Methods and Modelling in Forestry (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
1. Design survey questionnaire and determine the sample size (composing the questionnaire, creating and organizing database, sampling methods, determination of sample size for desired precision of estimate – mean and proportion, determination of sample size for binomial distribution) 2. Explain comparison of two frequency distributions (chi-square test) 3. Present correlation analysis (define correlation in population and estimate correlation coefficient; testing statistical significance of correlation coefficient based on random sample) 4. Formulate analysis of variance: comparing more than two population means; parametric (ANOVA) and non-parametric test (Kruskal-Wallis), defining multiple comparison (post-hoc) test of difference between populations; graphical presentation using statistical software 5. Present regression analysis: define and classify types of regression, model building methods, indicators and tests for model goodness of fit, testing statistical significance of estimated parameters, graphical presentation using statistical software	Computer exercises, partial exams, written and oral final exam	A1, B13, D1

General competences

Collect and statistically analyse, present and interpret analysed data. Discuss and make conclusions based on analysed data. Compare and interpret results obtained by different methods.

Type of instruction

Lectures

Exercises

Exercises complement subject exposed in lectures. Students compose their own survey questionnaire, collect data and form a database. Each student gets individual assignments (with data from questionnaire database) for work during the exercise hours that are reviewed by associate teacher. Exercises are carried out using hand calculator, Excel and STATISTICA software.

Working methods:

Teachers' obligations:

Direct teaching – lectures and exercises. Designing and reviewing the student assignments. Formulating seminar themes, composing and evaluating written exams. Carrying out oral exams and consultations. Designing and composing teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, working individual assignments, seminar theses. Taking partial and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	15	1
Exercises (E)	-	-	-	30	30	2
Partial exam (PE)	100%	65-74	Sufficient (2)	4	26	1
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
Final exam (FE)	100%	60-70	Sufficient (2)	3	-	-
		71-80	Good (3)			
		81-90	Very good (4)			
		91-100	Excellent (5)			
UKUPNO	**100%**			52	71	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance is checked for all students during the semester. Each student is allowed to be absent up to 4 hours of lectures and 4 hours of exercises.		-
Partial exam	Two partial exams are carried out, each with 5 assignments and resulting maximum 100 (2*50) points. Minimum 65 points (20 points per exam) can substitute the final exam.	During semester	-
Written exam	Students that meet attendance and exercise assignment criteria can access the written exam. Written part consists of 5 assignments making maximum total 100 points.	Exam terms	-
Oral exam	Students that pass written part can access the oral exam.	Exam terms	-

Obligatory literature

1. Statistical Methods and Modelling in Forestry: course on e-learning system Merlin: https://moodle.srce.hr/2018-2019/course/view.php?id=36298

Recommended literature

1. Sokal, RR., Rohlf, FJ., 1995: Biometry. Freeman and Company. New York. 880 pp.
2. Jazbec A., 2009: Osnove statistike, Šumarski fakultet, Zagreb
3. Pranjić, A., 1986: Šumarska biometrika,. Šumarski fakultet, Zagreb, 204 str.
4. Bahovec V, Erjavec N ur. 2015: Statistika, Element, Zagreb
5. Jongman, R.H.G., Braak, C.J.F., van Tongeren, 2002: Data Analysis in Community and Landscape Ecology, Cambridge University Press

Knowledge of vegetation

UD2005

ECTS 4

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof. Joso Vukelić, Ph.D.
Prof. Dario Baričević, Ph.D.

Associate teacher for exercises
Irena Šapić, Ph.D.
Prof. Joso Vukelić, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
The Mediterranean forest vegetation region, from steno-Mediterranean to epi-Mediterranean will be handled in detail. Following this, the Euro Siberian-North American forest region will be address, the European sub-region through five vegetation belts and fifteen vegetation zones. Other natural ecosystems to be addressed are the vegetation of saline zones and reefs, aquatic habitats, springs and peat, silty coasts, mountain slopes, rocky habitats, cliffs and crevices, landslide areas and climatogenic grasslands. Anthropogenic ecosystems to be addressed include anthropogenic grasslands (wetlands, lowlands, highlands), agro-ecosystems, weed vegetation and ruderal vegetation. Noted in the description of the community will be the distribution, basic synecological factors affecting its arrival, development and distribution and the organization of the association of the most significant species, regardless of whether they are characteristic, distinctive, edificator or dominant.
The course is based on the classical assumptions of the Braun-Blanquet approach, as well as using the most up-to-date information and technological aids. The course also relies on the principle of naturalness, permanence and bio-diversity. It is made up of lectures and laboratory exercises, with the use of modern teaching aids and a field component in real natural and close-to-natural ecosystems. The participation of guest speakers is also planned in the segment of non-forest vegetation.

Type of course:
Knowledge of vegetation (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret the forest vegetation of Croatia from the ecological, flora-genetic, syntaxonomic and biogeographic point of view (historical development of flora and vegetation, vegetation type overview, horizontal and vertical distribution, ...)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Present occasionally floody and humid forest communities (floodplain forests and bushy communities, forests of willows and poplars, forests of black alder, forests of pedunculate oak and narrow-leaved ash, moist lowland communities, ...)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Compare the acidophilic, neutrophilic and basophilic forest communities of the coline-submontane belt, the montane belt and the Pannonian-montane belt (species of Illyrian floral geoelement in oak-hornbeam forests, acidophilic, neutrophilic and basofilous species in the communities of the hilly belt, species of fresh, mesophilic and dry communities, ...)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Differentiate the thermophilic forests and coppice of pubescent oak, hungarian oak and turkey oak (areal and ecological conditions, main vegetative macrotype, syntaxonomic classification, community status towards National classification of habitats and Natura 2000 network)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Differentiate dry, basophilic pine forests on dolomites (historical and ecological factors for the development of the forest of the class *Erico-Pinetea*, main vegetation macrotypes, syntaxonomic classification, forest communities of black pine, forest communities of hop hornbeam.)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Analyse the boreal coniferous forest (forest associations of silver fir, Norway spruce, mugho pine, threatened forest communities, mires.)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5
Present forest vegetation of the coastal zone of the Mediterranean region (forests of holm oak, Aleppo pine, degradation stages, other communities of evergreen vegetation, flora of Mediterranean forests in urban areas.)	Preliminary exam, final exam	A1, B10, B13, D2, D4, D5

General competences
The objective of the course is to introduce the student to the vegetation of the Republic of Croatia, i.e. the basic patterns of vegetation distribution in Croatia. The majority of the course is focused on acquainting the student with forest vegetation which is present over the largest surface area, however, the vegetation of grasslands, rocky habitats, mountain slopes, peatbeds, river banks and the sea coast and vegetation under anthropogenic influences, which in recent times comprises an increasingly significant place in the overall vegetation. Furthermore, a syntaxonomical overview will be given of the most significant forms of vegetation in Croatia, with a concrete description of the main associations. With this knowledge, students will receive the necessary knowledge for the drafting of all relevant ecological studies and other foundations for the management of natural and close-to-natural ecosystems.

Type of instruction

Lectures
According to the curriculum lectures include 15 terms by two school hours.

Exercises
15 exercises are performed in the form of field, computer and auditorial exercises. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Field work is planned for 2 days, according to the curriculum.

Working methods:

Teachers' obligations:
Performing of the original teaching: lectures, exercises and field teaching. Consultation, partial exams and final exams. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-		30	0	1
Creating exercises and field work reports (E)	20%	Partly untidy and incomprehensible, with major corrections and on time	Sufficient (2)	31	10	1,34
		Neat, legibly, with bigger corrections and on time	Good (3)			
		Neat, legibly, with small corrections and on time	Very good (4)			
		Neat, legibly, correct and on time	Excellent (5)			
Partial exam (Pe)	80%	60-70%	Sufficient (2)	0	50	1,66
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + Pex80)/100**		61	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)		60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	0	50	1,66
TOTAL	**100%**	**(FEx80+Ex20)/100**				

* Students who do not pass during the semester by a written partial exam, approach to final exam which accounts for 80% of the final grade, and the remaining 20% is grade from exercises

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises + reports	The presence of students is being checked and noted. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lectures)	-
1. Partial exam	1st partial exam is available to students who have participated lectures, exercises and field work of the first half of the semester. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject, whereupon 60% of the points are to be collected for passing.	8. week	-
2. Partial exam	2nd partial exam is available to students who have participated lectures, exercises and field work and passed the first partial exam. The students in the pre-printed exam answer the questions asked. The partial exam is evaluated and participates in the final evaluation of the subject. The two partial exams are scored with a total of 80 points, each with 40 points. The total is required to collect 60% of points on both the partial exam for passing.	15. week	
3. Partial exam	The third partial exam can be accessed by students who have completed lectures, exercises and field teaching. Students on pre-prepared herbal materials must identify plant species and associate them with the type of habitat and the communities they are associated with. The partial exam is evaluated with a rating passed or repeated. Passage is a condition for entering a final grade.		
Written exam	The exam can attend students with realized exercises and field work. The students in the pre-printed exam answer the questions asked. The written exam is evaluated and participates in the final assessment of the subject, whereby it is necessary to collect 60% points for passing	Exam terms	-
Oral exam	Students who pass a written exam are being asked questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Rauš, Đ. i sur., 1992: Biljni svijet hrvatskih šuma. Šume u Hrvatskoj, Šumarski fakultet Sveučilišta u Zagrebu i J.P. Hrvatske šume, str. 33–78.
2. Vukelić, J., Rauš, Đ., 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Šumarski fakultet Sveučilišta u Zagrebu, 310 str.
3. Skender, A., 1990: Fitocenologija u spontanim i antropogenim ekosistemima. Sveučilište u Osijeku, Poljoprivredni fakultet, 239 str.
4. Šoštarić-Pisačić, K., 1963: Travnjačka flora. Nakladni zavod Znanje.
5. Topić, J. & J. Vukelić, 2009: Priručnik za određivanje kopnenih staništa u Hrvatskoj prema Direktivi o staništima EU. Državni zavod za zaštitu prirode, 376 str.

Recommended literature

1. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str.
2. Horvat, I., Glavač, V., H. Ellenberg, 1974: Vegetation Südosteuropas. Gustav Fischer Verlag, Stuttgart, 768 str.
3. Horvat, I., 1949: Nauka o biljnim zajednicama. Nakladni zavod Hrvatske, 434 str.
4. Kovačević, J., 1979: Poljoprivredna fitocenologija. Nakladni zavod Znanje, 269 str.

Forest mycorrhizae

UD2006

ECTS 2

English R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Danko Diminić

Grading system
Insufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Course content is to get students acquainted with forest mycorrhizae. Generally, about mycorrhiza, what is it, explanation of specific symbiotic association between fungi and plant roots, what are biological principles behind it.
Classification of mycorrhizal fungi on trees and shrubs in kingdom Fungi. Types of mycorrhiza, taxonomy of ecto and endomycorrhiza. Students get to know which the most common ectomycorrhizal fungi of tree species in forest ecosystems and urban areas are, their biology, ecological features and importance for tree species. Possibility of application of ectomycorrhizal fungi by inoculating them in forest tree seedlings in urban forestry, nursery production and plant protection as possible preventive biological protective measure.

Course category:
Forest mycorrhizae (elective course, 2nd semester, 1st year)

Learning outcomes and assessment

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Show historical overview of mycorrhiza research.	Describe and explain, list and explain types of mycorrhizae. List most important genera and species of mycorrhizal fungi.	B9
Explain role of mycorrhiza in mineralization and nutrition uptake. List and describe basic mineralization mechanisms and list impacts of mycorrhiza on mineralization, nutrition uptake and growth of plants.	Explain impact of mycorrhiza on processes of biological wear-out. Describe and explain impact of mycorrhiza on water uptake.	B9
Describe and explain plant protection mechanisms and explain role of ectomycorrhizal fungi in plant protection..	Present possibilities of choosing ectomycorrhizal fungi in plant protection. Recommend use of ectomycorrhizal fungi in plant protection from diseases, with or without other protectants.	B9
Show and explain importance and possibilities of use of mycorrhizal fungi as one of indicators of tree health status. Connect health status of forest ecosystem with mycobiota (with its limits). Predict trend and connect status of forest stand health based on mycobiota present – no indices of change, improvement or deterioration of health status, use mycobiota present as a tool for health status prediction.	Connect knowledge of mycobiota with other methods of forest ecosystem health status assessment and standard methods in phytopathology.	B9

General competences

Students gain basic knowledge about specific fungal group – mycorrhizal fungi, their presence in forest ecosystems, importance for individual plant hosts and ecosystem as a whole. They gain knowledge about main mycorrhizal species in Croatian forest ecosystems, methods for their identification and valorisation.

Type of instruction

Lectures

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures. Taking oral exams and giving seminars.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	0,5
Seminar (S)	35%	-	-	0	7,5	0,25
Exam (PUI)	65%	60-70%	sufficient (2)	0	7,5	0,25
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Sx35 + PUIx65)/100**		15	15	1

Detailed explanation of rules for preparing and taking midterm exams, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (15 direct teaching hours)	-
Seminar	Seminar presentation is graded and taken into account for the final grade of this course.	after 3rd week	-
Oral exam	Students who present the seminar are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **Sx35+PUIx65/100**		

Obligatory literature

1. Smith, S.E. i Read, D.J., 1997: Mycorrhizal Symbiosis. Academic Press, San Diego, 605 str.
2. Glavaš, M., 1996: Osnove šumarske fitopatologije. Sveučilište u Zagrebu, Šumarski fakultet, 140 str.
3. Glavaš, M., 1999: Gljivične bolesti šumskoga drveća. Sveučilište u Zagrebu, Šumarski fakultet, 281 str.

Recommended literature

1. Carlile,M.J, Watkinson, S.C., Gooday, G.W., 2001: The fungi. Academic Press, San Diego, London, 588str.
2. Pfleger, F.L. i Linderman, R.G. (eds.), 1994: Mycorrhizae and Planth Health. APS Press, St. Paul, 344 str.
3. Butin, H., 1995: Tree Diseases and Disorders. Oxford University Press, Oxford, 252 str.

Medicinal plants

UD2007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. dr. sc. Marijana Zovko Končić

Grading
Sufficient (2) 55%
Good (3) 66%
Very good (4) 76%
Excellent (5) 86%

Course content:
Introduction to medicinal plants. Herbal preparations. Vitamins and minerals in medicinal plants. Medicinal plants with phenolic glycosides. Medicinal plants with coumarins. Medicinal plants with flavonoids. Medicinal plants with tannins. Medicinal plants with antracene derivatives. Medicinal plants with saponins. Medicinal plants with cardiotonic glycosides. Medicinal plants with alkaloids. Medicinal plants with iridoids. Medicinal plants with polysaccharides. Medicinal plants with essential oils.

Type of course:
Medicinal plants (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Assess the use of herbs in treatment in the past and today	Partial exams during the semester, oral exam	B1
Present herbal preparations	Partial exams during the semester, oral exam	B2
Analyse plant species with high content of primary or secondary metabolic metabolites having a pharmacological effect	Partial exams during the semester, seminar work, oral exam	B3

General competences
General knowledge of basic groups of medicinal plant metabolites and their pharmacological effects. Recognizing of medicinal plants, especially members of Croatian flora and their use for healing purposes.

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Giving lectures. Assembling the knowledge tests and their evaluation. Providing colloquia, oral exams and consultations. Production of teaching materials.

Students' obligations:
Regular attendance and active participation in lectures. Preparation of seminar work. Participating in partial tests

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Seminar work (SW)	20%	The student handed over the seminar work in the given deadline	Sufficient (2)		15	0,5
		In addition to the above mentioned, the student adheres to the given guidelines, the work is understandably and satisfactory written	Good (3)			
		In addition to the above mentioned, content reflects the student's efforts and interest for the given topic	Very good (4)			
		In addition to the above mentioned, the seminar has been written in a way that it reflects a deep understanding of the matter	Excellent (5)			
Partial exam (PE)	80%	55-65%	Sufficient (2)		30	1
		66-75%	Good (3)			
		76-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**				

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	55-65% 66-75% 76-85% 86-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			
TOTAL	**100%**	**(SWx20+FExx80)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and recorded. A student may justifiably be absent from a maximum of 15% of direct teaching hours.	semester (15 hours of direct teaching)	-
Seminar work	A student hands over seminar in a given form.	Before the end direct teaching	
Partial exam	Students fill in the pre-printed exams by answering questions asked, entering the required information, or complete the correct answers. Partial exams are evaluated and participate in the final grade of the subject according to the formula **(SWx20 + PEx80)/100**	During the semestar	
Final exam	The students who submitted their essays can attend the exam. The students answer the questions asked. The exam is evaluated and participates in the final grade of the subject according to the formula **(SWx20 + FEx80)/100**	Examination periods	

Obligatory literature

1. Link on the presentations with lectures can be found at the website https://moodle.srce.hr/2018-2019/course/view.php?id=42336
2. 1. Schaffner, W., 1999: Ljekovito bilje - kompendij. Leo – comerce, Rijeka.
3. Kuštrak, D. 2005: Farmakognozija fitofarmacija. Golden marketing - Tehnička knjiga, Zagreb.

Recommended literature

1. Gelenčir, J., 1991: Atlas ljekovitoga bilja. Prosvjeta, Zagreb.

Waste management

UD2008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Associate Professor Damir Barčić

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Waste management according to the principles of sustainability, recovery and recycling of waste, methods and methods of waste collection and sorting. Treatment of industrial and municipal waste as raw materials. Waste management on the principles of avoidance, valuation and removal. Organizational measures and environmental justification for the use of waste management systems. Direct and indirect benefits through the use of new technologies in waste processing and recycling. Waste Disposal in the World and Croatia. Differences, adaptation of existing systems and capabilities in our conditions. Treatment with different types of waste. Waste Management Strategy in Croatia, implementation and achievement of objectives in accordance with EU legislation.

Type of course:
Waste management (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
After learning the student will be able to make the valorisation of the waste according to its place of origin and its properties. Students will be able to rank recuperation and recycling methods from the point of view of environmental protection and conservation. Students will be able to propose measures and models for reducing waste.	Partial exam, seminars, Final exam	B2
After learning, the student will be able to judge and analyse the technologies in waste utilization. The student will be able to present organizational measures for the implementation of the waste management system. Students will be able to critically evaluate waste treatment models and assess their impact on the environment.	Partial exam, seminars, Final exam	B2
After learning, the student will be able to classify and evaluate arranged and unmanaged waste landfills. Students will be able to present methods of remediation and reclamation of waste disposal sites. Students will be able to manage and organize waste disposal. The student will be able to valorise the costs of waste disposal.	Partial exam, seminars, Final exam	B2

General competences

Define and classify waste landfills.
Interpret and analyse the ways of mechanical biological waste treatment.
Define and present the structure of waste for the purpose of developing waste management plans.
Show organizational measures of waste management system.
Application and development of waste management costs.

Type of instruction

Lectures

Working methods:

Teachers obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, written exams, oral exams and consultations. Creating teaching materials.

Studenats obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				11	0	
Seminar (S)	10%	50-70%	Sufficient (2)	2	5	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	45%	50-70%	Sufficient (2)	1	10	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	45%	50-70%	Sufficient (2)	1	10	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + P1x40 + P2x40)/100**		15	25	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	50-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**(Fex80+Sx20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and making seminar work (S)	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyses and interpretations of the teaching units in the exercises.	semester (15 hours of direct lecturer)	
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Sx20)/100**		

Obligatory literature

1. Barčić, D., 2017: Gospodarenje otpadom. Skripta za internu upotrebu, Zavod za ekologiju i uzgajanje šuma, Šumarski fakultet Sveučilište u Zagrebu, Zagreb.

Recommended literature

2. GLAVAČ, V. 1999: *Uvod u globalnu ekologiju*, Državna uprava za zaštitu prirode i
3. okoliša i Hrvatske šume d.o.o. Zagreb.
4. CARTER, N. 2004: *Strategije zaštite okoliša,* Barbat, Zagreb.
5. Španjol, Ž., Deželjin, D., & Barčić, D. 2000: «Utjecaj odlagališta otpada Sorinj na stanje okoliša otoka Raba». Zbornik radova VI međunarodnog simpozija «Gospodarenje otpadom Zagreb 2000.»: 475-486, Zagreb.
6. Barčić, D., Deželjin, D., Španjol, Ž. & Rosavec, R. 2006: «Osnovne značajke gospodarenja otpadom na otoku Rabu». Zbornik radova 1. međunarodnog savjetovanja «Gospodarenje otpadom na otocima». 1-13, Zadar.
7. Barčić, D., Ivančić, V. 2010: «Utjecaj odlagališta otpada Prudinec/Jakuševec na onečišćenje okoliša». Šumarski list br. 7-8, 347-359, Zagreb.
8. Barčić, D., Dubravac, T., Španjol, Ž. 2010: «Upravljanje komunalnim otpadom na jadranskim otocima». Zbornik radova, međunarodna konferencija «Upravljanje opasnim i neopasnim otpadom u regiji» održano 11.-13.2.2010. u Zenici. Sarajevo, 325-329.
9. POTOČNIK, V., LAY, V. 2002: *Obnovljivi izvori energije i zaštita okoliša u Hrvatskoj.* Ministarstvo zaštite okoliša i prostornog uređenja RH i «Barbat». Zagreb.
10. *Ekološki leksikon,* 2001: Barbat i Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, Zagreb.

Zoonoses in forest ecosystems

UD2009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Josip Margaletić, PhD
Asst. prof. Marko Vucelja, PhD

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:
Students are introduced to the following content: definition of zoonoses, pathogenesis, infection potential, transmission, risk groups, and consequences of zoonoses. Epidemic and pandemic. Historical overview of the occurrence of certain zoonoses. Horizontal and vertical distribution of zoonoses and their association with forest communities. Different zoonoses that are common in the forests of Croatia (leptospirosis, lyme borelosis, hemorrhagic fever, rabies, tick borne meningoencephalitis). Understanding zoonotic agents (bacteria from the genus of leptospira and borrelia, hantaviruses, rabies virus, West Nile virus). Transmission of zoonotic agents. Symptoms of selected zoonoses. Animal groups that are a reservoirs or zoonotic vectors, (small rodents, ticks, roe deer, wild boar, birds, foxes, dogs, cats, domestic animals). Interactions between humans and animals as possible zoonotic reservoirs. Importance of understanding zoonoses. Understanding zoonotic agents (importance, risk, education, prevention, treatment, legal frameworks).

Type of course:
Zoonoses in forest ecosystems (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
1. Comprehend the definition of zoonoses, reservoirs and disease vectors, list the causes of zoonoses and link them to specific zoonoses.	Colloquium exam and written and oral exam	A2, B9
2. Interpret and explain the way of spreading zoonoses, identify and describe the importance of protected forest ecosystems (National Parks, Nature Parks) as natural habitats of zoonotic agents, considering the risk factors for forest workers	Colloquium exam and written and oral exam	A2, B14, C1
3. Comment on the horizontal and vertical distribution of the Dobrava and Puumala viruses in the protected forests of Croatia, name their reservoirs and spatial distribution according to the latest scientific knowledge.	Colloquium exam and written and oral exam	A2, B14
4. Identify the occurrence of leptospirosis, Lyme borreliosis, tularemia, salmonellosis, lymphocytic choriomeningitis, West Nile fever in protected forests of Croatia, with particular reference to the flood forest of Lonjsko polje and forests of the Plitvice Lakes and Risnjak National Parks, Medvednica, Papuk and Žumberak-Samobor.	Colloquium exam and written and oral exam	A2, B14, C2
5. Comment on the horizontal and vertical distribution of certain serological variants of Leptospira (floodplain forests of Lonjsko polje Nature Park, forests of the Plitvice Lakes and Risnjak National Parks, Medvednica, Papuk and Žumberak-Samobor.	Colloquium exam and written and oral exam	B14, C2

General competences

The course is designed on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the main components of the complex forest ecosystem. The course is accompanied by modern teaching resources (multimedia, video, slides) and organized laboratory and field exercises.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Holding lessons - lectures. Holding written and oral exams and consultations. Composition and preparation of teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures. Writing seminar. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	-	0,5
Seminar	-	-	-	-	2,5	0,08
Colloquium exam 1	25%	60-74%	Sufficient (2)	-	5,5	0,17
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Colloquium exam 2	25%	60-74%	Sufficient (2)	-	7,5	0,25
		75-84%	Good (3)			
		85-94%	Very good (4)			
		95-100%	Excellent (5)			
Exam	50%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**			15	45	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-74% 75-84% 85-94% 95-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Writing seminar	Students write and present their seminar work related to relevant forest protection topics	semester	-
Colloquium exam 1 Colloquium exam 2	Colloquium exam is evaluated and participate in the final assessment of the subject	8th week 15th week	Students passing a colloquium can take the exam
Written exam	Written exam must be positively graded (2-5) so the student may participate in oral exam.	Exam terms	-
Oral exam	Students, which passed written exam, participate in oral exam and get their final grade.	Exam terms	-

Obligatory literature

1. Shakespeare, M., 2002: Zoonoses. Pharmaceutical Press, 285 str.
2. Casil, M., 2005: Hantavirus. The Rosen Publishing Group, 64 str.

Recommended literature

1. Articles in scientific journals

Forest typology

ŠDU2007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Joso Vukelić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Definition and objectives of forest typology. Phytocenology in forest typology. Historical development. Typological schools in Europe (Russian, Ukrainian, Czech, German, Finnish, Swedish). Croatian forest typology. Basic components of typological research. Ecological-biological components. Geological-lithological material. Phytocenological component. Pedological component. Microclimatic component. Forest management component. Silvicultural component. Tending component. Economic component. Systematic units in forest typology (region, zone, type, subtype). Marking systematic units. Types of forests in the Mediterranean region. Forest types in the continental region (Dinaric, Pannonian). Examples of typological processing of forest ecosystems. Application of typology in forestry.
This course is based on the basics of the Croatian typological school of thought and uses the most up-to-date information and technological aids. The course also relies on the principles of naturalness, sustainable forest management and bio-diversity. The course is comprised of lectures using modern teaching aids.

Type of course:
Forest typology (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse the forest typology and the role of phytocenology (reasons for the establishment of the forest typology, the role of phytocenology in typology, the possibility of ecological characterization of habitats by floral composition, indicator species and scale).	Seminar, Final exam	A3, B3, B9, D4, D5
Interpret typological courses and schools (Scandinavian School, Russian School, Ukrainian School, courses in Central Europe).	Seminar, Final exam	A3, D4, D5
Present the Croatian forest typology (bases of definition of types, ecological-economic type, component of definition of area, zones and types, labelling of typological categories, typological research and mapping of forests of the Republic of Croatia).	Seminar, Final exam	A1, A3, B3, B14, D1, D4, D5
Evaluate typological classification (Natura 2000, EUNIS, Physis, national classification of habitats, determining habitat types, the application in management and conservation of forest habitats and communities).	Seminar, Final exam	A1, A3, B9, D1, D2, D4, D5

General competences

The objective of the course is to introduce students to the basic concepts of forest typology, i.e. to teach students to independently define and categorize forests and forest habitats into clearly distinctive entities (types) according to existing or potential productive abilities, for the easier and more rational management of forest ecosystems. Using the most up-to-date information, methods and aids adapted for each individual forest, this will form the foundation for modern silviculture, management and exploitation of forests.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams. Creating teaching materials.

Studenats obligations:

Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper (SP)	In the first half of the semester, the student is given the topic of seminar paper, which the student prepares during the semester, and at the end of the semester submits the lecturer to the exam. If assessed positively, it is accepted as an elaborated seminar paper.	in accordance with the agreed terms	
Written exam (FE)	Examinations can be attended by students who have completed exercises and preparation and positive evaluation of the seminar paper. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject. The final grade is obtained according to the formula (FEx80 + SPx20)/100	Exam terms	

Obligatory literature

1. Bertović, S., V. Glavač, 1963: Tipologija šuma. Šumarska enciklopedija II, Zagreb.
2. Horvat, I. i sur., 1950: Priručnik za tipološko istraživanje i kartiranje vegetacije. Ministarstvo šumarstva FNRJ, 227 str.
3. Rauš, Đ., 1980: Šumarska fitocenologija (skripta) – drugo ispravljeno i dopunjeno izdanje. Šumarski fakultet Sveuč. u Zagrebu, Zagreb, 353 str.
4. Stefanović, V., 1963: Tipologija šuma. Univerzitet u Sarajevu, Sarajevo, 344 str.
5. Vukelić J. i sur. 2008: Šumska staništa i šumske zajednice u Hrvatskoj. Nacionalna ekološka mreža. DZZP, 263 str.

Recommended literature

1. Bertović, S., 1961: Istraživanje tipova šuma i šumskih staništa. Šum. list 85 (9-10): 374-389.
2. Cestar, D. i sur., 1966: Tipološko istraživanje i kartiranje šuma i šumskih staništa SR Hrvatske. Svezak I. Institut za šum. istraž. Šumarskog fakulteta Sveuč. u Zagrebu, 58 str.
3. Cestar i sur., 1986: Bukva i bukove šume Hrvatske. Radovi 69. Šumarski institut Jastrebarsko, 45 str.
4. Pogrebnjak, P.S., 1955: Osnovi lesnicke tipologii – 2. izd.. Kiev.
5. Zlatnik, A., 1976: Lesnicka fytocenologie. Statni zemedelske nakladatelstvi, Praha, 495 str.

Wildlife feeding

ŠDU2008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof.dr.sc. Krešimir Krapinec
Prof. dr. sc. Marijan Grubešić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Contemporary hunting ground management includes a whole series of activities for habitat preservation (various international conventions), so as to ensure protection of species, habitat, but also a relevant trophy and physical structure in the population of single animal species. Therefore, this course of lectures intends to direct the students towards such manners of habitat management, aiming at upgrading of nutritional and legal factors, which will ensure a lasting fauna management.

Type of course:
Wildlife feeding (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Managing and autonomous making decision in wildlife/game management	Oral exam	B8

General competences
Development of inductive and deductive abilities required for better knowledge of habitat potentials. Up-to-dateness in the work, systematism and effectiveness in data compilation on botanical or animal composition of nourishment and calculation of various measures applied for the improvement of habitat circumstances. Identifying of similarities and differences in determining of vegetable species, used for the upgrading of habitat capacities

Type of instruction

Lectures

Working methods:

Teachers' obligations:
Direct lessons. Keeping writing and oral exam, consultations, teaching material making.

Student's' obligations:
Regularity at teaching and active participation teaching. Passing the exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The student attendance is checked and recorded. Student absence of max 15% of lectures is allowed.	semester (15 hours of direct lecturer)	-
Partial exam	-	-	
Written exam	Exceptionally (f.e. for students with speech disorder)	Exam terms	
Oral exam	Asks from different parts of course content	Exam terms	

Obligatory literature

1. Weiß, G. B., 1997: Anlage und Pflege von Wildäsungsflächen. Nimrod – Verlag, Suderburg., 320 p.
2. Černe, L.,1990: Ureditev lovišč za malo divjad; Lovska zveza Slovenije; Ljubljana; 70 pp.
3. Šoštarić-Pisačić, K., Kovačević, J., 1968: Travnjačka flora i njena poljoprivredna vrijednost; Nakladni zavod Znanje, Zagreb; 443 pp.
4. Mustapić, Z., i sur., 2004: Lovstvo. Hrvatski lovački savez, Zagreb, 597 p.

Recommended literature

1. Randal, D., Burggren, W., French, K., 1998: Eckert animal physiology: mechanisms and adaptations; W.H. Freeman and Company; New York; 824 pp.
2. Schwartz, M.W., 1997: Conservation in higly fragmentet landscapes; Chapman & Hall; New York; 436 pp.
3. Bookhout, T.A.,1996: Research and management techniques for wildlife and habitats; The Wildlife Society Bethesda; Maryland; 740 pp.
4. ***, 1986: Lehrbuch Jägerprüfung, Bänden 1-5, Paul Parey, Berlin und Hamburg, 1017 pp.

Biotechnology of forest trees

ŠDU2016

ECTS 2

English language R1

E-learning R2

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Professor Davorin Kajba, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:
The students become acquainted with the following contents: a) plant cell and tissue culture techniques (*in vitro*), cell culture suspensions, protoplast cultures, vegetative propagation in vitro, commercial replication, meristem culture, embryo and megagametophyte cultures, somatic embryogenesis, conservation of the plant gene pool *in vitro* and with somaclonal variability; estimates of somaclonal variability (phenotypic, biochemical, cytological, molecular); b) application of biochemical and molecular genetic research in forest trees, biochemical and DNA markers, structure and genetic variability in forest trees, genetic mapping, genetic engineering and application of transgenic plants in forestry and urban forestry, properties subject to genetic engineering (pest resistance and pathogenic organisms, resistance to extreme ecological factors, reproductive ability, lignin fraction modification, biotechnology and biosecurity); c) storage of seeds, pollen and herb tissue, in vitro storage, medium storage (3 to 4 years) and for a longer period of time (cryopreservation), cryopreservation process (ultrasound temperature - 80º to -196ºC), dehydration and cell cultivation, acquaintance with plant growth substances (auxins, gibberellins, cytokinin, ethylene, abscisic acid, etc.), seed bank and seed bank, and legislation related to forest reproductive material.

Type of course:
Biotechnology of forest trees (elected course, 2th semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Suggest a technique of plant cell and tissue culture (in vitro) for each species of forest tree. Review the commercial use of in vitro propagation techniques. Organize conservation of plant gen pool in vitro (pollen preservation, preservation of DNA). Evaluate the possibility of somaclonal variability (phenotypic, biochemical, cytological, molecular).	Seminar, final exam	B3, B6, B14, D1, D4
Suggest a cryopreservation process. Classify the plant growth factor. Recommend storage of seeds, pollen and herbal tissue for conifers and broadleaved trees. Organize seed plant and seed bank. Choose an option to find markers that indicate genetic variants. Formulate the study of the function and interaction of all genes in the genome.	Seminar, final exam	B3, B14, D1, D4
Review the link between molecular markers and genetic variants. Present the method of transferring DNA to the plant cell (Agrobacterium tumefaciens, biolistics - genetic pistol). Review the possibilities of lignin modification and cellulose biosynthesis. Review the possibility of resistance to herbicides and insects.	Seminar, final exam	B3, B14, D1, D4

General competences

Students acquire knowledge of plant and tissue culture techniques (in vitro), application of biochemical and molecular genetic research in forest trees, storage of seeds, pollen and plant tissue in the short and long term, roles of plant material collections, seed banks and banks and their role in breeding and preserving the genetic diversity of forest trees. Knowledge is gained from seed preservation, pollen and plant tissue, their endurance, reproduction and regeneration, estimation of genetic structure and genetic erosion, all in order to better understand the importance of preserving and breeding plant material in forest trees through biotechnology techniques, in accordance with regulatory legislation and biosafety.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	20%	Satisfies with major corrections or upgrades.	Sufficient (2)	0	15	0,5
		Satisfies with significant corrections and upgrades.	Good (3)			
		Satisfies with minor corrections and upgrades.	Very good (4)			
		Satisfies completely.	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx80 + SPx20)/100**		15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours. Student activity is recorded.	semester (15 hours of direct lecturer)	-
Written exam	The written exam consists of six assignments. For the passage it is necessary to have 28 points out of a total of 47 points (60%).	Exam terms	
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the university textbook) is checked.		

Obligatory literature

1. Kajba, D., Ballian, D.: ŠUMARSKA GENETIKA, Zagreb-Sarajevo 2007, 283 str.
2. Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, str. 1-398.
3. Marić, V. i sur., 1991: BIOKEMIJSKO INŽENJERSTVO, Interna skripta, PBF, Zagreb.
4. Bajrović, K. i sur., 2005: UVOD U GENETIČKO INŽENJERSTVO I BIOTEHNOLOGIJU, Institut za genetičko inženjerstvo i tehnologiju, Sarajevo, 320 str.
5. Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.

Recommended literature

1. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, str. 277.
2. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, str. 240.
3. FAO, 1993, EX SITU STORAGE OF SEEDS POLLEN AND IN VITRO CULTURES OF PERENNIAL WOODY PLANT SPECIES. Forestry Paper 113, FAO, Rome.
4. Turner, P.C., McLennan, A.G., Bates., A.D., White, M.R.H., 1997: MOLECULAR BIOLOGY, Bios Scientific Publishers, Oxford.
5. Nicholl, D.S.T., 2002: AN INTRODUCTION TO GENETIC ENGINEERING, Cambridge University Press, Cambridge.
6. Rosillo-Calle, F.: THE BIOMASS ASSESSMENT HANDBOOK.BIOENERGY FOR SUSTAINABLE ENVIRONMENT.,Earthscan, London, 2007, 269 str.
7. EUFORGEN publikacije (www.euforgen.org).

Recovery of degraded terrains

UD3001

ECTS 5

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Prof. dr. sc. Nikola Pernar
Prof. dr. sc. Igor Anić
Prof. dr. sc. Goran Durn

Associate teacher for exercises
Doc. dr. sc. Ivan Perković
Prof. dr. sc. Goran Durn
Prof. dr. sc. Nikola Pernar
Prof. dr. sc. Igor Anić
Prof. dr. sc. Darko Bakšić
Doc. dr. sc. Stjepan Mikac

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:
Program is realized through lectures, practical part and field courses and includes following basic units: Concept of degraded terrain – factors, processes and indicators of degradation, Recovery of terrain – starting point, opportunities, obligations, Recovery of eroded terrains, Recovery of depots, Recovery of surface mineral raw material pit, Recovery of area of construction projects, Recovery of contaminated soil and substrate.
The first part will get students more acquainted with the concept and definition of degraded area and with factors, processes and indicators of degradation, with special emphasis on soil.
Furthermore, starting points in the recovery of terrain connected to the character and proportion of deviations in relation to natural state and opportunities of recovery of such deviations are considered. After that, legal obligations for recovery of terrain or habitat niches (for example soil) should be analysed as well as directions that originate from conventions and international declarations relating primarily to soil recovery.
The third, basic part of the program, elaborates recovery processes and methods of degraded terrain. The greatest impact in degradation is most often manifested on soil characteristic. Therefore, the program in this part focuses primarily to rehabilitation of environmental function of the soil.

Type of course:
Recovery of degraded terrains (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the most important forms of terrain degradation Valorise the influence of soil degradation. Present the most important forms of terrains recovery.	full examination	A2
Principles for selection of plant species for biological recovery. Predict and evaluate the processes of biological remediation. Evaluate the effects of biological recovery.	full examination	B4
To predict the development of erosion processes. Recommend appropriate preventative anti-erosion measures. Establish measures for recovery of eroded terrain. Evaluate the effects of the recovery process.	full examination	B4, B7
Identify and classify soil damage. Select corresponding soil recovery method. Evaluate the effects of the recovery process.	full examination	B4, B7
Analyse of surface mineral raw material pit. Corresponding recovery methods. Develop and participate in the design of a recovery project. .	full examination	B4, B7
Determine a degradation processes as a result of petroleum mining. Preventive measures for progression of degradation. Optimal recovery method. Evaluate the effects of the recovery process.	full examination	B4, B7
The landfill classification. Optimal method for recovery a landfill The landfill monitoring measures.	full examination	B4, B7, C2
Assess the nature of forestry degradation Biological recovery of fire site. Create a forestry plan for the biological recovery of forest land. Evaluate the causes of individual or massive drying of trees in the stand. Appropriate technical and biological measures of remediation.	full examination	B4, B7

General competences

The curriculum from the course Recovery of Degraded Terrains aims to offer students the possibility of acquiring knowledge and skills in the recovery of area that suffered the reduction of functions or utilization opportunities caused by natural or anthropogenic factors. This acquires competences: Establishing and prevention of degradation processes, Recovery measures for degraded terrain, Recovery of waste landfill, Recovery of open mining pits, Recovery of contaminated soil, Recovery of eroded lands.

Type of instruction

Lectures

The lectures are realized in blocks-hours in one of the major classrooms. They are based on PP presentations and correspond to a material in the textbook.

Exercises

Exercises are the upgrading of knowledge adopted in lectures and there are platforms for understanding individual chapters, e especially from the aspect of soil recovery.

Field works

Field course is maintained at the open mining pit in the phase of exploitation of mineral raw materials, at recovered mining pit and on the landfill in the recovered phase.

Working methods:

Teachers' obligations:

Teaching - lectures, exercises, field courses. Designing topics for seminar task, compiling knowledge tests and evaluating them. Observations of written and oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation on lectures, exercises and field courses; preparation of exercises report and preparation and presentation of seminar work (possibly). Full examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)		-	-	30	15	1,5
Exercises (E)		-	-	15	15	1
Field courses (FC)		-	-	16	5	0,7
Exam (E)		50-60 %	Sufficient (2)	6	78	2,8
		61-75 %	Good (3)			
		76-90 %	Very good (4)			
		91-100%	Excellent (5)			
TOTAL				67	113	5

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	On the lectures is checked the students presence. The student can justifiably be absent with up to 30% of teaching hours (5 lectures).	Semester (30 hours of direct teaching)	-
Exercises (E)	Exercises are auditoria and are maintained in the laboratory and classroom.	According syllabus and agreement with the students	In the case of a justified reason, the student draws up absence from the particular exercise term
Field courses (FC)	Field course is performed as complex field course, and the terms are published at the beginning of the semester.	Second half of the semester.	-
Full exam (FE)	Students who have fulfilled their obligations in relation to lectures, exercises and field courses can access the regular exam. Examination of the entire program (realized through theoretical lectures, exercises and field courses) is examined on the exam. Students on exam (pre-printed questions) fit the questions asked in the form of rounding and written answers. A written exam is a condition for access to an oral exam, when gets a final grade.	Published test deadlines	-

Obligatory literature

1. Pernar, N., D. Bakšić, I. Perković, 2019: Sanacija degradiranog tla (predavanja, interni materijal) 120 p.
2. Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Šumarski fakultet, Zagreb, 192 p.

Recommended literature

1. Kisić, I., 2012: Sanacija onečišćenog tla. Agronomski fakultet Sveučilišta u Zagrebu. 271 p.
2. Osman, K. T., 2014: Soil Degradation, Conservation and Remediation. Springer, 237 p.

Spatial analysis and valorisation

UD3002

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15

Lecturer
Prof.dr.sc. Renata Pernar
Izv. prof. dr. sc. Ante Seletković

Associate teacher for exercises
Doc.dr.sc. Mario Ančić
Dr. sc. Jelena Kolić

Grading
Sufficient (2) 60%
Good (3) 75%
Very good (4) 85%
Excellent (5) 95%

Course content:
Course curriculum Spatial analysis and valorisation is realized through lectures and exercises. The lectures include the following thematic wholes: Introduction to spatial analyses; Sources, formats and possibilities for exchange of geodata with other systems; Use of different types of data for spatial analyses and space valorisation; Meaning of thematic data; Concepts for saving of thematic data; Establishment, use, maintenance and amendment of data bases; Connection between thematic and geometrical data; Manners for interpolation of thematic variables and their spatial division; Preparing of DEM and connecting of thematic data with DEM; Generation of new variables based on DEM; Space analysis (zoning, searching, thematic overlaps, extraction of contents, autocorrelation, connection of surfaces and contents); Quantification of spatial elements for the manners of land use, land cover and habitats; Generation of variables for implementation of fragmentary statistics (polygon surface and volume, lengths of lined objects, number of polygons on one surface unit, number of lined elements on a given area, integration and distance between polygons of the same type, analyses of neighbouring polygons, …).

Type of course:
Spatial analysis and valorisation (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Pronounce the definition of spatial analysis. Distinguish ordinary from spatial information. Describe and explain sources of spatial data. Recognize and apply types and forms of spatial data. Create spatial databases.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, D4
Describe and explain models of spatial data. Carry out the procedure georeferencing. Link thematic and geometric data. Explain and carry out interpolation of thematic variables.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B14, D4
Pronounce the definition of a digital relief model. Explain the ways of creating and editing of DEM data. Carry out a vectorization process of contour lines. Create DEM. Show and compare DEM visualization methods.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B14, D4
Generate new variables based on the DEM. Show the creation of different raster layers based on the DEM. Present and explain terrain categorization using DEM. Create a digital orthophoto (DOP). Interpret and explain the data obtained from DEM and DOP.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B13, B14, D4
Compare and describe the analysis of vector and raster data. Collect data and show data analysis (overlay analysis, operations on location/distance, network analysis, thematic mapping). Creating queries into built database.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B13, B14, D4
Explain fragmentary statistics. Calculate the area and perimeter of polygons, distance, correlation and distance of the same polygons. Analyse isolated polygons with aim of determining the homogeneity and / or heterogeneity of the studied area.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B13, B14, D4
Distinguish models for determining and quantifying spatial elements of land use, land cover and habitat. Classify results of image interpretations. Analyse the classification results and overlap them with other raster and vector content. Explain the significance of spatial analysis in the evaluation of urban and protected areas.	Performing exercises in a computer classroom, midterm exam, comprehensive exam	A1, B10, B13, B14, D4

General competences

Introduction to the types and models of spatial data, sources and methods of gathering data for spatial analysis and evaluation of space. Introduction to the basic methods and possibilities of application of spatial analysis and evaluation of the urban area and the protected area

Type of instruction

Lectures

Lectures are performed in form of the block classes with computer presentations. Within the course, along with regular attendance of lectures and exercises, students during the semester creates individual tasks.

Exercises
Exercises are the upgrading of knowledge adopted in lectures. Exercises are performed in a computer classroom, in groups according to a schedule that adjusts to the number of students.

Working methods:

Teachers' obligations:
Teaching - lectures and exercises. Preparing seminar topics (compensation for justified absences from lectures and exercises). Providing midterm exams, oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Within the course, with the regular attendance of lectures and exercises, students create individual assignments during the semester. Taking an exam is through the obligatory midterm exam and oral exam. Regular attendance and active participation on lectures and exercises, preparation of seminar work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-			15	7,5	0,75
Midterm exam (ME)	25%	60-70%	Sufficient (2)		22,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Comprehensive exam (CE)	75%	60-70%	Sufficient (2)	3	42	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(MEx25 + CEx75)/100**		48	72	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	On the teaching is checked and recorded the presence of students. The student can justifiably absent from the highest 20% of hours of direct teaching (3 lectures).	semester (30 hours of direct lecturer)	-
Exercises	Exercises are held in a computer classroom. Each student is doing individual tasks. The accuracy, precision, regularity, and engagement on the exercises are evaluated. 2 absences from exercises are allowed with the additional preparation of the seminar work.	In accordance with the syllabus and agreed terms directly with the students.	The student does the absence of a particular term exercise
Midterm exam	A compulsory midterm exam is laid within the course. The term is agreed with the students. The midterm exam can be accessed by students who have been reviewed and had correct individual task. A passed midterm exam is a condition for students to get a signature and to go to the oral exam. The midterm exam is repeated during the academic year, according to the published schedule of exams.	Eight days before each test deadline, according to the published schedule.	-
Regular examination deadlines	All students who have fulfilled their obligations in relation to lectures and exercises and passed the midterm exam are eligible to attend a regular exam period. On exam checks knowledge of the entire program (implemented through theoretical lectures and exercises). A passed midterm examination is a requirement for an oral exam, and grade of a midterm examination is part of the final grade.	Published examination deadlines.	-

Obligatory literature

1. Frančula, N. (2000): Digitalna kartografija, Zagreb, 187 str.
2. Pernar, R., 1996: Primjena rezultata interpretacije aerosnimaka i GIS-a za planiranje u šumarstvu, Zagreb, 156 str.
3. Kušan, V., 1994: Nove tehnike izmjere i kartografije, Zagreb.
4. Kereković, D. (1998) GIS u Hrvatskoj. INA-INFO, Zagreb, 450 str
5. Pernar, R.: Prezentacije s predavanja

Recommended literature

1. Göpfert, W., 1991: Raumbezogene Informationssysteme, Karlsruhe, 318 str.
2. Furlan-Zimmermann, N., Salaj, M., 1999: Krajolik: sadržajna i metodska podloga krajobrazne osnove Hrvatske, Ministarstvo prostornog uređenja, graditeljstva i stanovanja, 185 str.
3. Digital Photogrametric Systems, Karlsruhe, 1991, 344 str.

Eco-tourism

UD2003

ECTS 4

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 0
Field work 16

Lecturer
Assoc. prof. Stjepan Posavec, PhD

Associate teacher for exercises
Karlo Beljan, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Introduction – what is eco-tourism, history of term use, comparison with sustainable tourism. Definition of carrying capacity as a base to ensure sustainable development and position of eco-tourism in model of sustainable tourism development. Protected areas in the world and their role in eco-tourism development – types of protected areas, world distribution, and main areas per continents (UNESCO world heritage, main national parks, nature parks and other protected areas). The role of the landscapes typology in eco-tourism development – specificity of high mountains, polar, swamp, forest, tropic, desert and other landscapes. Different views on ecotourism in the world – cases from the high developed countries with protected heritage (Anglo-America, Austral-Asia, Scandinavia), cases from developed and densely populated countries with endangered or destroyed natural heritage (western Europe, South Europe), and cases from the countries in development (Central America, tropic Africa, Middle East, South and South-east Asia). Economic effects eco-tourism – on local community, broad area, and on other activities. Prospects of eco-tourism development.

Type of course:
Eco-tourism (compulsory, semester 3, year 2)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To present sustainable tourism development and basics of touristic policy (specific tourism forms, factors and sustainable development principles, environmental economics and environmental management, sustainable tourism, UNCED agenda 21)	seminar papers, final exam	A1
To analyse place and role of the tourism in national economy, correlation between tourism, traffic and inhabitants (tourism as a set of complementary products and services, direct and indirect economic effect, capital redistribution, the influence of inhabitants on environment and development of ecological conscious in tourism).	seminar papers, final exam	B3
To define characteristics of tourism resources and markets (specifics and elements of touristic market, development trends, main inbound and outbound markets, touristic resources classification).	seminar papers, final exam	B2
Valorise environmental goods in tourism, to analyse the role of forestry in tourism (economic evaluation of the space in tourism, evaluation goals and methods, use value, contingent value ecosystem services, environmental goods and services, wood and non-wood forest products, eco-agro tourism as a driver of sustainable tourism).	seminar papers, final exam	B13

General competences

Students should understand the term of eco-tourism, sustainable tourism development and carrying capacity as basis for understanding eco-tourism issues. simultaneously they should be aware about the main eco-tourism destinations in the world and understand the cause of differences in development of eco-tourism activities in different aspects like climate, green cover and culture with society development.

Type of instruction

Lectures
Field work

Working methods:

Teachers' obligations:

Teaching original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge exams and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Taking lessons and active participation in all segments (lessons, exercises). Individual preparation and exercise submission. Taking exam

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Regularly lessons attendance and activity	-	30	0	1
Field trip (F)	10%	Participation and regularly submission	-	16	0	1
Self-conducting seminar (presentation form) E_1	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	7,5	15	0,5
		Proper, readable, with major corrections and on time	Good (3)			
		Proper, readable, with minor corrections and on time	Very good (4)			
		Proper, readable, accurate and on time	Excellent (5)			
Self-conducting seminar (presentation form) E_2	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	7,5	15	0,5
		Proper, readable, with major corrections and on time	Good (3)			
		Proper, readable, with minor corrections and on time	Very good (4)			
		Proper, readable, accurate and on time	Excellent (5)			
Partial exam (PE)	50%	60-70%	Sufficient (2)		45	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E_1x15+E_2x15 + PEx70)/100**		61	45	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	60		4
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Checking the attendance of students on lectures. Student can miss the lectures justifies no more than 15%	semester (45 hours of direct lecturer)	-
Paper work	During the semester Students are performing two seminars. The first work is done in pairs (two students prepare the default topic) and presents it in the form of a PowerPoint presentation. The second work is also done in pairs and submitted in writing form (Word). Instructions for the seminar papers are provided by the lecturer, and are entirely available on the Faculty web site.	1st seminar until January 15th 2nd seminar until June 15th	
Written exam	no	-	
Oral exam	Students who submit the exercises and do both seminar works have the right to access the exam. Exercises are not evaluated and have no impact on the final assessment. Seminar papers are evaluated and have an impact on the final assessment.	Exam terms	

Obligatory literature

1. Müller H., 2004: Turizam i ekologija, povezanost i podru~ja djelovanja, Masmedia, Zagreb
2. Klarić Z., Gatti, P., 2005: Ekoturizam, prilog u knjizi Instituta za turizam iz Zagreba povodom 45. obljetnice postojanja (u tisku)
3. Vidaković, P., 1989: Nacionalni parkovi i turizam, Institut za turizam, Zagreb.
4. Klarić Z., 2000. (urednik): Ekoturizam i održivi razvoj turizma u ekološki osjetljivim prostorima, Tematski broj časopisa Turizam, Zagreb

Recommended literature

1. WEB site Svjetske turističke organizacije (World Tourism Organization) sekcija Sustainable tourism i sekcija vezana uz Svjetsku konferenciju o ekoturizmu u Quebecu, 2002 (http://www.world-tourism.org), Madrid
2. WEB site Obrazovne, znanstvene i kulturne organizacije Ujedinjenih naroda (United Nations Educational, Scientific and Cultural Organization) – opisi zaštićenih prirodnih područja (http://www.unesco.org), Paris
3. WEB SITE Ministarstva kulture RH – zaštićena područja (www.min-kulture.hr), Zagreb.
4. Zakon o zaštiti prirode, Narodne novine br. 162/2003, Zagreb.
5. Ostali aktualni materijali u skladu s novim spoznajama koji će biti dostupni 2008. godine

Nursery production of ornamental plants

UD3004

ECTS 5

English language R1

E-learning R1

Teaching hours 61
Lectures 30
Exercises 15
Field work 16

Lecturer
Doc. dr. sc. Damir Drvodelić
Doc. dr. sc. Vinko Paulić

Associate teacher for exercises
Doc. dr. sc. Damir Drvodelić
Doc. dr. sc. Vinko Paulić

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course contents:
The subject is designed to introduce students to nursery production of ornamental plants. In plant production it is necessary to introduce the listeners with the basic concepts of generative reproduction as well as vegetative. Choice of habitats as well as basic machinery and equipment for nursery production. Special cultivation techniques, substrates, types and ways of fertilizer application will be processed in detail. Basic concepts of marketing and management will be elaborated. The subject is unique because it is not listening to any other faculty, so it will probably be interesting for students from other faculties.
The subject is conceived of the latest knowledge of plant reproduction, plant physiology, and the production of ornamental trees and shrubs. The course consists of lectures and field work classes.

Type of course:
Nursery production of ornamental plants (compulsory course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present ways of propagating plants in nurseries (generative and vegetative propagation of ornamental plants)	Practicum, Preliminary exam, Final exam	B6, B14, C2
Analyse Container Planting (Comparison of root crop rootstocks and containerized seedlings, types of containers with the advantages and disadvantages of each type, conditions required for successful production, work dynamics)	Practicum, Preliminary exam, Final exam	B6, B14, C2
Recommend procedures for plant care in nurseries (care work, green fertilization, protection and adaptation of plants in nurseries, ways of planting seedlings)	Practicum, Preliminary exam, Final exam	B6, B14, C2
Present and explain the production of large-scale trees (ways of transplanting, factors influencing the success of the transplant, works on increasing value and receiving large trees)	Practicum, Preliminary exam, Final exam	B6, B14, C2
Identify the reproduction of individual species, species and cultivars of ornamental trees and shrubs	Practicum, Preliminary exam, Final exam	B6, B14, C2

General competences

The aim of the course is to introduce students with the specifics of the production of ornamental plants. By mastering this course, students are able to independently reproduce ornamental plants as well as produce new cultivars and breeding forms.

Type of instruction

Lectures

Exercises

During semester seven different exercises are performed which are an upgrade to knowledge adopted in lectures.

Field work

As part of the course, field work is done in two days:

1. Production of ornamental plants on open surfaces, extraction, packaging and dispatch.
2. Visit of a large fairground (garden centre) of decorative trees and shrubs.

Working methods:

Teacher' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures, exercises and field sessions. A justified absence with a maximum of 20% of lectures and 10% of exercises is allowed. Creating and delivering exercises within the given time frame. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1,0
Exercises (E)	-	-	-	15	6	0,7
Field work (FW)	-	-	-	16	5	0,7
1. Partial exam (PE1)	50%	60-70%	Sufficient (2)	-	39	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
2. Partial exam (PE2)	50%	60-70%	Sufficient (2)	-	39	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(P+V+TN+K1x50+K2x50)/100**		61	89	5

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	78	2,6
TOTAL	**100%**	**(ZIx100)/100**				
Students who do not pass during the semester by a written partial exams, approach to final exam which accounts for 100% of the final grade						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	The lectures are checked and the presence of students is recorded. Students may be excluded with a maximum of 20% of direct tuition hours.	semester (30 hours of direct lectures)	-
Exercises (E)	Exercises are checked and students attend. Student may justifiably be absent with a maximum of 10% of direct teaching hours. At the end of the semester, the students submit their exercises based on the instruction given from the beginning of the course on the layout and content of the exercises.	After completing classes	-
Field work (FW)	On-site teaching is checked and the presence of students is recorded and no absences allowed. After completing each field course, the students are obliged to write and submit a report from the field teaching.	According to the field curriculum	-
1. Partial exam (PE1)	All students who have enrolled the subject for the first time in the current academic year can access the first queue. In the content of the 1st Column the first half of the tuition is entered. Colloquy is a written test with 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. It is necessary to collect more than 60% points for the passage to the colloquium.	8. week	There is a possibility of a correction deadline for the colloquium.
2. Partial exam (PE2)	2. Colleges can be accessed by students who have passed the 1st Colloquium. The second half of the semester enters the second half of the tuition. Colloquy is a written test with 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. It is necessary to collect more than 60% points for the passage to the colloquium. Students who get enough points from both hands get the final grade from the subject that is the arithmetic mean of the score from the first and second rounds.	15. week	There is a possibility of a correction deadline for the colloquium.
Written exam	Written exam consists of 20 questions. The exact answer is scored with 1 point, a half answer with 0.5 points, and the inaccurate or empty answer with 0 points. For passage on a written exam, it is necessary to collect more than 60% of the points.	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. The final grade is obtained according to the formula **(ZIx100)/100**		-

Obligatory literature

1. Davidson, H, 2000: Nursery Management, administration and culture. Prentice Hall.
2. Bärtels, A., 1995: Der Baumschulbetrieb. Verlag Eugen Ulmer.
3. Krussmann, G., 1997: Die Baumschule. Parey Buchverlag Berlin.

Environmental pedagogy

UD3005

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Anđelina Svirčić Gotovac, Assistant Professor

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 81%
Excellent (5) 91%

Course content:
Ecological education and forest pedagogy - history and concept. The significance of public education about forest and forestry. Sustainable development - the concept and application. Ecological-ethical orientation. Defining target groups. Selection of goals. Preparation and planning of presentations. Choice of content and techniques. Methods and techniques of education. Training of lecturers. Theories of motivation. Models of performance. Field demonstrations. Motivation. Basic thematic entities: soil, water and tree. Usefulness, forest as a living space, forest in danger. Forest and hunting. Definition of sociobiology. Animal sociobiology. Public relations. Concept, significance and role. The most common attitudes about forest and forestry. Interest groups. Specificity of interest groups. Basic communication strategies. Communication techniques. Public opinion investigation. Basic research techniques: sample assignment, survey, direct observation method, interview method, content analysis method. Interpretation of findings. Promotion and popularization of forestry. Successful and unsuccessful examples.

Type of course:
Environmental pedagogy (electoral, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the environmental education and the significance of education about forest and forestry in public.	Seminar papers and presentations, oral exams	A1
Understand the concept of sustainable development and application the concept in forestry.	Seminar papers and presentations, oral exams	A1
Define methods and techniques of education through theories of motivation (early and new).	Seminar papers and presentations, oral exams	A2
Understand and awaken the concepts of endurance use, forest as living space, forest in danger.	Seminar papers and presentations, oral exams	A3
Define the basic concepts on the process of public opinion and communication techniques.	Seminar papers and presentations, oral exams	A3

General competences

Understand ecological education and the importance of education about forest and forestry in the contemporary context. Understand the concept of sustainable development (the emergence and role of international agreements aimed at resolving an ecological crisis, eg the Kyoto Protocol and the Paris Accord). Determine the state of the ecological crisis in relation to terms of endurance use, forest as living space and forest in danger. Learn basic concepts about the process of public opinion polling. Differentiate basic research techniques: sample design, survey, direct observation method, interview method, content analysis method, and ability to interpret the obtained findings.

Type of instruction

Lectures

As part of the seminar exercises, there are several examples and topics from the contemporary context of Europe and the world. Seminars are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original classes - lectures, seminars. Designing topics for seminars and workshops and assembling knowledge tests and evaluating them. Holding of oral exams and consultations. Creation of teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and seminars, preparation and presentation of seminar work. Take an oral exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students work load outside the direct teaching	ECTS
Lectures (L)				15		2
Exercises (E)	40%	50-60%	Sufficient (2)	15		
		61-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral exam (OE)	60%	50-60%	Sufficient (2)			
		61-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex40 + OEx60)/100**		15	0	2

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100%	50-60% 61-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of students is checked and recorded. The student can be legally absent with up to 15% of the hours of direct instruction. Students must hold a seminar as an oral presentation.	semester (15 hours of direct lecturer)	-
Oral exam	The exam can be attended by students who have a seminar conducted. Oral exam has questions from different parts of the program content. The final grade from the subject is obtained according to the formula **Ex40+PIx60/100**	Exam terms	

Obligatory literature

1. Anđelina Sviršić Gotovac. Environmental pedagogy, Lectures, link: http://www.sumfak.unizg.hr/Odsjek.aspx?mhID=3&mvID=6.
2. Schroeder, W. Lhota, S. Gugić (2004). Supervisor Manual. JU PP Lonjsko polje
3. Črnjar, Mladen, (1997). Economy and Environmental Protection. Školska knjiga, Zagreb, Glosa-Rijeka
4. Cifrić; I. (2000). Bioethics and ecology, Matica hrvatska Zaprešić
5. Ivan Cifrić (2003). Environment and sustainable development - environmental vulnerability and landscape aesthetics, HSD, Zagreb.

Recommended literature

1. Burnie, D. (1994). Lexicon of the nature. Mozaik knjiga, Zagreb
2. Glavač, V. (2001). Introduction to Global Ecology. Hrvatska sveučilišna naklada, MZOPU RH, Pučko otvoreno učilište Zagreb
3. Wildermuth, H. (1994). Nature as a task. DUZPO, Zagreb
4. David Harvey (2013). Short History of Neoliberalism., HSD, Zagreb.

Preparation and management of ecological projects

UD3006

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Ivan Martinić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Project basic: definition, role and significance; project characteristics: types, elements / structure, concept, goals. Resources in project: people, resources, time. Project development: problem identification, project idea, input strategy, purpose and objectives, project outcomes. Actors and stakeholders in preparation and development of projects; stakeholders forum, key stakeholders, project partners. Team work in project preparation and management: team characteristics and functioning, team development phase, team potential. Evaluating collaborators in the team. Planning and decision-making in the team. Styles of leadership, internal communication and patterns of motivation. Ecological projects: characteristics, specifics and goals. Current global ecological challenges and programs. Legislative framework for the implementation of ecological projects. Environmental legislation. Public participation. Life cycle of the project - start-up, stabilization, matureness, restart or disappearance. Project organization: project organization models, project tactics, risk management, monitoring of project development. Project budget: structure of revenues and expenditures, sources of funding, eligible costs. Project implementation: relationship between 'contracting / financing - carrier / performers', controlling, monitoring and reporting in the project. Performance evaluation and project economics. Overall rating of the project's effects (economic, environmental and social impacts), key financial performance indicators. Promotion and reporting in the project. Communication from the public: ways of communication, communication channels and the media.

Type of course:
Preparation and management of ecological projects (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define role and significance of projects and analyse main characteristics of project; to make a problem analysis ("problem tree") and analyse the objectives related to the concrete project.	Knowledge test, final exam	A1, D1, D5
Make a decision on chosen collective decision methodology and propose a human resource assessment technique and evaluate collaborators in team.	Knowledge test, final exam	A1, D1, D5
Interpret the life cycle of the project and analyse the key elements of a particular project phase and establish an organization model with the project management and reporting model.	Knowledge test, final exam	A1, D1, D5
Create a list of quantitative and qualitative indicators in project development (ante-ports and ex-port assessments) and evaluate the project's viability.	Knowledge test, final exam	A1, D1, D5
Identify the areas where projects can be submitted to public and private sources of funding and to present the project proposal by the given structure.	Knowledge test, final exam	A1, D3, D5
Interpret the evaluation methods and design the evaluation questionnaire according to the set indicators of achievement of the planned goals.	Knowledge test, final exam	A1, D1, D5

General competences

Ability to conclude the basic legality of the implementation of ecological projects and to master the techniques of preparation and participation in project implementation

Development of knowledge and skills of project cycle management to choose methods and techniques for achieving project goals in different implementation contexts.

The ability to recognize the opportunities and favourable opportunities of financing ecological projects.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures. Compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures. Taking final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15	0	0,5
Final exam (FE)	100%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx100)/100**		15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have exercises and a colloquy. The students in the pre-printed exam fit the questions asked, completing the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam teacher asking questions from different parts of program content. Final grade of subject is obtained according to the formula. **(FEx100)/100**		

Obligatory literature

1. Boers, M. Kako voditi i financirati projekte? [priručnik za udruge]. Zagreb: Europski dom Zagreb, 2002.
2. Martinić, I.: Zbirka prezentacija iz predmeta „Priprema i vođenje ekoloških projekata“ (za tekuću ak. god.)
3. TenStep proces upravljanja projektima, Primakon 2010

Recommended literature

1. Bendeković, J. Priprema i ocjena investicijskih projekata. Zagreb : Foip 1974, 2007.
2. Bešlić, B. Upravljanje EU projektima. Zagreb : TIM4PIN, 2014.
3. Fresl, A. Osnove uspješne provedbe projekata : priručnik. Zagreb : Algebra, 2010.
4. Horine, G. Vodič za upravljanje projektima : od početka do kraja. Zagreb : Dva i dva, 2009.
5. Radnich, M. EU fondovi na dohvat ruke : praktični vodič kroz europske fondove, programe, natječaje i bespovratna sredstva. Zagreb : Folpa, 2012.
6. Martinić, I.: Upravljanje zaštićenim područjima prirode – planiranje, razvoj i održivost, Šumarski fakultet u Zagrebu, Zagreb 2010.

Protected natural values

UD3007

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Željko Španjol
Prof. Jozo Franjić

Grading
Sufficient (2) 50%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Students are introduced to the issues of protection of biological and landscape diversity in the Republic of Croatia. Teaching involves exploring protected, endangered and rare species of flora and fauna, and the principles of their protection. Also, all spatial categories of protected nature areas (national park, nature park, strict reserve, special reserve, regional park, nature monument, significant landscape, forest park, monument park architecture) are treated in the protected area. Students are introduced to the principles of protection and practical measures for the conservation of certain plant and animal species. The aim is to introduce students with the legal regulation of designation, definition, management, evaluation, spatial planning, zoning, financing, ecological monitoring of fundamental phenomena.

Type of course:
Protected natural values (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Describe categories of endangered plant and animal taxa. Analyse and utilize literature data on endangered plant taxa. Assess the endangerment of individual plant taxa based on available data.	Partial exam , seminars, Final exam	B1
Present facts on the threat of Croatian flora. Present facts about the endangered fauna of Croatia. List the most significant endangered plant taxa by category of vulnerability.	Partial exam, seminars, Final exam	B2
To rank conditions and define the meaning of protected natural values. Evaluate and analyse the spatial potential of national parks and nature parks with the purpose of zoning. Assess the possibilities of natural spaces in Croatia and the differences between protected areas and those that are not protected under the Nature Protection Act.	Partial exam, seminars, Final exam	B3

General competences

Methods of protection and evaluation of endangered and rare plant and animal species
Display, structure and organization of the institution for protected natural values
Applying applicable laws related to protected natural values.

Type of instruction

Lectures

Working methods:

Teachers obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing partial exams, written exams, oral exams and consultations. Creating teaching materials.

Studenats obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				12	0	0,5
Seminar (S)	20%	50-70%	Sufficient (2)	1	10	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P1)	40%	50-70%	Sufficient (2)	1	20	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam (P2)	40%	50-70%	Sufficient (2)	1	20	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Sx20 + P1x40 + P2x40)/100**		15	50	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and seminar work	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Seminar papers are produced in accordance with the assigned topics related to the analyses and interpretations of the teaching units in the exercises.	semester (15 hours of direct lecturer)	
Partial exams (P1and P2)	Students will take the exam from the above mentioned thematic areas.	8. and 15. week	Students who do not attend the partial exams will approach the written and verbal part of the exam
Written exam	The exam is attended by students who have not passed the first and second partial exam. Students who have passed the first and second partial exam only access the verbal part of the exam. The students in the pre-printed exam answer the questions asked, round out the exact answers, describe the images. The written exam is evaluated and participates in the final assessment of the subject.	Exam terms	
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is obtained according to the formula: **(Fex80+Sx20)/100**		

Obligatory literature

1. *Crvena knjiga vaskularne flore Hrvatske,* 2005: Ministarstvo kulture Republike Hrvatske,
    i. Državni zavod za zaštitu prirode, Zagreb.
2. *Crveni popis ugroženih biljaka i životinja Hrvatske*, 2004: Državni zavod za zaštitu prirode, Zagreb.
3. *Biološka raznolikost Hrvatske, priručnici za inventarizaciju i praćenje stanja*, 2006: Državni zavod za zaštitu prirode, Zagreb.

Recommended literature

1. Španjol, Ž., 1994: *Problematika nacionalnih parkova u svijetu i u Republici Hrvatskoj*.
2. Glas.šum. pokuse 30: 61-94, Zagreb.
3. Španjol, Ž. 1993**:** *Uloga posebno zaštićenih objekata prirode u turizmu***,** Glas. šum. pokuse,
4. posebno izdanje 4: 231-242, *Zagreb.*
5. Pregled stanja biološke i krajobrazne raznolikosti Hrvatske sa strategijom i akcijskim planovima zaštite, 1999, *Državna uprava za zaštitu prirode i okoliša. Zagreb*.
6. *Crvena knjiga morskih riba Hrvatske*, 2008: Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode, Zagreb.
7. *Crvena knjiga gljiva Hrvatske*, 2008: Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode, Zagreb.
8. *Crvena knjiga vretenaca Hrvatske*, 2008: Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode, Zagreb.
9. *Crvena knjiga špiljske faune Hrvatske***,** 2009: Ministarstvo kulture Republike Hrvatske, Državni zavod za zaštitu prirode, Zagreb.

Virgin forests and forest reserves

UD3008

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof.dr.sc. Igor Anić
Doc.dr sc. Stjepan Mikac

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
The following course units are dealt with: definitions of virgin forest/forest reserve concepts; meaning and role of virgin forests; anthropogenic impact; virgin forest range in the world, Europe and Croatia; phylogenetic development of forests; ontogenetic development of forests (pioneering, transitory, and final forests with illustrations); ways and methods of research on virgin forests and forest reserves; structure of virgin forest (initial phase, optimal phase, terminal phase, selection phase, other phases; virgin forest texture; dynamics of virgin forest with illustrations of development cycles; virgin forest stability; production of virgin forest ecosystem; growth and increment of forest trees in virgin forest; physical maturity; dying, dead and decaying trees; decay of dead wood; regeneration in virgin forest; virgin forest zoocenosis; analysis of virgin forests in Croatia: beech and fir virgin forests and beech and oak virgin forests; forest reserves in Croatia; virgin forests in Europe; structure of tropical virgin forests; virgin forest of the boreal region – taiga; experience gained in virgin forests applied to forest management; concept of natural forest management, and comparison of virgin forest with natural management forest.

Type of course:
Virgin forests and forest reserves (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the significance and role of virgin forests and forest reserves, ontogenetic development of virgin forests (importance and role of virgin forests and forest reserves, anthropogenic influence, phylogenetic development of virgin forests, approaches and methods of exploration of virgin forests and forest reserves, ontogenetic development of virgin forests, pioneer, transitional and final forests, Area of virgin forests in the world and the Republic of Croatia)	Seminar, Final exam	B3
Determine the structure and texture of the virgin forest (initial, optimal, terminal, selection and other phases and stages of the virgin forest, dynamics and stability of the virgin forest)	Seminar, Final exam	B3
Analyse the comparison of the virgin forests and the management forests (physical maturity, deadwood, dead and decomposing trees, decomposition of dead wood, regeneration, zoocenosis, use of forest knowledge in forest management, natural forests management, comparison of virgin forest and natural forest management)	Seminar, Final exam	B12

General competences

The task of this course subject is to inform the students on the virgin forests and forest reserves, particularly the European virgin forests and those in Croatia. The knowledge on virgin forests is used in the management of natural forests. Besides the development of science, especially forestry science, primary forest serves for the conservation of plant and animal species, and the genetic pool, and has educational, aesthetic, and cultural significance. Virgin forests are regarded as schools of Nature, which offers the possibility of learning about the natural life cycle of the forest from its genesis to its death, i.e. decay, with immediate regeneration. Considering that Croatia is covered by natural forests that are managed by the principles of natural methods, it is of utmost importance to learn about the processes going on in a virgin forest. The subject is conceived so that students of other faculties who have no previous forestry knowledge, especially students of natural and bio-technical sciences, can follow it.

Type of instruction

Lectures

Lectures cover 15 units according to the teaching plan.

Working methods:

Teachers obligations:

Maintaining Original Teaching: Lectures. Designing seminar papers. Consultation, written exams, oral exams. Creating teaching materials.

Studenats obligations:

Regular attendance and active participation in lectures. Making seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Designing seminar papers (SP)	30%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)		45	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex70 + SPx30)/100**		15	60	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written seminar paper	The student prepares seminary work on the topic. The quality of the seminar work is evaluated.	15. week	
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	

Obligatory literature

1. Anić, I., 2004: Prašume i njihovo značenje za gospodarenje šumama u Hrvatskoj. Glasnik zaštite bilja, 6(27): 85–96, Zagreb.
2. Matić, S., B. Prpić, I. Anić, M Oršanić, 2003: Bukove prašume. U: Obična bukva u Hrvatskoj, Akademija šumarskih znanosti, 414 – 434, Zagreb.
3. Matić, S., B. Prpić, Đ. Rauš, A. Vranković, Z. Seletković, 1979: Ekološko-uzgojne osobine specijalnih rezervata šumske vegetacije Prašnik i Muški bunar u Slavoniji. U: Đ. Rauš (ur.), Drugi kongres ekologa Jugoslavije, Savez društava ekologa Jugoslavije, str. 767 – 823, 1979, Zagreb.
4. Prpić, B., S. Matić, J. Vukelić, Z. Seletković, 2001: Bukovo-jelove prašume hrvatskih dinarida. U: Obična jela u Hrvatskoj, Akademija šumarskih znanosti, 479 – 492, Zagreb.
5. Prpić, B., Z. Seletković, 1996: Istraživanja u hrvatskim prašumama i korištenje rezultata u postupku s prirodnom šumom. U: B. Mayer (ur.), Unapređenje proizvodnje biomase šumskih ekosustava, 97 – 104, Šumarski fakultet Sveučilišta u Zagrebu i Šumarski institut, Jastrebarsko, Zagreb.

Recommended literature

1. Korpel, Š., 1996: Razvoj i struktura bukovo-jelovih prašuma i njihova primjena kod gospodarenja prebornom šumom. Šumarski list CXX (3 – 4): 203 – 209, Zagreb.
2. Korpel, Š., 1995: Die Urwaelder der Westkarpaten. Gustav Fisher Verlag, Stuttgart-Jena-New York, 310 str.
3. Korpel, Š., M. Saniga, 1995: Prirode blizke pestovanie lesa. TU Zvolen, 158 str., Zvolen.
4. Korpel, Š., 1989: Pralesy Slovenska. VEDA, 322 str., Bratislava.
5. Leibundgut, H., 1982: Europaeishe Urwaelder der Bergstufe. Bern – Stuttgart.
6. Leibundgut, H., 1978: Über die Dynamik europaeisher Urwaelder. Allg. Forstzeitschr. 24: 686 – 690.
7. Leibundgut, H., 1959: Über Zweck und Methodik der Struktur- und Zuwachsanalyse von Urwaeldern. Schwiz. Zeitschr. f. Forstwes., 110 (3): 111 – 124.

Utilization of forest biomass

UD3009

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Željko Zečić, PhD.
Assist. prof. Dinko Vusić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Within this subject, the sources, quality, methods of harvesting and utilization of forest biomass, especially the part of woody forest biomass which can be used in horticulture, will be elaborated.
On examples of energy plants, the possibilities of using wood chips for heat production in energy, cogeneration plants and greenhouses will be elaborated.
The application of forest biomass in general and wood biomass, wood chips and bark, for mulching in nursery production and in horticulture will be explained. Particular emphasis will be placed on the properties of wood chips, the moisture content and the granulometric structure, and on the characteristics of the wood bark and the available volume in particular tree species.
One teaching unit will treat the compost production technology as one of the forms of forest biomass utilization in horticultural production and application on landscaped parkland surfaces.

Type of course:
Utilization of forest biomass (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Establish a production system according to the potential of wood biomass of certain stands and biomass from urban areas by introducing new technologies.	Final exam	B11
Organize collection-logistic centres for storing and selling certain quantities of solid biofuels according to the basic features of the product declaration.	Final exam	C2
Valorise solid biofuel based on physical and chemical properties and use.	Final exam	C2

General competences

The aim of this course is to provide an insight on the sources, harvesting methods and the potential for use of forest biomass, primarily in nursery production and horticulture.

Type of instruction

Lectures

Working methods:

Teachers' obligations:

Conduction of teaching programme – oral presentations. Conduction oral exams and consultations. Creation of teaching materials.

Studenats' obligations:

Ordinarily participation and active participation in classes. Examination.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	15	0	1
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1
TOTAL	**100%**			15	**45**	**2**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Checking the attendance of students on lectures.	semester (15 hours of direct lecturer)	-
Oral exam	Sufficient (2) 60% Good (3) 71% Very good (4) 81% Excellent (5) 91%	Exam terms	

Obligatory literature

1. Zečić, Ž., Current lectures
2. Hakkila, P., 1989: Utilization of Residual Forest Biomass. Springer-Verlag. Berlin Heidelberg
3. Röser, D., Asikainen, A., Raulund-Rasmussen, K., Stupak, I., 2008: Sustainable Use of Forest Biomass for Energy, Springer.

Recommended literature

1. Grassi, G., Zibetta, H., 1986: Energy from Biomass 1. Commission of the European Communities, 1-467.
2. Hummel, F.C., Palz, Z., Grassi, G., 1988: Energy from Biomass 3 (Biomass Forestry in Europe: A Strategy for the Future). Commission of the European Communities, 1-599.
3. Grassi, G., Pirrwitz, Zibetta, H., 1988: Energy from Biomass 4. Commission of the European Communities, 1-467.

Organizational culture

UD3010

ECTS 2

English language R1

E-learning R1

Teaching hours 15
Lectures 15
Exercises 0
Field work 0

Lecturer
Prof. Mario Šporčić, PhD.
Assist. prof. Matija Landekić, PhD.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Organizational or corporate culture represents the way of life and work of an organization, it understands a certain system of values, perceptions, beliefs, ethics, lifestyles, personality and character of the organization, the group of people who make this organization. By acting on employee satisfaction, motivation, communication, decision-making, conflict resolution etc., organizational culture indirectly influences the success of business organizations and today is an indispensable element in the analyses of efficiency of modern companies. Accordingly, within the course students will elaborate: the concept and definition of organizational culture, its elements, role and function, classification and typology of organizational culture, ethical components of organizational culture, influence of managers and environment on company culture, contemporary trends in organizational culture, organizational cultures of successful domestic and foreign companies.
Through these content students will learn about the importance and significance of organizational culture and master the basic elements of designing, maintaining and changing organizational culture of the company.

Type of course:
Organizational culture (elective course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Present the basics of organizational culture (elements of organizational culture, organizational climate, classification and typology, design and maintenance of organizational culture, role and functions, importance of organizational culture in forestry).	Written exam	B2
Evaluate organizational culture in the forestry situation and environment context (ethical components, influence of information and communication technologies, contemporary trends, research and features of organizational culture in forestry)	Written exam	B12
Ensure measurement and management of organizational culture (methods and models, influence of managers, best known theories and models of management and managerial styles, subculture in business organization, changes in organizational culture)	Written exam	C3
Compare the organizational culture and effectiveness of the organization (the impact of culture on organizational success and efficiency, the relationship between culture and business strategy, case studies and examples of best practice)	Written exam	C1

General competences
Students will be familiar with organizational culture as a factor of success and efficiency of the business system (in forestry). The aim is to master the minimal knowledge and skills of designing, maintaining and changing organizational culture in the company

Type of instruction

Lectures
Lectures include 4 methodological units, according to the teaching plan.

Working methods:

Teachers' obligations:
Giving lectures, consultations and exams. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15		0,5
Exam (E)	100%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex100)/100**		15	45	2

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures	Student attendance is checked and recorded. The student can justifiably be absent with a maximum of 20% of direct teaching hours.	semester (15 hours of direct lecturer)	-
Written exam	The students in the prepared printed exam answer the questions asked and solve the problem tasks. The written exam is evaluated and makes the final grade of the subject. The final grade is obtained according to the formula (FEx100)/100	Exam terms	

Obligatory literature

1. Žugaj, M., Bojanić-Glavica, B., Brčić, R., Šehanović, J.: Organizacijska kultura. TIVA Tiskara Varaždin, 2004.
2. Sušanj, Z.: Organizacijska klima i kultura. Naklada Slap, Jastrebarsko, 2005.

Recommended literature

1. Žugaj, M., Šehanović, J., Cingula M.: Organizacija. TIVA Tiskara Varaždin, 2004.
2. Peter F. Drucker: Upravljanje u budućem društvu. M.E.P. Consult, Zagreb, 2006.
3. Stephen P. Robbins: Bitni elementi organizacijskog ponašanja. MATE d.o.o., Zagreb, 1996.
4. Šporčić, M., Landekić, M., Lovrić, M., Bogdan, S., Šegotić, K., 2010: Višekriterijsko odlučivanje kao podrška u gospodarenju šumama – modeli i iskustva. Šumarski list 134 (5-6): 275-286.
5. Landekić, M., Šporčić, M., Martinić, I.,Lovrić, M., 2010: Effort-reward imbalance of the forestry experts in Croatia. Proceedings of the 43rd International Symposium FORMEC 2010 „Forest engineering: meeting the needs of the society and the environment“, Padova - Italy, 11.-14. July 2010.

Integrated forest protection in protected areas

UD4001

ECTS 4

English R1

E-learning R1

Teaching hours 61
Lectures 30
Practical exercises 15
Field classes 16

Lecturers
Prof. dr. sc. Danko Diminić
Prof. dr. sc. Boris Hrašovec
Prof. dr. sc. Josip Margaletić

Associate teacher for exercises
Dr. sc. Jelena Kranjec Orlović
Doc. dr. sc. Milivoj Franjevć
Doc. dr. sc. Marko Vucelja

Grading system
Insufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Purpose of course is to get students acquainted with specificities of term, role and importance of tree and shrub protection in protected forest ecosystems (national parks, special reserve, nature parks) and in urban areas (parks, park forests), as well as with dominant stress factors in urban areas and forest ecosystems. Harmful biotic factors. Most common harmful organisms which cause damage and/or pathological processes on trees and shrubs, with emphasis on conditions which lead to disease and damage development and protective measures. Harmful abiotic factors - Most common abiotic factors which cause damage and/or pathological processes on trees and shrubs in protected areas. Causes, consequences and possible from mechanical bark damage, use of herbicides and other pesticides, drought damage, sunscald damage and other types of injuries. Main emphasis is to get students acquainted with integrated approach in protection of trees and shrubs in forest ecosystems as a whole, linking knowledge obtained in undergraduate and graduate studies.

Type of course:
Integrated forest protection in protected areas (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyse integrated protection of lowland forest ecosystems (emphasis is on problems in water supply, including both underground and precipitation water, and increased temperatures (global warming), anthropogenic influence and roles of disease causative agents and pests, where aforementioned factors are analysed individually and in synergy and make the foundation for integrative approach to protective measures of main tree species and whole ecosystems).	Explain synergy of harmful effects of diseases, insects, rodents and wildlife on stability of lowland forest ecosystems as a whole.	B9
Present integrated protection of forest ecosystems of common beech (abiotic and biotic factors which individually or in synergy influence or can influence on stability of common beech ecosystems, climate disturbances, and anthropogenic influence).	Separate important biotic factors which influence negatively on health status of individual trees and on stability of common beech ecosystems as a whole.	B9
Analyse integrated protection of forest ecosystems of silver fir (forests and protected natural objects of hill and mountain ecosystems, abiotic and biotic factors which individually or in synergy influence or can influence on stability of silver fir ecosystems, emphasis is on problems with climate disturbances, anthropogenic influence and roles of diseases and pests).	Identify important abiotic factors which influence negatively on health status of individual trees and on stability of silver fir ecosystems as a whole.	B9
Present integrated forest protection of Mediterranean ecosystems (forests and protected natural objects of Croatian Mediterranean, important biotic and abiotic factors which individually or in synergy influence or could influence son stability of forest ecosystems, emphasis is on problems with climate disturbances with special overview of drought and forest fire, and anthropogenic influence and roles of diseases and pests	Identify important abiotic and anthropogenic factors which influence negatively on health status of individual trees and on stability of Mediterranean ecosystems as a whole.	B9

General competences

Students are trained for analytical approach to complex management activities in forest and protected ecosystems in management conditions with limitations (protected objects). Students implement modern methods and approaches and gain competencies for decision making and writing parts of elaborates for governance of protected objects which are related to forest protection.

Type of instruction

Lectures

Exercises

As part of exercises students are getting acquainted with application of different plant protection measures in protected areas (integrated approach). The exercises build on the knowledge acquired in lectures.

Field work

Field classes are carried out in protected forest areas with examples of application of tree protection measures and protective measures against forest fires on karst.

Working methods:

Teacher's obligations:

Teaching activities - lectures. Organization of oral and written exams and consultations for seminars. Preparation of teaching materials.

Student's obligations:

Regular attendance and active participation in lectures, practical exercises and field classes. Taking partial exams, written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	30	0	1
Practical exercises (V)	-	-	-	15	0	0,5
Field classes and field class seminar (TN)	-	-	-	16	2	0,7
Seminar (S)	65%	-	-	0	35	1
Exam (PUI)	35%	60-70%	sufficient (2)	0	20	0,8
		71-80%	good (3)			
		81-90%	Very good (4)			
		91-100%	excellent (5)			
TOTAL	**100%**	**(Kx20 + PUIx80)/100**		61	57	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (ZI)		60-70% 71-80% 81-90% 91-100%	sufficient (2) good (3) very good (4) excellent (5)	0	135	3,5
TOTAL	**100%**	**(ZIx100)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + practical exercises	Students' attendance is checked and recorded. Students can be absent with justification from maximum 15 % of direct teaching	semester (45 direct teaching hours)	-
Completion of practical exercises	Students attend practical exercises in groups. Practical exercises are carried out orientated to recognition of pests and diseases of urban and forest trees and to protective measures.	semester (15 direct teaching hours)	In case of justified reason student can additionally compensate for the absence from the exercise.
Seminar (S)	Students present given units. Seminar is graded and taken into account for the final grade of this course.	From 3rd week	Students who presented seminar can take oral exam.
Oral exam	Students are asked questions relating to the different parts of the course content. The following formula is used to calculate the final grade for this course: **Sx65+PUIx35/100**		

Obligatory literature

1. Klepac, D., Dundović, J., Gračan, J., 1996: Hrast lužnjak (*Quercus robur* L.) u Hrvatskoj. Hrvatska akademija znanosti i umjetnosti, Zagreb, 559 str.
2. Prpić, B. (ed.) 2001: Obična jela (*Abies alba* Mill.) u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 895 str.
3. Matić, S. (ed.) 2003: Obična bukva (*Fagus sylvatica* L.) u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 855 str.
4. Vukelić, J. (ed.) 2005: Poplavne šume u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 455 str.
5. Matić, S. (ed.) 2011: Šume hrvatskoga sredozemlja. Akademija šumarskih znanosti, Zagreb, 740 str.

Recommended reading

1. Manion, P. D., 1981: Tree disease concept. Prentice-Hall, Inc., London, 399 str.
2. Vajda, Z., 1974: Nauka o zaštiti šuma. Školska knjiga, Zagreb, 482 str.

Ecological Monitoring

UD4002

ECTS 4

English language R1

E-learning R1

Teaching hours 61
Lectures 15
Exercises 30
Field work 16

Lecturer
Prof. dr. sc. Ivica Tikvić
Izv. prof. dr. sc. Damir Ugarković

Associate teacher for exercises
Izv. prof. dr. sc. Damir Ugarković

Grading

Sufficient (2) 50%-62.5%
Good (3) 62.5%-75%
Very good (4) 75%-87.5%
Excellent (5) 87.5%-100%

Course content:
The course Ecological Monitoring includes an overview of the functioning of the main forest ecosystems in Croatia, the main disturbances to biological and ecological balance, monitoring conditions in virgin forests and forest reserves, assessments of tree vitality of the main types of forest tree species, air pollution and forest precipitation monitoring methods, dry and wet sedimentation, precipitation chemistry, monitoring pollution of flood waters and subterranean waters, determining the intensity of mycorrhizal development on the roots of the main tree species, monitoring and analysis of climate and microclimate, automatic systems of climactic monitoring, monitoring the influence of climatic factors on forest trees, ozone damage assessments, selection of bioindicators for assessing ozone damage, methods of monitoring the dynamics of flood and subterranean waters, hydrology of mountainous forest ecosystems, runoff, sinking and surfacing water, lyzimetric monitoring, phenological observation, monitoring leaf and generative phenophases of main forest tree species, monitoring the dynamics and intensity of seed yield, determining tree biomass, assessing canopy damage, lack of leaves or needles, changes in the colour of leaves or needles, dynamics of tree senescence, an overview of the main international ecological monitoring programs.

Type of course:
Ecological monitoring (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Independently collect data, statistical processing, display and analyse the collected data, discuss and draw conclusions based on the analysed data and discern the possibility of different interpretations of the same problems analysed in different ways.	tests of knowledge, oral exam	A1
Develop and implement management plans and programs in forest ecosystems of protected nature and management facilities in specific urban forest ecosystems.	tests of knowledge, oral exam	B3
Organize and implement works of management and protection of soil and water.	tests of knowledge, oral exam	B7
Develop ecological studies and forestry parts of spatial plans.	tests of knowledge, oral exam	B10
Organize and implement environmental monitoring, analysis and valorisation of space and the design of park spaces.	tests of knowledge, oral exam	B13

General competences
Complete training for the management of forest ecosystems in all respects. Methods and equipment for monitoring of ecological factors. Forest protection from abiotic and biotic factors. Preparation of environmental studies. The tasks of expert manager and supervisor in nature and environment protection.

Type of instruction

Lectures
Through lectures students are introduced to theoretical and practical knowledge from individual thematic units.

Exercises
As part of the exercise, 15 exercises from the ecological monitoring are performed. Exercises are an upgrading of the knowledge gained in lectures.

Field work
On the field work, students are introduced with practical examples of the application of knowledge of the general and landscape ecology in urban forestry and nature protection. Practitioners take part in it.

Working methods:

Teachers' obligations:
Maintaining lectures. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures, exercises and field work. Laying the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (La) attendance	5%	100% 90% 80% 70%	Excellent (5) Very good (4) Good (3) Sufficient (2)	15	-	0,5
Exercises (Ea) attendance	5%	100% 90% 80%	Excellent (5) Very good (4) Good (3)	30	-	1
Field work (FWa) attendance	3%	100%	Excellent (5)	16	-	0,5
Writing exercises (E) and field practice report	40%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	-	20	0,7
		In order, easy, with bigger corrections and on time	Good (3)			
		In order, easy, with minor corrections and on time	Very good (4)			
		In order, easy, accurate and timely	Excellent (5)			
Partial exam (PE)	37%	50%-62.5%	Sufficient (2)	4	20	0,8
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
Oral exam (OE)	10%	50%-62.5%	Sufficient (2)	0,5	15,5	0,5
		62.5%-75%	Good (3)			
		75%-87.5%	Very good (4)			
		87.5%-100%	Excellent (5)			
TOTAL	**100%**	**(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4) +(PEx0,37)+(OEx0,1)**		65,5	55,5	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. The student can reasonably be absent from a maximum of 30% lectures and 20% exercises and cannot be absent from the field work. Attendance is evaluated by grades 2-5, and this grade is taken when calculating the final grade of the subject.	semester (64,5 hours of direct lecturer)	Exceptionally, in the case of a justified reason the student should compensate for the lack of individual lectures or field work
Exercises and reports from the field work	Exercises are attended by groups. As part of the exercise is carried out 15 practical exercises in forest ecology. At the beginning of each exercise, students receive task templates and the layout of exercise reports in printed form. Estimated accuracy, neatness and regularity (exercise submitted on time). From each exercise, the student gets a grade and the average of all grades in the exercise is taken when calculating the final score from the subject.	In accordance with the agreed terms.	Exceptionally, in the case of a justified reason, the student draws the absence of the individual exercise.
Partial exam	Students can write two written tests during the semester according to personal choice (first on half of the semester and the second at the end of the semester). Students who score more than 40% of the correct answers from both tests do not write a final written test. Students who do not reach 40% correct answers from the written test are writing the final written test. All test scores are taken in the calculation of the final grade of the subject.	7. and 15. week in semester	Students who do not pass two written tests may take the final written exam.
Written exam	A written final test is written by all students who have not passed two partial written tests during the semester. Students on the previously designed printed exam answer questions. All grades from the written tests participate in the calculation of the final grade of the subject.	Exam terms	The student has the right three times to go to the exam.
Oral exam	Students who pass a written test and who receive passive grades from exercises, and have passive grades from lectures, exercises, and field work attendance take the oral exam. Each student in the oral exam gets five questions and the number of correct answers refers to certain mark. The final grade of the subject is obtained according to the percentage representation of each grade in the overall rating according to the formula: **(Lax0,05)+(Eax0,05)+(FWax0,03)+(Ex0,4)+(PEx0,37)+(OEx0,1)**	Exam terms	The student has the right three times to go to the exam

Obligatory literature

1. EKOLOŠKI LEKSIKON, Glavni urednik Oskar Springer, Zagreb: Barbat, Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, 2001., 361 str.
2. Vjekoslav Glavač, 1999. UVOD U GLOBALNU EKOLOGIJU, Državna uprava za zaštitu prirode i okoliša : Hrvatske šume. 207 str., Zagreb.
3. Mihovil Gračanin, Ljudevit Ilijanić, UVOD U EKOLOGIJU BILJA, Školska knjiga, Zagreb 1977.
4. ŠUMARSKA ENCIKLOPEDIJA, Jugoslavenski leksikografski zavod, Zagreb, Knjiga 1,1980, Knjiga 2, 1983, Knjiga 3, 1987.

Recommended literature

1. Daniel B. Botkin, Edward A. Keller: ENVIRONMENTAL SCIENCE EARTH AS A LIVING PLANET (1-649 str.)
2. Eugene P. Odum, 1971.: FUNDAMENTALS OF ECOLOGY (1-574 str.)
3. Robert E. Ricklefs, 1990.: ECOLOGY (1-885 str.)
4. BIOLOŠKA I KRAJOBRAZNA RAZNOLIKOST HRVATSKE, Državna uprava za zaštitu prirode i okoliša, Zagreb 1999, str. 151.

F-Undergraduate study

Wood technology

Wood is a challenging, versatile and renewable natural resource that represents an important potential of the Croatian economy. The use of new technologies increases production efficiency and makes the wood industry profitable. Due to the raw material, the Rebublic of Croatia has real possibilities for increasing the production of wood products, with the aim of increasing sales and exports and reducing imports of final wood products. Wood Technology Department of the Faculty of Forestry with undergraduate study Wood technology ensures the education of professional staff necessary for the development of wood processing and furniture production in Croatia. Undergraduate study Wood technology provides basic knowledge from a wide range of technical natural sciences and the professional knowledge and skills required by the modern development of woodworking companies: knowledge of wood and wood technical properties, basic knowledge of wood protection, basic technical knowledge for machine monitoring and control and transport equipment, training for monitoring of woodworking processes and implementation of certain technological operations, participation in procurement of materials and other equipment, monitoring the quality of products and the quality of work, expert, operational knowledge for conducting woodworking processes. The undergraduate study program can only partially be compared with similar wood technology studies in Europe. Namely, the study of wood technology at the Faculty of Forestry of the University of Zagreb, as the only institution of higher education in Croatia has been developed in a variety of disciplines according to the needs of industrial wood processing in our country, as opposed to most European studies based on the narrower scientific areas of wood science wood technology. manual, operational knowledge for guiding woodworking processes. One part of the undergraduate study of wood technology can be compared to undergraduate studies at the University of Vienna, Austria (Bakkalaureatsstudiumus Holz und Naturfasertechnologie, Universität für Bodenkultur Wien) and undergraduate studies at Mendel University of Agriculture and Forestry in Brno, Czech Republic (Drevarstvi, Lesnicka and Ancient Fach , Mendelova zemedelska a lesnicka univerzita v Brne). Co-operation (bilateral agreements) has been established with faculties from European countries, which has helped to create a modern, new knowledge of a harmonized study program whose essential qualification is the training for professional work in woodworking and furniture manufacturing and preparation for continuing university graduate studies at the Faculty of Forestry and related faculties. This study derives from a previous study at the Faculty of Forestry of the Faculty of Forestry, founded in 1948, and has been upgraded through several reforms (five timber-technical education periods) until the last change in 2001. Students at the undergraduate study Wood Technology has enabled horizontal mobility within the field of Biotechnical Sciences and between European universities with which the University of Zagreb or the Faculty of Forestry has signed a cooperation agreement. A special program will enable the inclusion of undergraduate students of related faculties who want and have the conditions for listening to individual courses or for further graduate studies at the Faculty of Forestry. University bachelor of wood technology has been prepared for professional training through various workshops and seminars during his work, and in full time he is fully trained to continue his studies at the Faculty of Forestry for Graduate Programs in Wood Technology and Wood Product Design. The woodworking technician is qualified for expert work in all types of wood processing and processing companies, can work as an associate in woodworking and wood product distribution and perform certain tasks and tasks in wood industry. The woodworking technician is trained to monitor the drying process of wood and wood materials, to monitor the implementation of

technological processes in sawmills, veneer production, plywood panel and fragmented wood panel, furniture manufacturing, wood products in construction and other wood products.

Learning outcomes of undergraduate study Wood Technology

A General engineering competencies

A1 Apply a physical approach of experimental observation and mathematical modelling, solve mathematically various research and practical problems, statistically process, present and analyse data, and reach conclusions based on analysed data

A2 Apply basic laws of physics that present the basis of wood technology, understand Newton's axioms and apply them to solve technical problems, explain phenomena in the field of electrical engineering, and make accurate and optimal use of electric energy

A3 Competently maintain, work with and use the possibilities of basic technical components

A4 Apply skills in solving practical issues in the business, either by control measurements, calculations or testing verifications

B Focused engineering competencies

B1 Identify parts and shapes of trees, macroscopic, physical and chemical wood properties, identify and explain the anatomic structure of the xylem of wood-like plants, identify wood-like species based on different morphological characteristics, and apply theoretical and practical knowledge of commercially important indigenous and foreign species of wood and shrubbery

B2 Recognise and determine the most important types of xylophagous bacteria, insects, fungi and marine borers, and determine flaws on wood incurred due to their activity; learn the basic principles of wood protection based on physical, chemical and structural properties of wood, and apply basic procedures and methods for wood protection

B3 Apply knowledge about the mechanical properties of wood, mechanical properties arrangement within individual trees and group of trees, tree flaws and the influence of flaws on the mechanical properties of wood

B4 Apply technical knowledge for the purpose of mastering wood industry procedures and processes, means of work and material handling methods

B5 Organise transport of wood and wooden materials, calculate and adjust the capacities of means of transport with technological procedures, calculate and analyse energyconsumption, and recommend solutions for less complex wood and wooden material transport projects.

C Technological engineering competencies

C1 Analyse the wood cutting process, select, optimally use and maintain primary process machinery, select machinery working regimes and tools for final wood processing, and recommend project assignments to special equipment manufacturers

C2 Recognise and assess sawmilling raw material and products, conduct the categorisation and measurements of sawmilling raw material and products, apply basic skills of wood sawmilling technology and techniques of log and board sawing, and identify factors of successful sawmilling wood processes

C3 Monitor and control processes of massive wood, veneer and wood particle drying, other special drying processes, and wood steaming

C4 Recognise particular types of veneer and wood panel, analyse the basic structural components of wood panels, explain the interdependency of structural components and technical properties of wood panels, monitor and control the manufacturing process in wood board factories, select and use wood panels with optimal properties

C5 Size constructions, define systems of construction compositions, as a prerequisite for product construction, define the basic construction documentation and develop it systematically, apply CAD systems in wood industry and 2D modelling with the help of AutoCAD
C6 Use wood gluing technology, select materials with optimal properties important for final processing, apply simpler technological methods in final wood processing
C7 Define the specifics of wood usage in construction, recommend adequate applications of a particular type of wood for building purposes, recommend the basic shape, physical and construction solutions, explain and ensure functional requirements, types and construction solutions for main product groups
C8 Recommend materials and procedures that are applied in the wood finishing process in the interior and the exterior, operate the wood finishing process starting from base preparation to the hardening of the material

D Organisational engineering competencies

D1Plan and organise the time study, work rationalisation, and perform quality control in technological processes and on finished products, maintain supply, stock and logistic support optimization, plan and calculate the production, calculate basic business KPIs, write basic financial reports, recognise types of expenses
D2Perform wood industry specific calculations, define and analyse expenses, organise and conduct distribution, promotion and market research, plan products and product programmes, form product cost and selling prices, organise and conduct sales of wood and wooden products

E Development engineering competencies

E1 Continue specialization on university graduate studies at the Wood Technology Department of the Faculty of Forestry.

The link between learning outcomes and the outcome of learning a study program

Course code	General engineering competencies				Focused engineering competencies					Technological engineering competencies								Organisational engineering competencies		Development engineering competencies
	A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	D1	D2	E1
DT-1101	+	+		+																
DT-1102	+	+	+	+		+	+		+											
DT-1103		+			+		+													
DT-1104					+															
DT-1205		+																		
DT-1206					+															
DT-1207														+						
DT-1208			+	+																
DT-1209	+	+	+				+	+	+											
DT1210					+															
DT-2311										+										
DT-2312					+															
DT-2313							+	+					+	+						
DT-2314	+																			
DT-2315	+			+				+	+											
DT-2416														+						
DT-2417												+								
DT-2418										+	+							+		
DT-2419															+					
DT-2420													+							
DT-3521													+							
DT-3522																		+		
DT-3523															+					
DT-3524						+	+								+	+	+			
DT-3525																			+	
DT-3626																			+	
DT-3627	+			+				+									+			+
DT-3628																		+		
DT-3629					+															
DT-3630										+										
DT-3631													+	+						
DT-3632	+						+							+				+		
DT-3633	+			+			+	+					+	+			+	+		+

Obliagatory and mandatory courses of undergraduate study Wood Technology

I YEAR

Code	Type of course	L*	E*	F*	ECTS
	1. semester				
DT-1101	MATHEMATICS	45	45		7
DT-1102	PHYSICS	30	30		5
DT-1103	WOOD CHEMISTRY	45	45		8
DT-1104	WOOD ANATOMY	45	60		10
	TOTAL:	165	180		30
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE		30		
	2. semester				
DT-1205	TECHNICAL mechanics	30	30		5
DT-1206	BASIC OF DENDROLOGY	15	30		3
DT-1207	APPLIED TECHNICAL GRAFICS	15	30		5
DT-1208	WOODINDUSTRY ENGINEERING	30	30		5
DT-1209	BASIC OF ELECTROTECHNICS	30	30		4
DT1210	TECHNICAL PROPERTIES OF WOOD 1	45	60		8
	TOTAL:	165	210		30
	PHYSICAL AND HEALTH EDUCATION				
	FOREIGN LANGUAGE		30		

* E-lectures (hours/semester); E-exercise (hours/semester); F-field work (days/semester), ECTS (European Credit Transfer System)

II YEAR

Code	Type of course	L*	E*	F*	ECTS
	3. semester				
DT-2311	WOODWORKING MACHINERY 1	45	45		6
DT-2312	TECHNICAL PROPERTIES OF WOOD 2	30	30		4
DT-2313	WOOD PROTECTION I	45	45		7
DT-2314	BASIC STATISTICS	30	30		4
DT-2315	TRANSPORT EQUIPEMENT IN WOOD INDUSTRY	30	45		5
	FIELD WORK			5	4
	TOTAL:	180	195		30
	PHYSICAL AND HEALTH EDUCATION				
	4. semestar				
DT-2416	CONSTRUCTION OF WOODEN PRODUCTS 1	45	45		7
DT-2417	DRYING OF WOOD AND WOOD MATERIALS	30	45		5
DT-2418	SAWMILLING TECHNOLOGY 1	30	45		5
DT-2419	GLUES AND WOOD GLUING	30	30		4
DT-2420	FRAGMENTED WOOD PANELS	30	45		5
	FIELD WORK			5	4
	TOTAL:	165	210		30
	PHYSICAL AND HEALTH EDUCATION				

* E-lectures (hours/semester); E-exercise (hours/semester); F-field work (days/semester), ECTS (European Credit Transfer System)

Mathematics

DT-1101

ECTS 7

English language

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Assist. Prof. Maja Moro

Associate teacher for exercises
Assist. Prof. Maja Moro

Grading
Sufficient (2) 50 %
Good (3) 65 %
Very good (4) 78 %
Excellent (5) 90 %

Course content:
Course content is tailored to wood technology students. There is a need to preserve the complete material (functions, differential and integral account), but access to all the most important terms is maximized. The focus is on mastering the skills of mathematical models, the development of abstract thinking and analytical thinking, the precision of expression, the perception of the essence.

Type of course:

Mathematics (obligatory, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define and implement the tasks terms of mathematical logic, sets, sets of numbers and mathematical induction	partial exams, oral exam	A1, A2, A5
Define, analyze and relate the concepts and properties of real functions of a real variable, as well as terms related to a sequences (limit of a sequence, limit of a function)	partial exams, oral exam	A1, A2, A5
Define and apply the concepts tasks derivatives, indefinite and definite integrals	partial exams, oral exam	A1, A2, A5
Define, analyze and apply the tasks terms of functions of two variables	partial exams, oral exam	A1, A2, A5
Define the term and solve differential equations using method of separation of variables	partial exams, oral exam	A1, A2, A5

Define and apply in the tasks from basic elementary algebra (vectors and matrices)	partial exams, oral exam	A1, A2, A5

General competences

- Demonstrate competences in theoretical principles, calculation methods and visualization of data of different measurements
- Understand mathematical methods and laws applied in wood technology
- Apply mathematics knowledge in identifying, formulating, and solving engineer tasks
- Conduct conclusions and interpret results based on performed computer processing
- Planning for continuing academic development in the field of wood technology, and for the development of interest in lifelong learning and further professional education

Type of instruction

Lectures (45 hours)
Exercises (45 hours)
Student's work independently (120 hours)

Working methods:

Teacher's responsibilities:

Prepare teaching and exam materials
Regularly and conscientiously perform teaching and other forms of teaching work
Evaluate students' work on partial exams and final exams
Encourage students for autonomously work
Develop students' interest in mathematical content
Be available for student on teaching hours and non-teaching time

Student's responsibilities:

Attendance at lectures (minimum 80% hours = 36h) and exercises (minimum 80% hours = 36h). Writing homeworks. Active participation in teaching. Solving three mandatory colloquia during the semester. Accessing to oral exam after passing the colloquia (minimum 50% points in each).

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (**P**)	20%			45		1,4
Exercises (**V**)	20%			45		1,4
1st Partial exam ($\mathbf{K_1}$)	5%	(50 – 64)%	sufficient (2)		10	0,35
2nd Partial exam ($\mathbf{K_2}$)	25%	(65 – 77)%	good (3)		50	1,75
3rd Partial exam ($\mathbf{K_3}$)	20%	(78 – 89)%	very good (4)		40	1,4
Oral exam (**UI**)	10%	(90–100)%	excellent (5)		20	0,7
TOTAL	**100%**	**$0{,}2P+0{,}2V+0{,}05K_1+0{,}25K_2+0{,}2K_3+0{,}1UI$**		**90**	**120**	**7,0**

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (**P**)	20%			45		1,4
Exercises (**V**)	20%			45		1,4
***1st Partial exam (K_1)	5%	(50 – 64)%	sufficient (2)		10	0,35
Written exam (**PI**)	45%	(65 – 77)% (78 – 89)%	good (3) very good (4)		90	3,15
Oral exam (**UI**)	10%	(90–100)%	excellent (5)		20	0,7
TOTAL	**100%**	**$0,2P+0,2V+0,05K_1+0,45PI+0,1UI$**		**90**	**120**	**7,0**

*** students who do not pass all of three colloquium during the semester will approach the exam period (subject to the K_1)**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (**P**)	Attendance at lectures (minimum 80% of 45 hours=36h)		
Exercises (**V**)	Attendance at exercises (minimum 80% of 45 hours=36h)		
1st Partial exam (K_1)	Minimum 50% for access to 2nd Partial exam or to exam period		Multiple during semester
2nd Partial exam (K_2)	Minimum 50% for access to 3rd Partial exam		Multiple during semester
3rd Partial exam (K_3)	Minimum 50% for access to Oral exam		Multiple during the academic year
Written exam (**PI**)	Condition for access $0,8P+0,8V+0,5K_1$	exam period	
Oral exam (**UI**)	Condition for access $0,8P+0,8V+0,5K_1+0,5\ K_2+0,5\ K_3$ or $0,8P+0,8V+0,5K_1+0,5PI$		

Obligatory literature

1. Bradić, T. I sur., 1998: Matematika za tehnološke fakultete, Element, Zagreb
2. Javor, P., 2003.: Matematička analiza 1, Element, Zagreb

Recomended literature

1. Hitrec, V., 1986: Matematika (analiza funkcija) skripta, Šumarski fakultet Zagreb
2. Htirec, V., 1991: Matematika (funkcija od dvije varijable, integriranje i primjena), skripta, Šumarski fakultet Zagreb
3. Šego, V., 2005: Matematika za ekonomiste, Narodne novine d.d., Zagreb

Physics

DT-1102

ECTS 5

English language Rx

E-learning Rx

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Doc.dr.sc. Kristijan Radmanović

Associate teacher for exercises
Doc.dr.sc. Kristijan Radmanović

Grading
Sufficient (2) 50%
Good (3) 65%
Very good (4) 80%
Excellent (5) 90%

Course content:

The methods of research in physics. Physical quantities, units and dimensions. Errors of the measurements. Motions. Kinematics: Rectilinear motion (uniform motion, non-uniform motion, uniformly accelerated, free fall), Circular motion, Motion of bodies in gravitational field. Dynamics: Force, Lows of dynamics (Newton`s laws) Friction forces, Resistance of the mediumimpulse of the force, momentum, Work, Energy, and PowerDynamics of rotation: Newton`s second law for rotational motion. Harmonics motion, Mathematical and physical pendulum, Resonance, Waves, Sound, intensity of sound, ultrasound. Mechanics of liquids and gases: Pressure, Statics (Pascal`s law, hydro-and aerostatics, Archimedes principle), Dynamics (ideal fluid, viscous fluid, motion of an ideal fluid, Bernoulli`s equation, motion of a viscous fluid). Internal friction. Surface tension of liquids. Capillarity.Heat: Measurement of temperature, Thermal expansion of solid and liquids, Quantity of heat, Heat capacities, First law of thermodynamics, Ideal gas laws, Mixtures of ideal gases, Basic thermodynamic processes, Power cycles, Transmitted of heat, Changing the aggregate state. Manufacture of steam. Wet air. Mollier's hx diagram.

Type of course:

Physics (compulsory collegium, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify the vector and scalar quantities.	colloquium, final exam, oral exam	A1
Explain the physical quantities that describe translational motion	colloquium, final exam, oral exam	B3
Different types of translational motion and performing kinematic expressions of translational motions.	colloquium, final exam, oral exam	A2
Analyze the graphic description of the translational motion.	colloquium, final exam, oral exam	B5
Explain and perform expressions describing a uniform circular motion. Describe the effects of centripetal and centrifugal forces.	colloquium, final exam, oral exam	B3
Analyze the horizontal, vertical and pieces shot	colloquium, final exam, oral exam	B5
Explain Newton's laws of motion. Explain Newton's general law of gravitation.	colloquium, final exam, oral exam	B3
Distinguish the basic forces in nature. Sketch and analyze the action of more force on the body. Find out the expressions for the force impulse and the amount of motion.	colloquium, final exam, oral exam	A3
Derive expressions for the impulse force and momentum.	colloquium, final exam, oral exam	B2
Analyze the graphical description of the isothermal, arsenic and isobaric changes of the state of ideal gases.	colloquium, final exam, oral exam	A5
Interpret the concept of work in the isobaric, isothermal and adiabatic change of state of an ideal gas	colloquium, final exam, oral exam	B2
Explain and analyze Carnot's circular process.	colloquium, final exam, oral exam	B3
Handle Mollier's h-x diagram.	colloquium, final exam, oral exam	B5

General competences

Understanding the basic natural principles on which one part of the wood technology is based.
Mastering the scientific physical approach of experimental observation and mathematical modeling of reality, to apply this method in the field of wood technology.
Explain certain processes and how to determine their parameters. Physical approaches strengthen the level of inferences and skills of mathematical solving of research and practical problems.

Type of instruction
Lectures
Exercises

Working methods:

Teachers' obligations:
Maintaining the original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Partial exam 1 (PE 1))	30%	50-64%	Sufficient (2)	30	45	2,5
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE 2)	30%	50-64%	Sufficient (2)	30	45	2,5
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**			60	90	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	50 %	50-64%	Sufficient (2)	60	90	5
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**					

*** Students who do not pass through the semester during the semester will approach the exam time of 50% of the grade, and the remaining 50% make the grade from the oral part of the exam.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Partial exam 1	Students who regularly attend classes can access the first colloquium. The quiz consists of 5 assignments, each assignment being 20 points. Students have met the first partial exam if they achieve 50 points.	8. week	Exceptionally, in the case of a justified reason for the absence.
Partial exam 2	Students who attend classes regularly and who have collected at least 50 points in the first colloquium can approach another colloquium. The second colloquium consists of 5 assignments, each assignment being 20 points. The students met the second exam if they scored 50 points.	15. week	Exceptionally, in the case of a justified reason for the absence.
Written exam	Exams can be accessed by students who regularly attend classes and did not meet the first or second qualifications. The written exam consists of 5 assignments, each carrying 20 points. The students met the written exam if they achieved 50 points, after which they approached the oral exam. The written exam is evaluated and participates in the final grade of the subject	examination deadlines	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is the arithmetic mean of the written and oral part of the exam.	-	Exceptionally, in the case of a justified reason for the absence.

Obligatory literature

1. Miljenko Primorac, Mehanika, interna skripta
2. Petar Kulišić i dr., Fizika, Mehanika-termodinamika, Školska knjiga Zagreb, 1991.

Recommended literature

1. N. Cindro, Fizika 1, Mehanika-Valovi-Toplina, Školska knjiga Zagreb, 1975.
2. P. Kulišić i V. Henč-Bartolić, Valovi i Optika, Školska knjiga Zagreb, 2004.
3. F. Bošnjaković, Nauka o toplini I i II, Tehnička knjiga Zagreb, 1978. i 1976.
4. Jakopović i V. Lopac, Fizika 1, Školska knjiga Zagreb, 2004.
5. P. Kulišić, Fizika 3, Školska knjiga Zagreb, 2004.
6. D. M. Burns i S. G. G. MacDonald, Physics for Biology and Pre-Medical Students, Inc. Racine, Massachusttes, USA 1970. i Školska knjiga Zagreb 1975. (Fizika za biologe i medicinare).

Wood Chemistry

DT-1103

ECTS 8

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Associate Professor Alan Antonović, PhD.

Associate teacher for exercises
Associate Professor Alan Antonović, PhD.

Grading

Sufficient (2) 51-63%
Good (3) 64-76%
Very good (4) 77-89%
Excellent (5) 90-100%

Course content:

Wood structure, density of wood, water content, chemical composition of wood, analysis of elements in wood, analysis of wood age. Inorganic substances in wood, content and role of inorganic substances, wood ash. Chemical reaction of wood. Fundamentals of carbohydrate chemistry, monosaccharides, oligosaccharides, polysaccharydes. Cellulose, molecular and supramolecular properties. Nature and classification of polyoses, xylans, mannans, glucans, galactans, pectins. Fundamentals of aromatic compounds, phenols, precursors of lignin. Synthesys and role of lignin, structure and properties of lignin. Instrumental and chemical methods analyses of cellulose and lignin. Extractives, extractives of softwood. Extractives of hardwood, extractives from foliage, buds and fruits. Acidity of wood, measuring the pH of wood. Chemical composition of bark, cellulose, polyoses, lignin, polyphenoles, suberin, extractives. Combustion and pyrolysis of wood, degradation of wood

Type of course:

Wood chemistry (obligatory subject, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Use the knowledge acquired in different areas of wood technology, and to solve technological and qualitative tasks and problems in the wood industry.	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	A2
Explain the chemical composition and properties of wood and apply the same during the basic working and processing of wood	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	B1
Analyze and isolate all chemical components, whether analytically or instrumentally, related to determining different properties or for further working and processing of wood.	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	B3

		90-100% (180-200 points)	excellent (5)			
2. partial exam (PE2)	50%	51-63% (102-126 points)	sufficient (2)	5	45	3
		64-76% (128-153 points)	good (3)			
		77-89% (154-179 points)	very good (4)			
		90-100% (180-200 points)	excellent (5)			
Total Final mark (FM)	**100%**	FM = PE1x50 + PE2x50)/100		100	140	8

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100%	51-63% (102-126 points)	sufficient (2)	5	90	1
		64-76% (128-153 points)	good (3)			
		77-89% (154-179 points)	very good (4)			
		90-100% (180-200 points)	excellent (5)			
TOTAL Final mark (FM)	**100%**	**FM = FEx100/100**		5	90	1

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Elementi praćenja	Opis	Rok	Nadoknada
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from the direct teaching as much as stipulated in the Rulebook on Studying.	Semester (90 hours of direct lecturer and exercies)	-
Exercises (E)	As a part of the exercise, 15 practical laboratory exercises in the chemical laboratory are conducted, which are related to the subject content and the knowledge upgrade adopted during the lectures. Students with task assignments and instructions for making all 15 exercises, as well as the appearance of the fascicles, liners and inserts, receive during the the first exercise in the form of Work Log. Exercise 1. The basics of laboratory chemistry work in the Work log is also a material for the qualification partial exam which is a prerequisite for the presence of other laboratory exercises in the chemical laboratory. The qualification partial exam consists of 8 questions and you need to answer exactly or more 5 answers for passage.	Continuously during the term of the semester according to the agreed term. Students who have created and explained all the exercises and those accepted by the teachers can access the exam.	-
Partial exam (PE)	Examination through the partial exams consists of two parts (1st and 2nd partial exam). Each partial exam consists of three units, namely (1) tasks, (2) structural formulas and (3) theories, and they must be taken in that order. The tasks consists of three questions (2 exact answers are required for the passage and does not enter the total sum of points) and the structural formula and theory of 10 questions where each question is worth for a maximum of 10 points (51% points required for the passage). The minimum number of points from both partial exams is 204 and a maximum of 400. The total score from the partial exams is also the final grade (no oral part of the exam).	Partial exam terms	
Written exam (WE)	Students who do not pass through the partial exams during the semester will approach the final exam that makes 100% of the grade. The final exam consists of three units, namely (1) tasks, (2) structural formulas and (3) theories and they must be taken in that order. The tasks consists of three questions (2 exact answers are required for the passage and does not enter the total sum of points) and the structural formula and theory of 10 questions where each question is worth for a maximum of 10 points (51% points required for the passage). The minimum number of points obtained is 102 and a maximum of 200.	Written xam terms	-
Oral exam (UI)	The oral exam is only in case the students want a higher final grade than the written exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score.	Exam terms	-

Obligatory literature

1. V. Sertić: Kemija drva, skripta, Zagreb, 2000., str.1-120
2. M. Kaić, Organska kemija, Šumarski fakultet, Zagreb, 1991.
3. M. Hus, Predavanja iz organske kemije i polimera, Šumarski fakultet, Zagreb, 2000.
4. H.S. Pine i drugi. Organska kemija, Školska knjiga, Zagreb, 1991.

Recommended literature

1. V. Rapić, Nomenklatura organskih spojeva, Školska knjiga, Zagreb, 1991.
2. E. Sjöström, Wood chemistry, Fundamentals and Applications,Academic Press, New York, 1981.
3. D. Fengel, G. Wegener, WOOD, Chemistry, Ultrastructure, Reactions, Walter de Gruyter, Berlin-New York, 1989.

Wood Anatomy

DT1104

ECTS 10
English language R1

E-learning R1

Teaching hours 105
Lectures 60
Exercises45

Lecturer
Prof.dr.sc. Jelena Trajković
Izv.prof.dr sc. Bogoslav Šefc

Associate teacher for exercises
Prof.dr.sc. Jelena Trajković
Izv. prof. dr. sc. Bogoslav Šefc
Dr.sc. Iva Ištok

Grading

Dovoljan (2) 60
Dobar (3) 71
Vrlo dobar (4) 81
Izvrstan (5) 91

Course content:

Introduction: The aims of wood anatomy. The origin of wood in plant kingdom. Commercial utilisation. Methods in wood anatomy. Coarse structure of wood. Structure of vascular plants: basic parts of a vascular plant, primary and secondary growth. The origin and development of wood cells. Tissues. Cambium. Cell and cell wall: dimensions, forms, parts, divisions, development of cell wall. Composition and distribution of cell wall components in wood cells. Submicroscopic structure and organisation of cell wall. Sculptures of the cell wall: pits, perforations of vessel members, spiral thickenings and dentations, warty structures and warty pits. Macroscopic and microscopic structure of conifer wood: types of cells and tissues, their distribution and shape, useful features in identification of conifer wood, comparative anatomy of different kinds of conifer woods. Macroscopic and microscopic structure of hardwoods: types of cells and tissues, their distribution and shape, useful features in identification of hardwoods. Comparative anatomy of different kinds of hardwoods, guide through the hand lens key for identification of selected wood species. Wood identification: methods, limiting conditions, wood identification keys. Wood structure variations inside the species and inside the tree. Physical nature of wood, moisture content, dimensional changes, specific weight and density, porosity, permeability. The influence of wood structure on shrinking, density, permeability and final utilisation of wood. Irregularities of wood structure.

Type of course:

Wood anatomy (mandatory subject, 1. semestar, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain main terms of macroscopic, microscopic and submicroscopic characteristics of wood structure useful for its identification and for technical wood properties.	Exercises in practicum, colloquium and exam	B1
differentiate native comercial wood species on the base of their microscopic and macroscopic characteristics with help of wood identification keys.	Exercises in practicum, colloquium and exam	B1
Explain variations in wood anatomy structure within tree, between trees of each species and explain the influence of variations in wood structure on technical porperties of wood and its use.	Exercises in practicum, colloquium and exam	B1
Explain the origin of natural wood „defects“ and recognize them and explain their influence on selected technical properties.	Exercises in practicum, colloquium and exam	B1
Explain the influence of wood anatomy structure on its technical properties	Exercises in practicum, colloquium and exam	B1

General competences

Students achieve teorethical knowledge about origin and formation of wood in tree. They can define and describe macroscopic, microscopic and submicroscopic wood structure.
Students know the role of wood structure in selected technical properties of wood and differentiate variations in wood structure.
By application of keys for wood identification, differentiate native comercial wood species on the base of their macroscopic and microscopiccharacteristics

Type of instruction

Lectures

Exercises

Eleven practical exercises of the microscopic and macroscopic identification of wood are performed as part of laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers obligations:
Maintaining original lessons - lectures, exercises. Providing colloquia, oral exams and consultations. Creating teaching and testing materials.

Students obligations:

Regular attendance and active participation in lectures and exercises. A justified absence of up to 20% of lectures and 10% of exercises is allowed (Article 30 of the Ordinance on Undergraduate and Graduate Studies at the Faculty of Forestry of the University of Zagreb). Taking colloquia and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-	-	-	45	45	3
Exercises (E)	5%	Mostly inaccurate, with major corrections	Sufficient (2)	60	60	4
		Mostly accurate, with corrections	Good (3)			
		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Microscopic Wood Identification Colloquium (C1)	5%	Constant help of the examiner	Sufficient (2)	2	30	1
		Partial help of the examiner	Good (3)			
		Minor help of the examiner	Very good (4)			
		without any help of the examiner	Excellent (5)			
Macroscopic Wood Identification Colloquium (C2)	15%	Constant help of the examiner	Sufficient (2)	2	30	1
		Partial help of the examiner	Good (3)			
		Minor help of the examiner	Very good (4)			
		without any help of the examiner	Excellent (5)			
Exam (E_x)	75%	60-70%	Sufficient (2))	1	25	1
		71-80%	Good (3)			
		81-90%	Very good (4))			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex5+ C1x5 + C2X15+ E_XX75)/100**		110	190	10

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and recorded.	Semester	-
Exercises (E)	Exercises are attended by groups. There are 7 practical exercises of microscopic and macroscopic recognition of wood. The accuracy, tidiness and regularity of performance are evaluated.	Semester (15 hours of exercises)	Exceptionally, in the case of a justified reason
Microscopic Wood Identification Colloquia (C1)	It consists of determination of 2 types of coniferous and wood with the aid of keys. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Colloquia can be taken three times in one academic year
Macroscopic Wood Identification Colloquia (C2)	It consists of determination of 10 types of coniferous and dicotyledonous woods with the aid of magnifiers. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Colloquia can be taken three times in one academic year
Exam (E_x)	The exam can be attended by students whose exercises and colloquia were evaluated positively. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students get questions from different part of the subject program. Final mark of subject is achieved from the formula: **Ex5+C1x5+C2x15+Ex75/100**		

Obligatory literature

1. Na internet stranici http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74
2. pod predmet Strukturna svojstva drva, pod PREDAVANJA nalaze se poveznice: Predavanja iz
3. predmeta strukturna svojstva drva (skripta, autori: Jelena Trajković i Bogoslav Šefc, pdf
4. dokument oko 3 MB) i Atlas slika uz predavanja (Ilustracije uz predavanja, sabrali: Jelena Trajković i Bogoslav Šefc, pdf dokument oko 39 MB)

5. Z. Špoljarić 1978: Anatomija drva, Šumarski fakultet, Zagreb - može i starija izdanja
6. Anatomija drva e-kolegij na sustavu za udaljeno učenje:

7. https://moodle.srce.hr/2018-2019/course/view.php?id=37196

Recommended literature

1. Panshin, A. J.; Zeew, C. de, 1980: Textbook of wood technology, McGraw-Hill, Inc. 722 str.
2. Schweingruber, F.H., 1990: Anatomy of European woods, Paul Haupt Berne and Stuttgart Publishers, 800 str.
3. Špoljarić, Z.; Petrić, B.; Šćukanec, V., 1969: Višejezični rječnik stručnih izraza u anatomiji drva, Poslovno udruženje šumskoprivrednih organizacija, Zagreb, 85 str.
4. Šumarska enciklopedija, HLZ Miroslav Krleža, Zagreb
5. Osnove nauke o drvu, Šumarski fakultet Sveučilišta u Zagrebu, 1985. (Drvo, Anatomija drva)

Physical and Health Education

ECTS points 0

English R1

Hours of classes 60
Lectures 0
Exercises 60
Field work 0

Lecturer

Leader of exercises
Sen. Lec. Davor Pavlović

Evaluation
Continuous monitoring of presence and participation in exercises and the acquisition of motor skills of kinesiology.
Course contents:

The Physical and health programs at the Faculty of Forestry of the University of Zagreb are carried out as:

- Basic programs,
- Special programs,
- Programs for students with special needs
- Elective programs for students of senior years.

Teaching is carried out by choice of students of a particular teaching unit and content that is a part of one of the above programs. The aim of this course is the acquisition of theoretical and practical kinesiological knowledge with the purpose of training students for independent physical exercise. At the same time, students are informed about the importance of health education in order to preserve and improve health, the harmfulness of various forms of addiction to health, in particular the impact on intellectual efforts and physical exercise.
Students acquire knowledge about the importance of quality nutrition and the most interesting results of previous research carried out on the student population in the health segment (prevention, diseases, diet, diagnostics, stress, physical activity as a relaxation agent ....).

Types of classes:

- Physical and Health Culture general forestry (compulsory elective course, 1st semester, year 1)
- Physical and Health Culture general forestry (compulsory elective course, 2nd semester, year 1)
- Physical and Health Culture general forestry (compulsory elective course, 3rd semester, year 2)
- Physical and Health Culture general forestry (compulsory elective course, 4th semester, year 2)
- Physical and Health Culture urban forestry (compulsory elective course, 1st semester, year 1)
- Physical and Health Culture urban forestry (compulsory elective course, 2nd semester, year 1)
- Physical and Health Culture urban forestry (compulsory elective course, 3rd semester, year 2)
- Physical and Health Culture urban forestry (compulsory elective course, 4th semester, year 2)
- Physical and Health Culture-wood technology (compulsory elective course, 1st semester, year 1)
- Physical and Health Culture-wood technology (compulsory elective course, 2nd semester, year 1)
- Physical and Health Culture-wood technology (compulsory elective course, 3rd semester, year 2)
- Physical and Health Culture-wood technology (compulsory elective course, 4th semester, year 2)

Learning outcomes and methods of verification

Learning outcomes (IU)	Methods of verification	The connection with the UI study program
Describe the structure of the physical exercise class.	exercises, correction and evaluation exercises	D1
Explaination of the impact of physical exercise on health.	exercises, correction and evaluation exercises	D1
Choose fitness exercises designed to strengthen individual muscle groups.	exercises, correction and demonstration	D1
Demonstrate specific exercises with regard to kinesiologic activity.	exercises, structural analysis, assistance, correction and evaluation exercises	D1
Organize constructive free time	Exercises and evaluation exercises	D1
Assess personal diet and physical exercise habits.	exercise, diet diary correction and evaluation exercises	D1
Demonstrate general preparatory exercises and stretching exercises.	exercises, description, demonstration, correction	D1
Understanding kinesiology programs and their target orientation.	vježbe, korekcija i vrednovanje vježbi	D1
Control emotions and strengthen self-control.	Exercises, correction	D1

General competences

Social-civic competences- Understanding of social behavior and codex from a different environment, creating new social contacts and friendships. Organizational competences in teamwork - networking and creating contacts, contributes to group relationships and efficiency **.** Methodical - didactic kompetencije- Management of time in the learning process, the ability to use new knowledge in practice

Class forms:
Field work
Practical exercises in different sports facilities depending on the choice of activity

Lectures
Health care for students

Exercises

Practical exercises from basic, special or elective programs in different working conditions, with the option to apply different trainers and aids

Methods:

Teacher responsibilities:
Teaching - exercise and consultation with students, professional training of teachers, organization and preparation of sports teams and organization of faculty sports competitions .. Creating teaching materials.

Student responsibilities:
Regular attendance and active participation in exercises.

Reccomended literature:

1. Bos, K. (2004.) Walking to health, Mozaik knjiga
2. Colwin, C., M. (1998). Swimming for the 21st Century, Gopal d.o.o.
3. Cook, B., C. (1996) Strength Basics. Your Guide to Resistance Training for Health and Optimal Performance, Human Kinetics
4. Ćurković, S. (2010). Kinesiological Activities and Risk Behavior of Students, Dissertation. Faculty of Kinesiology, University of Zagreb
5. Janković, V. i Marelić, N. (1995). Volleyball, Faculty of Physical Culture in Zagreb
6. Neljak, B. i Caput-Jogunica, R. (2012) Kinesiology Methodology in Higher Education, Faculty of Kinesiology, University of Zagreb
7. Pavlović, D.(2010.) Script for Students of the Faculty of Forestry of the University of Zagreb
8. Sertić, H. (2005.) The Basics of Martial Arts, Faculty of Kinesiology, University of Zagreb
9. Šatalić, Z.(2016.) Sports nutrition, Znanje d.o.o, Textbooks of the University of Zagreb
10. Šnajder, V. (1995) From start to finish, Školske novine, Zagreb
11. Proceedings International Scientific Conference on Kinesiological Recreation and Quality of Life, ur. M. Andrijašević (2008) Faculty of Kinesiology, University of Zagreb

Engineering mechanics

DT - 1205

ECTS points 5

English language R1

E-learning R1

Teaching hours 60
Predavanja 30
Vježbe 30

Lecturer
Prof.dr.sc. Stjepan Risović

Associate teacher for exercises
Marko Rastija, mag. ing. mech.

Grading

Sufficient (2) 50 - 67%
Good (3) 68 - 78%
Very good (4) 79 - 89%
Excellent (5) 90% - 100%

Course content:

The basics of solid body statics. Definition of force and moment. Determining the resultant force. Conditions for equilibrium of forces as a result of the first axiom of mechanics. Replacement of real construction with computational model. Friction phenomenology. Dry friction. Limiting friction. Coulomb's law. The basics of mechanics of materials. The difference between a rigid and deformable solid body. Definition of the term stress. The stresses in point depend on the orientation of the surface on which they are computed. Definition of deformation and stress-deformation relationship in real materials (Hooke's law). Definition of terms engineering and allowable stresses and factor of safety for each type of material derived from material testing. Formulae for stress and deformation in structures with axial, shear, torsion and bending loading are described. Analysis of internal forces and moments in various structural members. Construction of Q, M, N diagrams. Statically indeterminate problems are solved using the method which combines the analysis of deformations with conventional analysis of forces used in statics. Basic concepts of the stability of columns (buckling) are given.

Type of course:

-Engineering mechanics (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determine the resultant force of system of forces acting on a body	partial exams, written exam, oral exam	A2
Calculate the moment of force around an axis	partial exams, written exam, oral exam	A2
Model the contact forces at the body contact points with the other body and environment	partial exams, written exam, oral exam	A2
Write conditions / equations for equilibrium of forces acting on a body	partial exams, written exam, oral exam	A2
Calculate reactive forces to keep the body in equilibrium	partial exams, written exam, oral exam	A2
Calculate the force of friction	partial exams, written exam, oral exam	A2
Determine the forces of belt friction	partial exams, written exam, oral exam	A2
Determine axial forces and draw axial forces diagram for axially loaded rods	partial exams, written exam, oral exam	A2
Determine sheer forces and bending moments and draw diagrams of shear forces and bending moments on a beam	partial exams, written exam, oral exam	A2
Calculate twisting moments of torsionally - loaded shaft and draw diagrams of twisting moments	partial exams, written exam, oral exam	A2
Determine stress and deformation of axially loaded rod	partial exams, written exam, oral exam	A2
Determine shear stress	partial exams, written exam, oral exam	A2
Calculate stress and deformation of a shaft subjected to torsion	partial exams, written exam, oral exam	A2

Determine bending stress	partial exams, written exam, oral exam	A2
Determine dimensions of cross sections of structural members based on material strength criteria	partial exams, written exam, oral exam	A4
Examine the stability of columns	partial exams, written exam, oral exam	A2

General competences

Understanding of the Newton three fundamental laws of mechanics and their application to the solution of engineering problems.
Ability to analyse any problem in a simple and logical manner.
Becoming able to design mechanical structures e.g. to determine such cross-sectional and material properties that the structures, subjected to given loading, can perform without failure.

Type of instruction
Lectures
Exercises

Working methods:

Teachers' obligations:
Delivering lectures, exercises. Organizing and setting partial exams, written exams, oral exams, holding consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Passing tests and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average student's workload hours outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	-	0
Exercises (E)	-	-	-	30	-	0
Partial exam 1 (PE1)	17 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	1,0

Partial exam 2 (PE2)	17 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	1,0
Partial exam 3 (PE3)	17 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		15	1,0
Oral exam (OE)	49 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	2
TOTAL	**100%**	**((PE1+PE2+PE3)x17+OEx49)/100**		60	90	5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average student's workload hours outside the direct teaching**	**ECTS points**
Written exam* (WE)	50 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	2,5
Oral exam* (OE)	50 %	50 – 67 % 68 – 78 % 79 – 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	2,5
TOTAL	**100%**	**(WEx50+OEx50)/100**				**5**
*** Students who do not pass tests during the semester will approach the exam, during examination period, that makes 100% of the grade (written exam - 50%, oral exam - 50%)**						

Detailed description of evaluation elements for lectures, exercises, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. The student can miss maximum 20% of hours of direct teaching.	semester (60 hours of direct teaching)	-
Partial exams (PE1, PE2, PE3)	Students who regularly attend classes can take semester tests, making it easier pass the exam "stage by stage". The semester tests are evaluated and participate in the final grade.	K1 – 6. week K2 – 11. week K3 – after the lectures	-
Written exam	Exams can be taken by students who have sufficient attendance at lectures. Students solve tasks containing computational problems. The written exam is evaluated and participates in the final grade of the subject.	Examination period	-
Oral exam	Students who pass 3 semester tests or a written exam are asked questions from different parts of the curriculum content. The final grade of the course is obtained according to the formula **((PE1+PE2+PE3)x17+OEx49)/100 or (WEx50+OEx50)/100**		

Obligatory literature

1. Damić V.: Statika, Hrvatska sveučilišna naklada, Zagreb 2000.
2. Matejiček F., Semenski D., Vnučec Z.: Uvod u statiku sa zbirkom zadataka, Golden marketing, Zagreb, 1991.
3. Alfirević I.: Nauka o čvrstoći, Tehnička knjiga, Zagreb 1989.

Recommended literature

1. Beer F., Johnston R.: Vector Mechanics for Engineers, Statics, McGraw-Hill, New York 1988.
2. Beer F., Johnston R.: Mechanics for Materials, McGraw-Hill, New York 1992.

The Basics of Dendrology

DT-1206

ECTS 3

English language R1

E-learning R2

Teaching hours 45
Lectures 15
Exercises 30

Lecturer
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Associate teacher for exercises
Professor Marilena Idžojtić, PhD
Assistant Professor Igor Poljak, PhD

Grading
Sufficient (2) 60-70%
Good (3) 71-80%
Very good (4) 81-90%
Excellent (5) 91-100%

Course content:

The basic botanical and dendrological terms important for understanding the course. Biological features, morphological characteristics, number of species and distribution of selected genera of gymnosperms and angiosperms. Morphological characteristics, distribution, special characteristics, economic importance of the species among these genera. The genera belong to the following families: *Pinaceae*, *Taxodiaceae*, *Cupressaceae*, *Taxaceae*, *Platanaceae*, *Ulmaceae*, *Moraceae*, *Juglandaceae*, *Fagaceae*, *Betulaceae*, *Tiliaceae*, *Salicaceae*, *Rosaceae*, *Fabaceae*, *Myrtaceae*, *Hippocastanaceae*, *Aceraceae*, *Simaroubaceae*, *Oleaceae* and *Scrophulariaceae*. The course covers economically most important autochthonous and allochthonous tree species, and the topics of the lectures follow a systematic order.

Type of course:

The Basics of Dendrology (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To define and explain biological features and morphological characteristics of the selected genera of autochthonous and allochthonous gymnosperms and angiosperms;	final exam	B1
To identify and describe economically important autochthonous and allochthonous gymnosperm and angiosperm tree species according to: bark, twigs and buds in winter, leaves, cones, fruits and seeds;	final exam	B1
To use determination keys;	final exam	B1
To group autochthonous and allochthonous gymnosperm and angiosperm tree species according to biological features, morphological characteristics, distribution and economic importance;	final exam	B1

General competences

Students acquire theoretical and practical knowledge about economically important autochthonous and allochthonous tree species. Theoretical knowledge encompasses biological features, morphological characteristics and distribution. Students acquire practical skills to recognize economically important trees on the basis of different morphological characteristics: habit, bark, twigs of deciduous species in winter, leaves, cones, fruits and seeds.

Type of instruction

Lectures

Exercises

The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, cones, fruits and seeds. The students use plant material and determination keys.

Working methods:

1. **Teachers' obligations:**
   Giving lectures and exercises. Holding consultations, written and oral exams. Mentoring students in the writing of their theses. Taking photos of woody plants, making digital teaching and learning materials, entering data into the internal database of woody plants and internal database of exam questions for learning and examination. Tracking professional and scientific literature required for teaching. Preparation of materials for the dendrological collection and classroom: collection herbarium specimens, twigs of deciduous species in winter, cones, fruits and seeds, processing, marking, systematisation and storage of collected plant material. Preparation of new and maintenance of existing

herbarium specimens in the scientific herbarium of the Faculty of Forestry. Digitising herbarium specimens and entering data into the database of scientific herbarium.

2. Studenats' obligations:

Regular attendance at lectures and exercises. Writing exercise reports. Collecting herbarium specimens. Doing and submitting homework. Passing final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				15		0.5
Exercises (E)	5%	60-70%	Sufficient (2)	30		1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Homework (HW)	5%	70-80%	Sufficient (2)		15	0.5
		81-89%	Good (3)			
		90-94%	Very good (4)			
		95-100%	Excellent (5)			
Herbarium collection (H)					15	0.5
TOTAL	**10%**	**(Ex5+HWx5)/100**		45	30	2.5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	90 %	60-70%	Sufficient (2)		15	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx90+Ex5+HWx5)/100**				
*** students take the final exam that is 90% of the grade; the remaining 5% is the grade of the exercises and 5% the grade of the homework**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Student attendance is recorded. Student may not be absent more than 20% of lectures and 10% of exercises.	II semester	
Exercises	The exercises are attended in groups. The students use plant material and determination keys. The practicum exercises enable students to acquire practical skills to recognize woody species on the basis of different morphological characteristics: leaves, twigs of deciduous species in winter, cones, fruits and seeds. At the end of each exercise the accuracy of determination is evaluated, and the evaluation affects the final grade.	II semester	
Homework	After each lecture and practicum exercises, the students do their homework and submit it via the Herbarium DEND application. The homework is evaluated and affects the final grade.	II semester	
Herbarium collection	On field exercises students collect herbarium specimens. Professor's signature confirms the accuracy of the herbarium.	II semester	
Written exam	Access requirements: professor's signature (regular attendance at lectures and exercises; positively graded all exercises and homework; collected and signed herbarium).	Exam terms	
Oral exam	Access requirement: positively graded written exam. In the oral part, apart from theoretical knowledge, students have a practical determination of trees according to different morphological characteristics. The final grade is obtained according to the formula: (FEx90+ Ex5+HWx5)/100	Exam terms	

Obligatory literature

1. Idžojtić, M., 2005: Listopadno drveće i grmlje u zimskom razdoblju. Šumarski fakultet Sveučilišta u Zagrebu. 256 pp.
2. Idžojtić, M., 2009: Dendrologija – List. Šumarski fakultet Sveučilišta u Zagrebu. 904 pp.
3. Idžojtić, M., 2013: Dendrologija – Cvijet, češer, plod, sjeme. Šumarski fakultet Sveučilišta u Zagrebu. 672 pp.
4. Šumarska enciklopedija Vol. I-III, 1980-1987. JLZ Miroslav Krleža, Zagreb.

Recommended literature

1. Anić, M., 1946: Dendrologija. Šumarski priručnik I, Zagreb. 475-582 pp.
2. Bean, W.J., 1989: Trees and shrubs hardy in the British Isles. John Murray Publ., Ltd., London.
3. Fitschen, J., 2007: Gehölzflora. Quelle und Meyer Verlag, Wiebelsheim. 915 pp.
4. Herman, J., 1971: Šumarska dendrologija. Stanbiro, Zagreb. 470 pp.
5. Hillier, J., Coombes, A. (Eds.), 2007: The Hillier manual of trees and shrubs. A David and Charles Books, Cincinnati.
6. Roloff, A., A. Bärtels, 2008: Flora der Gehölze. Bestimmung, Eigenschaften und Verwendung. Eugen Ulmer KG, Stuttgart. 853 pp.
7. Roloff, A., Weisgerber, H., Lang, U.M., Stimm, B. (Eds.), 1994–weiter: Enzyklopädie der Holzgewächse: Handbuch und Atlas der Dendrologie. Wiley-VCH.
8. Šilić, Č., 1973: Atlas drveća i grmlja. Zavod za izdavanje udžbenika, Sarajevo. 218 pp.
9. Vidaković, M., 1993: Četinjače – morfologija i varijabilnost. GZH & Hrvatske šume, Zagreb. 744 pp.

Applied technical graphics

DT-1207

ECTS 5

English language R1

E-learning R1

Teaching hours xy
Lectures 15
Exercises 30

Lecturer
Prof. Anka Ozana Čavlović, PhD

Associate teacher for exercises

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to computer drawing program AutoCAD. Introduction to drawing domain, selection line and tools, dialog frames. Measure standard. Drawing units choose. Paper area placement, drawing limits and measure units. Line type and layer properties orders. Introduction to x,y coordinates systems of AutoCAD – WCS and UCS. Absolute and relative coordinate system. Orthogonal drawing and tools. Movement, select, modifying drawing orders. Point, line, construction line and ray drawing. Cutting, copying and moving object orders. Trim, stretch and extend object orders. Text creation, text style, one or two-line text writing. Polygons and curves drawing with AutoCAD. Dimension lines, layout and print order. Orthogonal projection. Sections A-A, B-B, C-C. 3D projection. Introduction to x,y,z coordinates system for isometric, dimetric and oblique projection. 3D projection of basic geometry objects determines with orthogonal projection. Isometric drawing of basic and complex geometry objects with AutoCAD. Central projection. Perspective construction of point. Perspective construction of basic geometry objects. Perspective construction of rooms determines with orthogonal sections.

Type of course:

Applied technical graphics (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Apply the technical standards of orthogonal projection drawing (T, N, B, T1, N1, B1) (type of lines, technical letter, paper format, scale, dimensioning) according to the given 3D sketch or model measurement;	correction and evaluation of exercises, final exam	C5
Apply the technical standards for drawing of the cross sections;	correction and evaluation of exercises, final exam	C5
Apply basics of drawing program AutoCAD (templates, drawing tools and modify tools, text writing and dimensioning, print);	Exercises in a computer classroom, correction and evaluation of exercises, final exam	C5
Construction model sketch in isometric, oblique dimetric projection;	correction and evaluation of exercises, final exam	C5
Construction perspective projection of model and room with one or two points of view.	correction and evaluation of exercises, final exam	C5

General competences
Students acquire basic knowledge of orthogonal and 3D projection. This course offers all elements of technical drawing and geometrical basics needed for the use of the AutoCAD drawing computer program. Students practice technical perception and proportional transfer of seen or imagined objects by means of drawing.

Type of instruction

Lectures
Lectures are overwritten for the acquisition of practical sketching skills. Lectures in a computer classroom are conducted so that students acquire practical computer skills by getting the task of checking and determining the learning outcomes.
Exercises
Making technically equipped exercise by free hand sketching and by using drawing tools of AutoCAD with the purpose of correction and self-correction in the acquisition and improvement of skills of drawing.

Working methods:

Teachers' obligations:
Holding lectures and exercises. Designing exercises and evaluating them. Help students in mastering the skills of hand drawing and drawing using computer. Maintenance colloquium, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and submission of exercises in a given period. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	Transcribed lectures with less than 15% of the eligible weaknesses of the application of technical standards	Sufficient (2)	15	15	1
		Transcribed lectures with less than 10% of the eligible weaknesses of the application of technical standards	Good (3)			
		Transcribed lectures with less than 5% of the eligible weaknesses of the application of technical standards	Very good (4)			
		Transcribed lectures without any weaknesses of the application of technical standards	Excellent (5)			
Exercises (E)	30%	The exact exercise with less than 15% of the eligible weaknesses of the application of technical standards	Sufficient (2)	30	45	2,5
		The exact exercise with less than 10% of the eligible weaknesses of the application of technical standards	Good (3)			
		The exact exercise with less than 5% of the eligible weaknesses of the application of technical standards	Very good (4)			
		The exact exercise without any weaknesses of the application of technical standards	Excellent (5)			
Partial exam – orthogonal projection (Colloquia) (PE)	30%	60-70%	Sufficient (2)	2	19	0,7
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam – cross section (Colloquia) (PE)	30%	60-70%	Sufficient (2)	2	22	0,8
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx10+Ex30 + 2PEx30)/100**		49	101	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam* (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	4	41	1,5
TOTAL	**100%**	**(FE80+E20)/100**				
*students who do not pass through the colloquia approach the exam that makes 80% of the grade, and the remaining 20% make a grade out of the exercise						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The presence of students on the class is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. The student activity is recorded by signed drawing made in class. Lectures are overwritten and evaluated.	semester (45 hours of direct lecturer)	-
Making exercises	The exercises are performed in groups. Each exercise can be evaluated two times. If the rate is insufficient (1) or it is not evaluated, exercise can be given on conditional terms (if student have less absents hours than is prescribed, if average grade of all exercises is more than sufficient (2) and student have 50% signed drawings).	In order to Silabus	Two conditional terms for exercise evaluation
Partial exam / First colloquium (K1)	On the first colloquium can attend students how have positive grade of 1. exercise and have no absent more than 15%. Colloquium has 35 point and is needed to collect 21 point (60%) for positive grade.	11. week	-
Partial exam / Second colloquium (K2)	On the second colloquium can attend students how have more than 60 % points from the first colloquium. Each colloquium has 3 projection task and 5 theoretical questions. Each projection task has 10 points and each theoretical question has 1 point. Two colloquium have 70 points in total, each colloquium has 35 point. Total 42 point from70 points (60%) is needed for positive grade. Students who collect enough points from both colloquiums obtain the final grade. In that case, they can fix the score with additional points for none absent of the lessons (5 points) and for all signed drawings (5 points). The final grade is the average score from the exercise and the score by the points. An oral check of computer drawing skills follows behind the colloquium.	15. week	There is a possibility of repair for one of two colloquia
Written exam	Written exam has four drawing tasks and seven theoretical tasks. Drawings are made in sketch. Each drawing task has 10 points (40 points) and each theoretical task has 1 point (7 points). 28 points is needed for positive grade.	Exam terms	-
Oral exam	Passed written exam is needed for taking oral exam. Verification of theoretical knowledge (from scripts), understanding of projections and drawing in AutoCAD. The final grade is obtained according to the formula **(FE80+E20)/100**		-

Obligatory literature

1. Koludrović, Ć.: Osnovne vježbe iz tehničkog crtanja s kompjutorskim aplikacijama. Udžbenici Sveučilišta u Rijeci, 1990.
2. Opalić, M.: Tehničko crtanje. Udžbenici Sveučilišta u Zagrebu, 2003.
3. Uvod u AutoCAD 2019 (interna skripta)
4. Risović, S., Čavlović, A.O.: Primijenjena tehnička grafika (interna skripta)

Recommended literature

1. Lipošinović, L.: Nacrtna geometrija. Element, Zagreb, 2003.

Wood industry mechanical engineering

DT1208

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer

Prof.dr.sc. Stjepan Risović

Associate teacher for exercises
Doc.dr sc. Branimir Šafran
Marko Rastija, mag. ing. mech.

Grading

Sufficient (2) 50 - 67 %
Good (3) 68 - 78 %
Very good (4) 79 - 89 %
Excellent (5) 90 - 100 %

Course content:

Introduction. Basic terms. History of mechanical engineering. Classification of mechanical engineering and machines. SI units in WI mechanical engineering. Standards in WI mechanical engineering. Properties of metal materials and the ways of testing mechanical properties. Metal materials for the building of wood industry tools and products. Classification of engineering iron: steel, cast iron. Influence of adding alloying elements on properties of steel and cast iron. Using classification of steel. The most common steels in the building of WI tools and products. Heat treatment and chemical-heat treatment of steel. Light and non-ferrous metals and their properties. Application in the building of WI products. Engineering ceramics and hard metals. Composite materials, properties and application. Metal foams, polymers - properties and application. Examples of application of materials. Metal semi-finished products. Friction and lubrication of WI devices. Friction classification. Application and reduction of friction. Lubricants - properties, types and quality. Devices for oil and grease lubrication. Tolerances and joint tolerances. Tolerances of shape and position. Properties and quality of treated surface. Classification of machine elements. Connecting elements. Non separable joints (welded joints, soldered joints, glued joints). Separable joints (screw joints, wedge j., pin j., bolt j., springs). Rotary motion elements. Axles and shafts and their design. Critical rotation speed. Journals. Sliding and rolling bearings. Couplings. Switching couplings, disconnectning coupling. Power and motion transmition elements. Flat belt, V-belt, gear belt drives. Chain drive. Friction drives. Friction drives with fixed speed ratio. Friction drives with possibilities of continuous change of speed ratio. Gears. Type of gears, shapes, transmissions, efficiency, lubrication,

material used for production of gears. Spear gears calculation. Worm gears – types, engaging and dimensions, lubrication. Flow elements. Piping. Basic terms. Flow and pressure regulation elements. Flow elements sealing in processes and machines in WI. Brakes. Mechanical engineering technologies in WI. Welding. Welding and allied processes: current source,electric arc welding, welding under powder layer, MIG/MAG welding, electric resistance welding. Welding allied processes – cutting of metals. Soldering. Gluing of metals. Metal machining and special facing methods (diamond machining, superfinshing ...). Hidraulic machines in WI. Basic laws of fluid mechanics. Suction pumps. Definition and main exploitation characteristics. Classification of pumps. Performances of turbine pumps. Hydraulic motors. Ventilators. Radial and axial ventilators. Air (pneumatic) motor drives. Compressors – features and types of compressors in WI. Prime movers and machines in WI. Definition of drive and working machine. Heat motors and machines. Applicatin of internal combustion machines in WI. Features of internal combustion motors. Steam boilers. Steam boilers parts. Combustion and features of WI steam boilers, active power, efficiency. Biomass boilers. Heat pumps. Potential application in WI. Types and properties of turbine plants in WI. Overview of power issues in wood industry. CHP (combined heat and power production).

Type of course::

- Wood industry mechanical engineering (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define mechanical properties and testing	partial exam, written exam, oral exam	A3, A4
Compare effects of heat and chemical-heat treatment of steel on dinamic load of machine elements	partial exam, written exam, oral exam	A3, A4
Analyze use of tool steels and new materials in production phases of mechanical processing	partial exam, written exam, oral exam	A3, A4
Identification of connecting elements, power and motion transmition elements	partial exam, written exam, oral exam	A3, A4
Calculate load magnitude at non separable and separable joints	partial exam, written exam, oral exam	A3, A4
Check main quantitys in work with rotation motion elements, peripheral and angular velocity, speed frequency, torque	partial exam, written exam, oral exam	A3, A4
Calculate power transfer elements by friction and engagement	partial exam, written exam, oral exam	A3, A4
Construct machine elements and define their application	partial exam, written exam, oral exam	A3, A4

Apply basic technical criteria for designing and dimensioning machine elements (factor of safety)	partial exam, written exam, oral exam	A3, A4
Analysis of piping, stop, safety and regulating organs from the point of pressure loss	partial exam, written exam, oral exam	A3, A4
Compare of fusion and force (friction) welding methods in WI plants and calculation of stress in welded joints	partial exam, written exam, oral exam	A3, A4
Check and compare working features of turbopumps on Q - H, Q – η, Q – P diagrams	partial exam, written exam, oral exam	A3, A4
Differ types and characteristics of turbine plants in WI plants	partial exam, written exam, oral exam	A3, A4
Analyze the operation of the internal combustion engine from the standpoint of energy consumption considering the traveled distance	partial exam, written exam, oral exam	A3, A4
Describe existing energy problems in WI and make plans for application of renewable energy sources (forest biomass)	partial exam, written exam, oral exam	A3, A4

General competences

- Identification and distinction of certain machine and construction elements
- Apply acquired theoretical knowledge in practice.
- Apply the basic principles of constructing and dimensioning machine elements

Tipe of instruction

Lectures
Exercises

Exercise part of the teaching program is carried out in a laboratory where on the basis of specific measurements the calculations of observed systems and principles are carried out. The second part of the exercises are calculation tasks where the theoretical knowledge adopted in the lectures is upgraded with aim of better understanding of the subject.

Working methods:
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Providing partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Laying the partial exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	
Exercises (E)	-	-	-	30	0	
Partial exam 1 (PE1)	16 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		15	0,8
Partial exam 2 (PE2)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		20	0,85
Partial exam 3 (PE3)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		20	0,85
Oral exam (OE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		25	2,5
TOTAL	**100 %**	**(((PE1x16)+(PE2+PE3)x17 + OEx50)/100**		60	80	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Written exam*(WE)	50%	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		50	2,5
Oral exam* (OE)	50%	50 - 67 % 68 - 78 %	Sufficient (2) Good (3)		30	2,5

		79 - 89 % 90 - 100 %	Very good(4) Excellent (5)			
TOTAL	**100 %**	**(WEx50+OEx50)/100**				

*** students who do not pass the exam through the partial exams during the semester, will approach the final exam which makes 100% of the grade (written exam - 50%, oral exam 50%).**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercizes	The teaching attendance is checked and recorded. Students may be absent with a maximum share of 20 % of direct teaching.	semester (60 hours of direct lecturer)	-
Partial exam (PE1, PE2, PE3)	Students who regularly attend teachings can approach the writing of a partial exam, making them easier to pass the exam because the lessons are learned in the "stages". The partial exam is evaluated and participates in the final grade.	PE1 – 6. week PE2 – 11. week PE3 – after finished lectures	-
Written exam	Exams can be attended by students who have sufficient teaching attendance. Students solve tasks and answer asked questions. The written exam is evaluated and participates in the final grade.	Exam terms	-
Oral exam	Students who pass 3 partial exams or a written exam are areasked for questions from different parts of the teaching program content. The final grade is obtained according to the formula **(((PE1x16)+(PE2+PE3)x17 + OEx50)/100 or WEx50+OEx50/100**		

Obligatory literature

1. Perše, S. 2000: Osnove strojarstva, Sveučilište u Zagrebu, Fakultet prometnih znanosti, Zagreb.
2. Karl-Heinz Decker, 1987: Elementi strojeva, Tehnička knjiga Zagreb.
3. Ražnjević, K. (ured.) 1997: Krautov strojarski priručnik, Axiom, Zagreb.
4. Alfirević, I., Modlić, B. (ured. biblioteke): IP 1 –... Inženjerski priručnik, ŠK, Zagreb, izabrana poglavlja.

Recommended literature

1. Šumarska enciklopedija, HLZ Miroslav Krleža, Zagreb*** 2003: Dubbel Taschenbuch für den Maschinenbau, Springer.
2. Filetin, T., Kovačiček, F., Indof, J. 2002: Svojstva i primjena materijala, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje.
3. Franz, M. 1998: Mehanička svojstva materijala, FSB.
4. Kralj, S., Andrić, Š. 1992: Osnove zavarivačkih i srodnih postupaka, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje.
5. *** Izabrana poglavlja iz TE, LZ “Miroslav Krleža”, Zagreb, sv. 1-12.

Fundamentals of electrotechnics

DT-1209

ECTS 4

English language Rx

E-learning Rx

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Doc.dr.sc. Kristijan Radmanović

Associate teacher for exercises
Doc.dr.sc. Kristijan Radmanović

Grading

Sufficient (2) 50%
Good (3) 65%
Very good (4) 80%
Excellent (5) 90%

Course content:

Electrical engineering and its division, measuring units. Static electricity: electric field, induction capacity, protection measures.Guides, insulators and semiconductors. Electrical current and its effects. Circuit: voltage, resistance, conductivity. Connecting Resistance and Sources.Power and power of electric current and their measurement. Electric accumulators and galvanic articles.Electromagnetism: magnetic field of electric current, electromagnetic induction, force in magnetic field, principle of electromotor and transformer.Alternating Current: Generation and Presentation, Effective Value, Circuit Resistances and Ohm Act for AC, Resonance, Active, Appearance and Rejection Power, Compensation.Losses in alternating current circuit: current swirl, premagnetization, skin effect, dielectric losses.Three-phase alternating current system: position and display, rotary field, voltage and connection, power and line calculation. Electric machines and transformers: in general, DC motors, electric motors and generator voltages, DC motors (start, rotation control, type). Transformers. Synchronous generators. Asynchronous motors, collector motors. Converters. Heating, losses, utility of electric machines . Electrical lighting.

Type of course:

Fundamentals of electrotechnics (compulsory collegium, 2st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define Coulomb's law and explain the meaning of the constants in the expression for the Coulomb force.	colloquium, final exam, oral exam	A2
Name and describe the physical quantity which describes the electric field.	colloquium, final exam, oral exam	A1
Apply the Gaussian law, for example, to determine the electric field of charged metal spheres, plates and capacitors.	colloquium, final exam, oral exam	B4
Analyze the serial and parallel condenser connections.	colloquium, final exam, oral exam	B3
Explain the capacity of the capacitor and the role of the dielectric at the capacitor.	colloquium, final exam, oral exam	B3
Describe direct current sources. Demonstrate Kirchoff's rules on an arbitrary example.	colloquium, final exam, oral exam	A3
Analyze complex current circuits of direct current. Explain the occurrence of magnetism and electromagnetic induction.	colloquium, final exam, oral exam	B5
Use the rule of the right hand to determine the direction of Amper and Lorentz force.	colloquium, final exam, oral exam	B5
Appoint and describe the physical size of the alternating current with appropriate current and effective values.	colloquium, final exam, oral exam	A2
Analyze the RLC titre circle and explain the role of each element in the circle	colloquium, final exam, oral exam	B5
Distinguish the active, reactive and apparent power of alternating current.	colloquium, final exam, oral exam	A2
Explain the principle of electric motor and generator operation. Analyze the three-phase system. Interpret electrical measurements in woodworking plants.	colloquium, final exam, oral exam	B3

General competences

Define the basic laws of electrical engineering, the associated physical size and the unit of measurement.

Apply electrostatic laws to protect against electrostatic outbreaks

- Make appropriate calculations and measurements in the DC and AC circuits
- Select suitable electric machines in woodworking plants and know their characteristics
- Understanding the functioning of electrical engineering and power systems

Tipe of instruction
Lectures
Exercises

Working methods:
Teachers' obligations:

Maintaining the original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Partial exam 1 (PE 1))	30%	50-64%	Sufficient (2)	30	30	2,5
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE 2)	30%	50-64%	Sufficient (2)	30	30	2,5
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**			60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	50 %	50-64%	Sufficient (2)	60	60	4
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**					

*** Students who do not pass through the semester during the semester will approach the exam time of 50% of the grade, and the remaining 50% make the grade from the oral part of the exam**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Partial exam 1	Students who regularly attend classes can access the first colloquium. The quiz consists of 5 assignments, each assignment being 20 points. Students have met the first partial exam if they achieve 50 points.	8. week	Exceptionally, in the case of a justified reason for the absence.
Partial exam 2	Students who attend classes regularly and who have collected at least 50 points in the first colloquium can approach another colloquium. The second colloquium consists of 5 assignments, each assignment being 20 points. The students met the second exam if they scored 50 points.	15. week	Exceptionally, in the case of a justified reason for the absence.
Written exam	Exams can be accessed by students who regularly attend classes and did not meet the first or second qualifications. The written exam consists of 5 assignments, each carrying 20 points. The students met the written exam if they achieved 50 points, after which they approached the oral exam. The written exam is evaluated and participates in the final grade of the subject	examination deadlines	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is the arithmetic mean of the written and oral part of the exam.	-	Exceptionally, in the case of a justified reason for the absence.

Obligatory literature

1. Miljenko Primorac, interne skripte
2. Marinović, Opća elektrotehnika i elektronika, Školska knjiga Zagreb, 1993.
3. Marinović, Opća elektrotehnika i elektronika 2, Školska knjiga Zagreb, 1996.

Recommended literature

1. Stanić, Osnove elektrotehnike, Školska knjiga Zagreb, 2003.
2. Pintar Vinko, Osnove elektrotehnike 1 i 2, Tehnička knjiga Zagreb, Golden marketing.
3. Kaiser Dragutin, Elektrotehnika osnovi, Tehnička knjiga Zagreb, 1972.
4. Mlakar France, Opća električna mjerenja, Tehnička knjiga Zagreb, Golden marketing, 2003.
5. Pitrovski, L. M., Električni strojevi, Tehnička knjiga Zagreb, Golden marketing, 1974.
6. Primorac, M., Racionalizacija iskorištavanja električne energije u drvnoindustrijskim pogonima

Technical properties of wood I

DT-1210

ECTS 8

English language R1

E-learning R1

Teaching hours 105
Lectures 45
Exercises 60

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambreković mag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Course 'Technical properties of wood I' is composed of general theoretical knowledge about physical properties of wood. Knowledge about commercial wood species. Segments and form of tree. Factors, forms and modification of tree. Chemical structure of wood and its influence on wood properties. The wood structure and its influence on wood properties. Wood sections and their properties. Sapwood and heartwood. Process of heartwood forming. Theories and classification of earlywood and latewood and their ratio in annual ring. Closeness of grain. Macroscopic properties of domestic commercial wood species. Colour and lustre of wood. Texture of wood. Density and specific gravity of wood. The methods of determining density of wood. Significant factors towards density. Distribution of density inside the wood and tree. Wood and water, types of water in wood. The method of determining of moisture content. Recommended moisture content for various woods uses. Adsorption and desorption. Fiber saturation point. Maximum moisture content of wood. Shrinkage and swelling. Anisotropy of shrinkage and swelling. The dimensional changes of wood caused by temperature. Thermal properties of wood. Specific heat. Electrical properties of wood. Dielectric and piezoelectric properties of wood. Acoustical properties of wood. Distribution of physical properties in tree and between trees of same species. Comparison of physical properties of domestic and foreign commercial wood species.

Type of course:

- Technical properties of wood I (obligatory course, 2th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination of significant recognition parameters of commercial wood types, tree parts and tree modification	Exercises evaluation, partial exams, final exam	B1
Definition of wood structure as a factor of wood properties. Wood cross section properties	Exercises evaluation, partial exams, final exam	B1
Definition and determination of physical properties of wood	Exercises evaluation, partial exams, final exam	B1
Definition and determination of the most important factors affecting the physical properties of wood	Exercises evaluation, partial exams, final exam	B1
Definition of physical properties schedule in radial direction	Exercises evaluation, partial exams, final exam	B1

General competences

Type of instruction

The student gains knowledge about commercial wood species. Segments and form of tree. Distribution of macroscopic and physical properties in tree and between trees of same species. Basic knowledge important for wood processing technologies.

Lectures
Lectures on theoretical basis prepare students for basic knowledge about the macroscopic characteristics and physical properties of commercial types of wood, which facilitate workmanship and complete mastery of the material.

Exercises
Task exercises with the purpose of applying the theoretical knowledge learned in lectures. Work on computer and use of computer programs for making the exercises.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Students' obligations:
To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	75	4
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	60	30	3
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	29	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex70+ PE1x30)/100**		106	135	8

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	28	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (105 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semester	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semester	
Written and oral exam	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. .Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
2. .Horvat, I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
3. Karahasanović, A.: Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. .Ugrenović, A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3. Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Woodworking machinery I

DT-2311

ECTS 6

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45
Field work 2 days

Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Assistant Professor Branimir Šafran

Grading

Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:

Basic terms. Elements and angles of a cutting tool. Real cutting edge. Tool life. Tool wear and tool wear types. Methods for increasing tool life. The influence of the tool wear on the important cutting parameters. Causes of tool blade wear. Methods for tool life determination. Procedures for increasing blade strength. Materials for woodworking tools. Resharpening of tool tip. Thermal occurrences in mechanical wood processing. The cutting of wood. The properties of wood that have influence on cutting process. Wood cutting directions. Models of wood cutting. Cutting forces. Work required for cutting, cutting power, specific cutting energy and cutting resistance. The influencing parameters on specific cutting resistance. Basic kinematics relations during sawing. Band saws. Band saw blade. Sawing quality. Frame saw. Kinematics. Frame saw blade. Saw blade lateral stability and cutting quality. Circular saw. Circular saw kinematics. Circular saw blade.Machines and tools for planing and moulding, machines for boring, turning machines, sanding machines – kinematics, tools, cutting quality and efficiencies.

Type of course:

- Woodworking machinery I (compulsory, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish characteristic types of woodworking machines and tools with and without forming wood shavings (saw blades, circular saw blades, planers, mills, drills, lathes)	partial exam, final exam	C1
Explain the term elementary blade and sketch the basic geometrical cutting edge elements.	partial exam, final exam	C1
Explain the difference between elemental and real blade.	partial exam, final exam	C1
Identify the basic forms of tool-tip blunting and distinguish the causes of wear that cause some form of blunting.	partial exam, final exam	C1
Differentiate the basic materials for making tool blades (tool steel, high-speed steel, hard alloy, hard metals, artificial diamonds) and basic properties of these materials that are essential for woodworking (strength, hardness, temperature stability).	partial exam, final exam	C1
Group influential variables on tool-tip life time in different processing conditions and analyze their mutual relationship.	partial exam, final exam	C1
Sketch and analyze forces on the tool-tip.	partial exam, final exam	C1
Explain the role of individual cutting edge elements during cutting.	partial exam, final exam	C1
Identify wood properties and tool-tip characteristics that affect the cutting process.	partial exam, final exam	C1
Identify the basic types of wood shavings in mechanical woodworking and identify the causes of the formation of a particular type of shaving.	partial exam, final exam	C1
List the influential parameters and calculate the specific cutting resistance in the given processing conditions.	partial exam, final exam	C1
Calculate the technological parameters for basic types of woodworking machines	partial exam, final exam	C1
Calculate the cutting forces in basic types of woodworking machines	partial exam, final exam	C1
Calculate the cutting power and electric motor power required for basic types of woodworking machines	partial exam, final exam	C1
Calculate the capacity of basic types of woodworking machines	partial exam, final exam	C1
Sketch the basic woodworking tools (saw blades, circular saw blades, milling cutter, drill bit) with all the essential elements (tool diameter, tool blade angles, etc.).	partial exam, final exam	C1

General competences

- Acquiring the knowledge for the selection, optimal usage and maintenance of tools and machinery for wood processing.
- Acquiring the basics which are required for assigning project tasks to the manufacturers of special equipment for wood processing.

Tipe of instruction

Lectures

Exercises

Numerical exercises related to individual machines in a particular machine group. As part of laboratory exercises, drawing exercises of selected woodworking tools are performed with all the relevant parameters related to each tool and cutting power measurement at selected machines and the calculation of all relevant kinematic parameters, cutting forces, cutting power, unit output and specific cutting energy under the given conditions. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

Elementi praćenja	Udio u ocjeni	Bodovna skala/ocjena	Ocjena	Broj sati direktne nastave	Broj sati rada prosječnog studenta izvan direktne nastave	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	-	-	-	45	0	1,5
Partial exam 1 (PE1)	50%	50-60%	Sufficient (2)	2	43	1,5
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-60%	Sufficient (2)	2	43	1,5
		61-75%	Good (3)			
		76-90%	Very good (4)			

		91-100%	Excellent (5)			
UKUPNO	**100%**	**(P + V + K1x50 + K2x50)/100**		**94**	**86**	**6**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60% 61-75% 76-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	4	86	3
TOTAL	**100%**	**(FEx1)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (90 hours of direct lecturer)	-
Partial exam 1 (PE1)	The partial exam can be accessed by all students.	9. week	
Partial exam 2 (PE2)	The second partial exam can be accessed by students who have passed the first partial exam. Students who get enough points from both partial exams get a final score.	15. week	
Written exam	The written exam consists of three numerical tasks in the field of band saws, circular saw, planer, milling machine, drill and lathe. For the passage it is necessary to have at least 50% of the total number of points.	Exam terms	
Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked. The final grade is obtained according to the formula **(FEx100)/100**	Exam terms	

Obligatory literature

1. Goglia, V. 1994: Strojevi i alati za obradu drva – I dio, Šumarski fakultet Zagreb.
2. Zupčević, R. 1988: Mašine za obradu drveta I dio, Teorija rezanja, Mašinski fakultet Sarajevo.
3. Brežnjak, M. 1997: Pilanska tehnologija drva I dio, Šumarski fakultet Zagreb.
4. Brežnjak, M. 2000: Pilanska tehnologija drva II dio, Šumarski fakultet Zagreb.

Recommended literature

1. Lisičan, J. 1996: Teorija a technika spracovania dreva, MAT-CENTRUM, Zvolen.
2. Williston, E. M. 1978: SAWS – design, selection, operation, maintenance, Miller Freeman, S.Francisco
3. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 1, Školska knjiga Zagreb.
4. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 2, Školska knjiga Zagreb.
5. Prokeš, S. 1998: Obrabeni dreva a novych hmot ze dreva, SNTL Praha.

Technical properties of wood II

DT-2312

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambreković mag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Course 'Technical properties of wood II' is composed of lectures about mechanical properties of wood. Instruments and devices for determination of mechanical properties of wood. Hooks law, modulus of elasticity, Poisson ratios, plasticity and creep. Rheology of wood. Static bending, tensile strength, compression strength, impact test, torsion strength, shearing strength, hardness and abrasion resistance. The wood structure and its influence on mechanical properties of wood. The influenced factors on mechanical properties of wood. Distribution of mechanical properties in tree and between trees same species. Comparing mechanical properties of domestic and foreign commercial wood species. Defects and abnormalities of wood. Classification. Natural defects, reaction wood, compression and tension wood, cross grain, variations in log form and shakes. The influence of wood defects on mechanical properties of wood.

Type of course:

- Technical properties of wood II (obligatory course, 3th semester, 2rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Getting acquainted with measuring devices for determining the mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Determination of mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Evaluation of wood species based on the mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Definition of radial distribution of mechanical properties of wood and their impact on further processing and use of wood	Exercises evaluation, partial exams, final exam	B1
Defining of the wood defects on trees and round wood	Exercises evaluation, partial exams, final exam	B1
Practical recognition and valorisation of wood defects on trees and round wood	Exercises evaluation, partial exams, final exam	B1

General competences

The student gains basic knowledge about mechanical properties of wood, the distribution of mechanical properties of wood within tree and trees, wood defects and their influence on mechanical properties of wood. Basic knowledge required as an advance for basic wood technology processes.

Type of instruction

The student gains basic knowledge about mechanical properties of wood, the distribution of mechanical properties of wood within tree and trees, wood defects and their influence on mechanical properties of wood. Basic knowledge required as an advance for basic wood technology processes.

Lectures

Lectures in theoretical basis prepare students to acquire basic knowledge about mechanical properties of wood and wood defects, facilitate exercises and the subject curriculum in general.

Exercises

Task exercises with the purpose of applying the theoretical knowledge learned in lectures. Work on computer and use of computer programs for making the exercises.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	15	1,5
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	30	30	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	14	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Vx40 + K1x30+K2x30)/100**		61	59	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Students attendance is checked and notified. A justified absence of up to 20% of lectures and 10% of exercises is allowed	semester (105 hours of direct lectures)	-
Exercise project	Each exercise is complex (1 par) and performed according to lectures. On the end of the semester student gives all exercises assignments. Some part of exercises assignment is checked during the exercises.	end of semester	
Partial exam 1	All students with absence from lectures and exercise minor than 15% can submit to 1. colloquium. Colloquium consist 30 points and curriculum covered from the lectures and exercises until then.	end of semester	
Written and oral exam	Students who did not achieved positive assessment from the exercises and the colloquium (less than 61% of the total score) or are not satisfied with that grade, approach the written and oral exams according to certain examination deadlines. The score obtained on the oral exam is the final grade in the 100% ratio.	In given exam periods	

Obligatory literature

1. Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
2. Horvat, I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
3. Karahasanović, A.: Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. Ugrenović, A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3. Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.
5. Walter, F.: Pruftechnikin der Holzindustrie, Leipzig, 1977, str. 1-318.

Wood protection I

DT-2313

ECTS points 7

English language R1

E-learning R1

Hours of classes 90
Lectures 45
Exercises 45
Field work 0

Lectures teacher
Associate Prof. Marin Hasan, PhD

Exercises teacher
Associate Prof. Marin Hasan, PhD

Grades

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to the history of wood protection and character and role of other fundamental courses involved in the wood protection. The role of natural wood durability to the wood protection. Degradation and biodegradation of wood, generally. Biological causes: morphology, anatomy, physiology, ecology, divisions and most significant representatives.
Wood decay and succession: lignicolous bacteria and fungi (moulds, blue stain, soft rot fungi, basidiomycetes – decay fungi). Wood pests; primary, secondary, tertiary and quaternary insects (Coleoptera – wood boring insects and Isoptera – termites). Marine wood borers. The use of physical and structural characteristics of wood in the wood preservation (porosity, permeability, diffusion, sapwood, heartwood). The fundaments on the division and use of wood protection methods (preventive and repressive methods, surface and deep protection).
Classic preservation methods without of pressure (brushing, spraying, dipping, hot-and-cold open tank processes, diffusion, penetration, absorption, adsorption). Pressure treatment methods (full-cell method, empty-cell method, double vacuum process). Wood preservatives (traditional and new inorganic and organic preservatives, fumigant gases). Properties of wood preservatives (water repellence, vapor permeability, absorption, adhesion). Wood preservatives application (wood in interior and exterior, wood in the ground and above ground contact, hazard classes, penetration classes, retention classes).

Type of the course:

- Wood Protection I (obligatory Course, 3. Semester, 2. Year)

Learning Outcomes and Methods of Verification

Learning Outcomes (LO)	Methods of Verification	Correlation with LO of the Study Program
Explain which chemical components of the wood structure and how they affect the biological resistance of the wood.	exercises 1 and 2, 1st colloquium, final exam	B3
Distinguish the biological resistance of the natural durability of wood and define them.	exercises 1 and 2, 1st colloquium, final exam	C4
Analyse and describe the degree of degradation of wood by abiotic factors.	exercises 1 and 2, 1st colloquium, final exam	C5
Differentiate and explain faults in the structure and physical properties of wood resulting from the degradation of abiotic factors from faults caused by biodegradation of wood.	exercises 3 and 4, 2nd colloquium, final exam	C5
Differentiate and explain the bacterial degradation of wood from fungal degradation of wood.	exercises 3 and 4, 2nd colloquium, final exam	C5
Differentiate and explain the faults in the structure and physical properties of wood resulting from the degradation of wood by certain groups (types, species) of wood decaying fungi.	exercises 3 and 4, 2nd colloquium, final exam	C5
Identify and distinguish insects from other arthropods.	exercise 4, 3rd colloquium, final exam	B4
Identify and distinguish between commercially the most important species of xylophagous insects based on morphological images of adult insects.	exercise 4, 3rd colloquium, final exam	C5
Differentiate and describe faults in the structure of wood caused by degradation of certain groups, genera and / or insect species.	exercise 4, 3rd colloquium, final exam	C5
Differentiate and describe faults in the structure of wood caused by the degradation of individual groups, genera and / or species of marine pests.	exercise 4, 3rd colloquium, final exam	C5
Analyse and describe the degree of degradation of wood caused by xylophagous organisms and assess the risk of using such wood in the manufacture of wooden products.	exercises 2 – 4, 3rd colloquium, final exam	D5
Predict the mechanism of degradation of wood in certain use classes.	exercises 2 – 4, 3rd colloquium, final exam	D5
Recommend an appropriate wood protection procedure under the given conditions.	exercises 3 – 7, 3rd colloquium, final exam	D6
Independently write a report and present it in front of a group of people.	Seminar	D6

General Competencies

The skills in the identification of the most important wood pests and wood decay fungi and the recognition of all damages produced by mentioned organisms.
Knowledge on the basic principles in the wood protection (the purpose of wood protection and preservation, applications of preventive and repressive methods and preservatives (influence of physical, chemical and anatomical properties of wood onto the wood preservation).

Form of Teaching

Lectures
Lectures are held in the classroom or in the field work according to ERR guidelines, with explicit insistence on the more active participation of students in the learning process.

Exercises
Part of calculation exercises as well as some of the exercises on introduction to laboratory work are held in classroom and student practice room, and laboratory measurement exercises on prepared wooden specimens are held at the Laboratory for Anatomy and Wood Protection.

Mode of Teaching:

Teachers' Responsibilities:
Maintaining the original teaching – lectures, exercises and field work. Developing exercises and topics of seminar papers, collecting literature for seminar papers, compiling knowledge tests and evaluating them. Reviews of written exercises and of seminar papers. Providing colloquia, oral exams, consultations and seminars. Creating teaching materials.

Students' responsibilities:

Regular attendance and active participation in lectures and exercises, making and delivering exercises and seminars within the given time frame. Passing the colloquia, written and oral exams.

Grading method = Taking exam

Tracking elements	Grading share	Score scale / Grading	Grade	Number of Direct Teaching Hours	Number of working hours of an average student beside direct teaching	ECTS credits
Lectures (L)	–	–	–	42		1.5
Making Exercises (E)	20%	Correct exercises with less than 15 % of acceptable deficiencies	Sufficient (2)	42	63	3.5
		Correct exercises with less than 10 % of acceptable deficiencies	Good (3)			
		Correct exercises with less than 5 % of acceptable deficiencies	Very good (4)			
		Correct exercises with less than 1 % of acceptable deficiencies	Excellent (5)			
1st, 2nd and 3rd	40%	60-70%	Sufficient (2)	3	30	1

Colloquium in written form		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam – oral exam (OE) or Seminar paper – SEM*	40%	60-70%	Sufficient (2)	3	27	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		Seminar paper with less than 8 % of acceptable deficiencies	Very good (4)	3		
		Seminar paper with less than 1 % of acceptable deficiencies	Excellent (5)			
TOTAL	**100%**	**(E×20 + (C1+C2+C3) ×40 + OE×40) / 100 or (E×20 + (C1+C2+C3) ×40 + SEM×40) / 100**		90	120	7
*** students who pass all three colloquia and choose to do seminar papers don't need to complete the final exam; the defended seminar paper changes the final oral exam.**						

Tracking elements	Maximum points ar grading share	Score scale / Grading	Grade	Number of Direct Teaching Hours	Number of working hours of an average student beside direct teaching	ECTS credits
Final Exam* (FE)	80 %	60-70%	Sufficient (2)		57	2
Written part (W) + Oral part (O)		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E×20 + FE×80) / 100**				
*** students who don't pass all three colloquia during the semester have to take final exam consisting of a written and oral part, and they make up to 80 % of the total grade, while the remaining 20 % make a grade of exercises**						

Advanced reasoned rules of preparation, implementation and taking colloquia, seminar papers, partial exams, written and oral exams:

Tracking elements	Description	Deadline	Recoupment
Lectures + Exercises (laboratory work)	The presence of students is checked and recorded during the lectures. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (90 direct teaching hours)	-
Making Exercises (E)	Exercises are attended by groups. As part of the exercise, 5 practical exercises are carried out. At the beginning of the first exercise, students will receive templates with the look of the file, inserts and worksheets on which the students will handle and teach their exercises. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted within the probationary period (the student has the right to submit a maximum of two exercises within the probationary period, otherwise the right to sign the course is lost).	according to the agreed delivery dynamics	One probationary period for submitting the exercises for revision.
First Colloquium (C1)	The first colloquium contains the following material: hygroscopicity and wood chemistry, natural durability of wood and biological resistance, history of wood protection, abiological degradation of wood. Each colloquium has 20 questions and each question equals one point. Partially correct answers (semi-points) or negative points does not exist. The minimum number of points for passage the colloquium is 12 (12 of	4th week	-

	20 = 60%).		
Second Colloquium (C2)	Second colloquium are available to students who have passed the first colloquium. Second colloquium contains the following materials: decaying fungi and bacteria. The minimum number of points for passage the colloquium is 12 (12 of 20 = 60%).	7^{th} and 13^{th} week	There is a possibility of correctional second colloquium at the time of the third colloquium.
Third Colloquium (C3)	Third Colloquium are available to students who have passed the first and second colloquium, as well as students who have passed only the first colloquium but at the same time, they are taking 2nd and 3rd colloquium together. The third colloquium contains the following: xylophagous insects and marine pests, wood protection. Each colloquium has 20 questions and each question equals one point. Partially correct answers (semi-points) as well as negative points does not exist. The minimum number of points for the passage each colloquium is 12 (12 points of 20 = 60%). All three colloquia are scored with a total of 60 points, with a total minimum of 36 of 60 points being needed for the pass (60%). Students who get enough points from all three colloquia only access the oral part of the exam, and if they successfully defend the seminar paper (the minimum grade is very good (4)), they get a final grade on the subject with no need of taking oral part of the exam. The final grade is the sum of Exercises (E), Colloquia (C1, C2 and C3) and Oral Exam (OE) or Seminar (SEM): **(E×20 + (C1+C2+C3) ×40 + OE×40) / 100** **or** **(E×20 + (C1+C2+C3) ×40 + SEM×40) / 100**	13^{th} week and first examination period	There is a possibility of correctional third Colloquium on the first examination period at the time of the written exam.
Seminar paper	Seminar work are available to students who, until the moment of presentation of the conditions of making and theme of seminar papers, do not have a single absence from lectures and from exercises, and have passed the first colloquium. Seminar work is submitted for review by arrangement with the teachers throughout the semester. The final version is submitted to the 14^{th} week and defending in the 14^{th} or 15^{th} week of the semester, provided that the student has passed all three colloquia. A written part of the seminar and oral presentation are evaluated (defence in front of the whole group of students). Overall rating of the seminar paper should not be less than very good (4) in order to replace the oral exam. The final grade is the sum of Exercises (E), Colloquia (C1, C2 and C3) and Seminar (SEM) **(E×20 + (C1+C2+C3) ×40 + SEM×40) / 100**	14^{th} and 15^{th} week	-
Final exam (FE) written part	The written exam consists of 60 questions, and each question carries one point. Partially correct answers (half-points) and negative points does not exist. The minimum number of points for the passage is 36 (36 of 60 = 60%). After completing the written part of the exam, students have a break (how much is needed for the teacher to review the written assignments) and afterwards (the same day) students that passed written part of exam approach the oral part of exam in groups of two to four students.	examination periods	-
Final exam (FE) oral part	The requirement for the oral part of the exam is enough points collected either in colloquia or on the written part of the exam. Practical knowledge of the recognition of biodegradation of wood on 4 samples is required, which is a condition for the further course of the oral part of the exam. After the successful recognition of all four samples, the student is asked two theoretical questions (questions from the least solved colloquium) or three theoretical questions covering entire material. The final grade is obtained according to the formula: **(E×20 + FE×80) / 100**	examination periods	-

Compulsory literature

1. Proceedings of the International scientific conferences: WOOD IN THE CONSTRUCTION INDUSTRY, (Despot, R. i Jambreković, V. Editors); (publication years: 2000 – 2004), Zagreb: Faculty of Forestry.
2. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom (selected chapters).
3. Bravery, A. F., Berry, R. W., Carey, J. K., Cooper, D. E.: RECOGNISING WOOD ROT AND INSECT DAMAGE IN BUILDINGS, BRE Bookshop, Second edition, 1992. Garston, Watford, United Kingdom (selected chapters).

Recommended literature

1. Hasan, M., Despot, R.: ZAŠTITA DRVA I – Abiološki čimbenici, lignikolne bakterije i gljive, ksilofagni kukci i morski štetnici. Skripta za studente drvne tehnologije iz predmeta Zaštita drva I i Patologija drva. Sveučilište u Zagrebu, Šumarski fakultet, 2018. (at the web page: http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the course Zaštita drva I (Wood protection I), there is a link to download the script).
2. Špoljarić, Z: ZAŠTITA DRVA (Impregnacija), skripta za slušače DT odsjeka VII stupnja nastave Šumarski fakultet Zagreb, 1973.
3. Glavaš M.: GLJIVIČNE BOLESTI ŠUMSKOG DRVEĆA. Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, 1999. (selected chapters).
4. Vasić, K.: ZAŠTITA DRVETA 1: KSILOFAGNI INSEKTI, Naučna knjiga, Beograd, 1971 (odabrana poglavlja).
5. Petrović, M.: ZAŠTITA DRVETA 2: TRULEŽ I OBOJENOST DRVETA, Naučna knjiga Beograd, 1980. (selected chapters).

Basic statistics

DT-2314

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0

Lecturer
Professor Anamarija Jazbec, Ph.D.

Associate teacher for exercises
Assistent professor. Maja Moro, Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Types of Variables. Scales of Measurement. Graphic Presentations. Frequency tables and distributions. Measures of Central Tendency and Dispersion. Measures of Relative Standing. Empirical distribution. A Survey of Probability Concepts. Discrete Random and Continuous Random Variables: Binomial, Normal and T Distribuitions. Sampling Methods. Sampling Distribution. Standard error. Point and interval estimations. Interval estimation of population mean and proportion. Individual index numbers. Linear trend.

Type of course:

Basic statistics (compulsory, 1. semester, 2. year udergraduate study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify and distinguish numeric and categorical variables types (continuous, discrete, dichotomous, nominal, ordinal). Choose the appropriate graphs. Create a frequency table. Calculate the central tendency measures and analyze them. Calculate variability measures and analyze them. Calculate median and quartiles and analyze them.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Apply the basics of probability. Calculate probabilities.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Differentiate, sketch and apply theoretical distribution: normal, T and binomial distribution.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Apply different sampling methods: a random, stratified, systematic sample. Know the main essence of the central boundary theorem and the standard error.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Estimate (point estimate) the arithmetic mean, the standard deviation and the proportions of the population	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Calculate and interpret the interval estimate of the arithmetic mean, the standard deviation and the proportions of the population.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Calculate, draw and interpret individual index numbers.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1
Interpret and draw the linear trend equation Calculate the prediction using a linear trend equation.	Hand calculation exercises, Partial exams, Written and Oral Exam	A1

General competences

• Collect, statistically analysed, display collected data.
• Discuss and make conclusions based on the already analysed data.
• Writing a compliance report for a product.

Lectures

Exercises

Exercises are an upgrade to knowledge adopted in lectures. Each student gets 5 excersises that she/he must independently solve outside the regular classroom.

Working methods:

Teachers' obligations:

Preforming original lessons - lectures, exercises. Preforming Partial, Written and Oral Exams and Consultations. Creating teaching materials. Correcting Exercises.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preapering, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-		-	30	15	1,5
Exercies	-	-	-	30	30	2
Partial exams	100%	65-74	Sufficient (2)	4	15	0,5
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
Final exam	100%	60-70	Sufficient (2)	3		
		71-80	Good (3)			
		81-90	Very good (4)			
		91-100	Excellent (5)			

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of students on lectures and exercies is checked. The student may not attend a maximum of 4 hours of lecture classes and 4 hours of. Exercies. The student have to submit correctly solved 5 excerises.	semester (60 hours of direct lecturer)	-
Partial exams	During the course, students write two partial exams each with 5 tasks total 100 (2 * 50) points. The minimum number of points that can be obtained by the partial exam is 20. If they collect at least 65 points in two partial exams they can pass exam without the final exam.	During the semester	
Written exam	Exams can be accessed by students who have received a signature. The written part of the exam consists of 5 tasks totaling 100 points.	Exam terms	
Oral exame	Students who have passed the written part of the exam access the oral exam.	Exam terms	

Obligatory literature

1. Basic statistics e-course na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=36296
2. Jazbec A. 2009: Osnove statistike, 2 ed. Šumarski fakultet, Zagreb

Recommended literature

1. Bahovec V, Erjavec N ur. 2015: Statistika, Element, Zagreb
2. Montgomery D.C.2005: Statistical Luality Control, 5ed. Wiley, NewYork.
3. Spiegel, M.R. 1998: Theory and problems of Statistics, Schaum's Outline of Statistics, McGraw-Hill Companies, New York.
4. McClave, J., Dietrich, F.H. II. 1988: Statistics, Dellen Publishing Company, San Francisco.
5. Pavlić, I., 1970: Statistička teorija i primjena, Tehnička knjiga, Zagreb.
6. Duncan, A. J. 1974: Luality Control and Industrial Statistics, Irwin, Homewood, Illinois.

Transport equipment in wood industry

DT-2315

ECTS 5

English language

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work

Lecturer
Prof. Ružica Beljo Lučić
Assist. Prof. Matija Jug

Associate teacher for exercises
Prof. Ružica Beljo Lučić
Assist. Prof. Matija Jug

Grading

Sufficient (2) 60 %
Good (3) 70 %
Very good (4) 80 %
Excellent (5) 90 %

Course content:

Purpose and task of transport. Historical development of transport. Basic types of transport and transport equipment. Maximum load and capacity of transport equipment of continous and discontinuos supply. Measures for evaluation of transport activities. Equivalent resistance coefficient. Characteristics of transported materials in wood industry. Types of loads of transport constructions. Components of transport equipment. Driving mechanism of the transport equipment in wood industry. Transport equipment in wood industry. Discontinous transport equipment. Winches. Lifts. Cranes. Industrial vehicles. Hand-operated industrial vehicles. Motor-operated industrial vehicles. Road vehicles. Manipulators, industrial robots. Transport equipment of continuous supply. Conveyors. Mechanical conveyors with a hauling element (belt conveyors, chain conveyors, slat conveyors, scraper conveyors and elevators). Mechanical conveyors without a hauling element (roller and wheel conveyors, vibratory conveyors, screw feeders and conveyors and gravitational conveyors). Air conveyors. Components of air conveyors. Control of chip and dust extraction system. Transport equipment in the function of the production technological process. Transport systems in a sawmill, in production plants of particleboards, in production plants of veneer and plywood, in furniture production. Characteristics of transport equipment important in terms of choice and efficient application. Storage facilities / log yards in wood industry.

Type of course:

Transport equipment in wood industry (compulsory, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Calculate the basic characteristics of transported materials in the wood industry that are important for transport and storage: volume, mass, density, bulk density, bulk angle, granulation.	solving computational tasks, partial exams, practical exercises, final oral exam	A1, A4, B4, B5
Analyze influential factors on the basic characteristics of transported materials.	practical exercises, final oral exam	A1, A4, B4, B5
Calculate the required capacity of transport equipment in the woodworking and processing industry: capacity of conveyors (belt conveyors, scraper conveyors, elevators, roller conveyors, chain conveyors), cranes and industrial vehicles depending on the parameters of the technological processing of wood.	solving computational tasks, partial exams, final oral exam	A1, A4, B4, B5
Evaluate the transport losses expressed in percentage relative to the transported weight. Calculate the required driving power of the transport equipment in the woodworking process.	solving computational tasks, partial exams, final oral exam	B4, B5
Calculate the dimensions (diameter, cross-sectional area) and select the appropriate components of the steel rope and chain according to the appropriate standards depending on the load weight, rope and chain strength and load mode.	solving computational tasks, partial exams, final oral exam	B4, B5
Control the operation of the air conveyor system – determine static pressure drop in the system, dynamic pressure, air flow rate, and calculate the fan's utility and system utility.	solving computational tasks, partial exams, practical exercises, final oral exam	A1, A4, B4, B5
Select the ventilator for the air conveyor system depending on the system parameters.	solving computational tasks, partial exams, final oral exam	B4, B5

General competences

Communication skills, teamwork, presentation skills. Basic technical and technological knowledge needed for the solution of less complex tasks and issues related to transport of logs, sawn timber, bulk wood materials and wood products.

Type of instruction

Lectures

Different teaching methods, such as ex cathedra lectures, debating, learning in pairs and quizzes are used.

Exercises
Exercises include audit exercises (calculations) and laboratory exercises related to the properties of bulk wood material and the determination of the fan operating point of chip and dust extraction system. Through exercises students gain practical skills and additional knowledge that is an upgrade to the knowledge gained in the lecture.

Working methods:

Teachers obligations:
Teaching - lectures, exercises. Applying different teaching methods to help students gain knowledge and acquire learning outcomes. Designing topics for group work of students and compiling knowledge tests and evaluating them. Providing partial exams, oral exams and consultations. Creating teaching materials.

Students obligations:

Regular attendance and active participation in lectures and exercises, creation and presentation of exercises and topics. Attending partial exams or the final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30		1
Exercises (calculation and practical exercises)	-	-	-	40	5	1,5
Active participation in lectures and doing homework (A)		Collected extra points can increase the positive grade after the exams and the oral exam for one grade	-	-	5	0,2
Self-done exercises (E)	10%	Partly untidy and incomprehensible, with major corrections and on time	sufficient (2)	-	10	0,3
		Tidy, comprehensible, with major corrections and on time	good (3)			
		Tidy, comprehensible, with minor corrections and on time	very good (4)			
		Tidy, comprehensible, without corrections and on time	excellent (5)			
Partial exams (PE)	65%	min. 55 %	sufficient (2)	4	40	1,5
		min. 66 %	good (3)			
		min. 77 %	very good (4)			
		min. 88 %	excellent (5)			
Oral exam (OE)	25%	min. 60 % correct answers to the questions asked	sufficient (2)			

		min. 70 % correct answers	good (3)	1	15	0,5
		min. 80 % correct answers	very good (4)			
		min. 90 % correct answers	excellent (5)			
TOTAL	**100%**	**(Ex10 + PEx65 + OEx25)/100**		75	75	5

Evaluation elements	**Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Self-done exercises (E)	10%	Partly untidy and incomprehensible, with major corrections and on time	sufficient (2)	-	10	0,3
		Tidy, comprehensible, with major corrections and on time	good (3)			
		Tidy, comprehensible, with minor corrections and on time	very good (4)			
		Tidy, comprehensible, without corrections and on time	excellent (5)			
Final exam (FE) (written and oral)	90 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	5	55	2
TOTAL	**100%**	**(FEx90+Ex10)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercises	The attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (75 direct hours of lectures and exercises)	-
Active participation in lectures and doing homework (A)	Students can achieve additional points by solving the assignment tasks and solving the tasks gained in the classroom. The first 3-5 students who send out the correctly solved tasks get additional points.		
Self-done exercises (E)	Exercises are attended by groups. As part of the exercise, students need to create 1 exercise in AutoCAD, 2 calculation exercises and 2 reports on practical exercises. Tasks and necessary materials for doing the reports of exercises should be taken over at Merlin. The accuracy, tidiness and regularity of doing the exercises are evaluated.	in accordance with the agreed terms	
	Students have the opportunity to pass the written part of the exam through 3 partial exams. Each partial exam consists of computational tasks and theoretical questions. The maximum number of points in a single partial exam is 150, a total of 450 on 3 partial exams.	The partial exams takes place after 5, 10 15 term of lectures and exercises	Students who pass partial exams can access the oral exam
Final writen exam (FE)	Exams can be taken by students who have all self-done exercises and reports from practical exercises. Written exam is taken by students who have not passed partial exams. The written exam consists of 3 calculation tasks, every with 5 points. Students who achieve at least 60% of the written assignments can access the oral exam.	exam schedule	-

Oral exam (OE)	Students passing partial exams or a final written exam can access the oral exam. On oral exam, students are asked questions from different parts of the program content that require understanding and linking of acquired knowledge and application on short problem assignments. The final grade of the subject is obtained according to the formula **(Ex10 + PEx65 + OEx25)/100 ili (FEx90+Ex10)/100**	exam schedule	

Obligatory literature

1. Sever, S. 1988: Transport u drvnoj industriji, autorizirani rukopis, Zagreb, 1 – 26, 50 – 231.
2. Hamm, Đ. 1987: Transportni uređaji, Šumarska enciklopedija, svezak 3, JLZ "Miroslav Krleža", Zagreb, 521-529.
3. Oluić, Č. 1991: Transport u industriji, Rukovanje materijalom I. dio, Sveučilišna naklada, Zagreb, 1 – 278.
4. Transportna tehnika e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=38296

Recommended literature

1. Biljan, M. 1980: Dizalice, Šumarska enciklopedija, svezak 1, JLZ, Zagreb, 346 – 357.
2. Mađarević, B. 1972: Rukovanje materijalom, Tehnička knjiga, Zagreb, 1 – 476.
3. Šćap, D. 1993: Prenosila i dizala (Odabrana poglavlja), Uvodne osnove, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje, Zagreb.

Field work I

DT-2316

ECTS 4

Teaching hours 40

Grading

Course content:
Field work is a compulsory course of Undergraduate study and implies a student's workload equivalent to the 4 ECTS. During the III semester of the Undergraduate Study, it is necessary to complete field work for a total duration of 5 days or 40 hours.

Type of course:
Field work I (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Calculate the operating regime of woodworking machines by separating the shavings. Calculate the cutting forces, the required cutting power, the power of the electric motor and the effect of the woodworking machines.	Field work report evaluation
Distinguish the defects in coniferous and hardwood species. Identify the wood defects of round wood and specify each of them. Classify the defects of the wood according to their significance in wood processing. Evaluate the impact of the defect of round wood. Evaluate the quality of round wood considering the wood defects.	Field work report evaluation
Identify and differentiate hazard classes, mechanism of degradation and the current health condition of wood or wooden products. Identify and anticipate critical points of the product where the fastest and most intense degradation of wood will be. Predict the mechanism of weathering and / or biodegradation of wooden products for each hazard class.	Field work report evaluation
Measure and collect the required parameters for the effectiveness calculation of the transport equipment capacity and the transport driving powerin the woodworking industry and furniture production. Calculate the approximate effectiveness of the transport system.	Field work report evaluation

General competencies
Field work in production facilities with examples from practice completes theoretical knowledge of students acquired at undergraduate studies.

Calculate the operating regime of woodworking machines and the effect of the wood working machiens. Disitinguish defects in coniferous round wood from defects in hardwoods, evaluate the quality of round wood considering the wood defects. Identification, differentiation and prediction of hazard calsses in wood. Recognition

of wood defects caused by biotic degradation in wood. Application of procedure and preservatives in wood protection.Basic technical and technological knowledge needed for the solution of less complex tasks and issues related to transport of logs, sawn timber, bulk wood materials and wood products.

Working methods:

Teachers' obligations:
Organize field work, design tasks that students will be able to handle independently, and be available for consultation during and after field work. To introduce students to the rules of behavior in the field work. To provide the student with the necessary help and instruction in working on the solution of field work assignments. Review and evaluate field-based reports.

3. Students' obligations:

Active participation in field work. Respect the rules on the field work. Write a report from the field tutorial.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				40	80	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student's skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		

Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Constructions of wooden products 1

DT-2416

ECTS 7

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Professor Silvana Prekrat, Ph.D.

Associate teacher for exercises
Professor Silvana Prekrat, Ph.D.
Assistant Professor Vjekoslav Živković, Ph.D.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Construction venue and tasks. Wood, wooden and non-wooden materials as furniture and equipment construction materials. Technical drawing of wooden products. Technical drawing according to the standards. Deviations from measures, tolerances and fits. Technological markings for mechanical finish, connecting with glue, surface finish, upholstery. Control of drawings. Selection of characteristic views and cuts by determining position of the cut plane, demonstration of parts, product assemblies and details views and cuts. System of constructional forms for joining wooden constructions. Longitudinal, latitudinal, plain and miter joint of the elements of solid wood and of wood based panels.. Corner joints of wooden elements. Computerized construction. Advanced mastering of AutoCad in 2D projection. Products designing as information processing. CAD/CAM system and its importance, designing equipment and computerized construction. Functional description of CAD system. Assembling and connecting elements. Construction principles for wooden products.

Type of course:

- **Constructions of wooden products 1** (compulsory course, III. semester, II. Year)

Learning outcomes and evaluation methods

Learning outcomes (LO	Evaluation methods	Connection with the study program LO
Recognition of different wood species, types of wooden and non-wooden materials in the construction of furniture and furnishing.	exercises in computer lab, colloquium, test, final exam	C5
Make a technical drawing of the element and the assembly in terms of and cross section according to norms	exercises in computer lab, colloquium, test, final exam	C5
Use technological labels, adhesive joints, mechanical and surface treatments	exercises in computer lab, colloquium, test, final exam	C5
Apply tolerances - tolerances on wood products. Calculate the percentages on wood assemblies	exercises in computer lab, colloquium, test, final exam	C5
Choose characteristic views and cross sections by determining the plane position	exercises in computer lab, colloquium, test, final exam	C5
Apply simple calculations for dimensioning construction elements.	exercises in computer lab, colloquium, test, final exam	C5
Make a technical description of the product.	exercises in computer lab, colloquium, test, final exam	C5
Describe and recognize the system of constructional forms of assembly on the products.	exercises in computer lab, colloquium, test, final exam	C5
Sketching and technical drawing in orthogonal and axonometric projections showing different forms of construction of wooden structures.	exercises in computer lab, colloquium, test, final exam	C5
Separate joints and assemblies and use fitting and joining elements in wooden structures.	exercises in computer lab, colloquium, test, final exam	C5
Design longitudinal assemblies width and angle assembly and edge and corner assembly	exercises in computer lab, colloquium, test, final exam	C5
Create basic structural documentation of furniture and wood products using AutoCad.	exercises in computer lab, colloquium, test, final exam	C5
Apply appropriate hardware on products of wood	exercises in computer lab, colloquium, test, final exam	C5

General competences

- Mastering of the advanced 2D modelling with AutoCAD.
- Learning about CAD system in wood industry.
- Tasks of the constructor.
- Mastering of the construction systems and preconditions for products construction.
- Basic construction documentation and systematic approach to its development.

Forms of teaching

Lectures

Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise management in wood processing and furniture manufacturing in the field of project management with practical examples and with computer technology aid, which make exercises and the whole subject easier to acquire.

Exercises

Exercises on individual tasks with a purpose to implement theoretical basics learned on the lectures in a work in computer practicum using computer software.
As part of the exercise, 14 construction exercises are performed, one lab and one practical exercise to create a physical model.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Teaching - lectures, exercises, homework, topics of seminar papers. Providing colloquia, written and oral exams and consultation. Creating teaching materials

Student's' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	5 %	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	45	15	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Colloquium notice in technical drawings (K1)	20%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
Colloquium Constructional forms of assembly (K4) (K2)	20%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Colloquium Constructional forms of assembly (K4) (K3)	20%	60-70%	Sufficient (2)	0	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Colloquium Constructional forms of assembly (K4)	20%	60-70%	Sufficient (2)	15	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Short tests (ST)	**15%**	50-65%	Sufficient (2)	0	15	0,5
		66-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Vx5+K1x20+K2x20+K3x20+K4x20+KTx15)/100**		90	90	7

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	100 %	61-70%	Sufficient (2)	*3*	*90*	*3*
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(ZIx95+Vx5)/100**				

*** Students who do not pass Colloquium during the semester have to attend the final exam access examination period that makes 95% of the grade, and the remaining 5% is rating from exercises**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (90 hours of direct lectures)	-
Exercise	Exercises will be performed in 14 separate parts. Before the start of each exercise, students are given exercise forms. Punctuality, tidiness, and regular attendance are evaluated (exercise must be delivered on time).	According to specified date	-
Colloquium (K1,K2,K3,K4)	Overall written exam is divided in 4 parts.	K1– 4th week K2 – 8th week K3 – 13th week K4 – 15th week	Students who do not pass Colloquium can take the written exam
Short tests	Duration 10 min. From 5 to 10 questions.	before the lecture	
Written exam	Students can attend the exam when following conditions are satisfied: Finished and tested exercises, short tests passed. The written exam is evaluated and participates in the final grade of the subject.	In given exam periods	-
Oral exam	Students who pass a written exam are asked questions from different parts of the subject content. The final grade of the subject is obtained according to the formula **Vx5+KTx15+PIx65+UIx15/100**		-

Obligatory literature

1. Tkalec, S. Prekrat, S. (2000): Konstrukcije proizvoda od drva – osnove drvnih konstrukcija, Sveučilišni udžbenik Šumarski fakultet i Znanje, Zagreb
2. Konstrukcije proizvoda od drva I e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=41658

Recommended literature

1. Drvna industrija. Znanstveni časopis za pitanja drvne tehnologije
2. Nutsch i ostali (20015): Holztechnihnik Tabelenbuch, Europa Lehrmittel
3. Nutsch, W. (2015): Holztechnik Gestaltung, Konstruktion und Arbeitsplanung
4. Hamad M. (2019): AutoCAD 2019 Beginning and Intermediate

Drying of wood and wood materials

DT-2417

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45

Lecturer
Professor Stjepan Pervan, PhD

Associate teacher for exercises
Miljenko Klarić, PhD

Grading

Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The theoretical basics of wood drying process, wood - moisture relations, hygroscopic properties of wood, shrinkage and swelling in drying process, wood moisture content measuring and controlling in wood drying process, air drying – basics, green and dry lumber stockyard, basics and means of technical drying of solid wood, types and use of kiln drying schedules, kiln dryers: types and equipment, drying control systems – basics usage, wood defects in drying process, diminishing of wood drying defects, Processes and schedules for chipped wood drying, Processes and schedules for veneer drying

Type of course:

- Drying of wood and wood materials (compulsory, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the basics of wood chemistry and its impact on the drying process	exercises, lectures, exam	C3
Define the basics of wood technology and the impact of technological properties on the drying process	exercises, lectures, exam	C3
Define the anatomical basics of wood and their influence on the drying process	exercises, lectures, exam	C3
Explain the theoretical basics of the drying process, the relationship between water and wood	exercises, lectures, exam	C3
Describe the hygroscopicity of wood in relation to the surrounding climate, the negative phenomena of shape change (shrinkage and swelling) during drying the most commonly used commercial wood species in Croatia	exercises, lectures, exam	C3
Identify the impact of process errors on wood and finished products quality	exercises, lectures, exam	C3
Provide methods for measuring water content during the wood drying process and explain their industrial application	exercises, lectures, exam	C3
Describe the natural drying - basics, storage yard of raw and dried material	exercises, lectures, exam	C3
Describe ways of organizing the storage yard by the type of transport means	exercises, lectures, exam	C3
Describe the basics of technical drying of massive wood	exercises, lectures, exam	C3
Categorize the types of technical drying of the massive wood according to the technical criteria	exercises, lectures, exam	C3
Categorize and apply types of wood drying regimes	exercises, lectures, exam	C3
Distinguishing wood drying kilns according to the type of process and the level of equipment	exercises, lectures, exam	C3
Describe and use of kiln control systems in industrial conditions	exercises, lectures, exam	C3

Group and identify wood faults in the drying process to reduce the share of wood defects. Choose the most economical wood drying method without defects (natural drying, technical drying or combination of both types)	exercises, lectures, exam	C3
Explain the processes and techniques of technical drying of chopped wood	exercises, lectures, exam	C3
Explain the processes and techniques of veneer technical drying	exercises, lectures, exam	C3
Group and identify veneer drying defects	exercises, lectures, exam	C3
Organize the storage yard for natural drying and the typical types of stacks used	field work	C3
Suggest wood types that dry on the storage yard and distinguish their characteristics	field work	C3
Apply the method of calculating the capacity of the storage yard for natural drying	field work	C3
Develop a kiln scheme with a technical description of the process, capacity, and type of stacks	field work	C3
Suggest wood types to be dried in the factory and under which regimes	field work	C3
List and describe the main and auxiliary equipment of the wood drying kilns	field work	C3

General competences
The aim of the course is to qualify the expert for self-governing monitor and control of drying process of solid wood, veneer and chipped wood**.**

Type of instruction

Lectures
In the course of lectures, students gain knowledge about wood drying processes.

Exercises
As part of auditory exercises, laboratory exercises and practical exercises, students receive an upgrade to the knowledge gained during the lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the colloquia and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	30	2
Exercises (E)	20 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	15	2
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE)	80 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PEx80)/100**		75	75	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 %	Sufficient (2)			1
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100	Excellent (5)			
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 10 % of direct teaching hours.	semester (75 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. At the beginning of the first exercise, students will receive templates. Exercises are written by hand. For each exercise, the term in which the exercise is handed and evaluated positively, is defined. If the exercise is not handed within the defined time frame or if the exercise is not evaluated positively, then that exercise will be reviewed later after semester ends and the student will receive the seminar assignment and additional computational tasks for each exercise. The accuracy, tidiness and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Written exam	Exam can be attended by students who have completed the exercises. The exam consists of theoretical questions, computational tasks and of the sample that students must describe. For passage students must collect at least 60 % of points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **(FEx80+Ex20)/100**		-

Obligatory literature

1. Pervan, S. (2000): Priručnik za tehničko sušenje drva. 272 p. SAND 2000.
2. Krpan, J. (1965): Sušenje i parenje drva. Šumarski fakultet Zagreb, 363 p.

Recommended literature

1. Gorišek, Ž., Geršak, M., Velušček, V., Čop, T., Mrak, C. (1994): Sušenje lesa. Lesarska založba, Ljubljana. 235 p.
2. Simpson, W. T. (1991): Dry kiln operator's manual. USDA, FPL, Madison, Wisconsin, 274 p.
3. *** (1987): Die Schnittholztrocknung. Dipl. ing. R. Brunner. Hannover. 322 p.

Sawmilling technology 1

DT-2418

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45

Lecturer
Assistant professor Josip Ištvanić, Pd.D.

Associate teacher for exercises
Assistant professor Josip Ištvanić, Pd.D.

Grading

Sufficient (2) 70-79%
Good (3) 80-89%
Very good (4) 90-95%
Excellent (5) 96-100%

Course content:

Introduction to the sawmilling production. Short overview of sawmilling history. The importance of the sawmilling industry. Sawmilling raw materials. Variety of the sawmilling raw material. Measurement of round wood. Quality and characteristic defects of our most important wood species. Standard rules for sawmilling logs. Sawmilling products and residues. Main characteristics of the sawn wood. Quality and defects of sawn wood. Standard rules for sawmilling products. Measurement of sawn wood. Oversizes of sawn wood. Sawmilling plant. Main parts of sawmilling plant. Other parts of sawmilling parts. Major sawmill machinery. Vertical log band saws and resaws. Other types of log band saws. Frame saws. Circular saws. Log chipping machines. Selection and working conditions of sawmill machines. Criteria for selection of sawmill machines. Significance of sawmill machines for the quantity and quality yield of logs. Capacity of major sawmill saws. Production and technological process in sawmill. Production flow and technological charts processing fir and spruce logs and hardwood logs. Log conversation methods. Conversation of logs by chipping methods. Other methods of log conversation. Log conversation methods. Methods of sawing of more important wood species. Criteria for a successful machining of saw logs. Log yield in form of sawn wood. Integral log yield.

Type of course:

Sawmilling technology 1 (obligatory subject, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish type and quality of oak, beech, fir and spruce sawmilling raw material	Exercises, exsam	C2
Distinguish type and quality of oak, beech, fir and spruce sawmilling products	Exercises, exsam	C2
Measure the dimensions of the round wood (diameter and length)	Exercises, exsam	C2
Calculate individual volumes of round wood shavings based on the measurement of their dimensions (diameter and length)	Exercises, exsam	C2
Estimate (calculate) the volume of the stack, or the volume of the round wood in the stack	Exercises, exsam	C2
Calculate individual volumes of sawmilling products by measuring their dimensions (thickness, width and length)	Exercises, exsam	C2
Estimate the (computed) volume of the stack, or the volume of sawmilling products in the stack	Exercises, exsam	C2
Calculation of oversizes on sawmilling products	Exercises, exsam	C2
Distinguish types and application of log band saws and resaws	Exercises, exsam	C1
Distinguish the types and application of the frame saws	Exercises, exsam	C1
Distinguish types and application of circular saws	Exercises, exsam	C1
Distinguish types and applications of secondary sawing circular saws specializing in cross-cut sawing	Exercises, exsam	C1
Different types and applications of secondary sawing circular saws specializing in rip sawing	Exercises, exsam	C1
Link different types of sawing machines to sawmilling technology,	Exercises, exsam	C1
Calculate the success of sawing of certain wood species according to the criteria of quantitative yield of round and sawn wood,	Exercises, exsam	C2
Calculate the success of sawing of certain wood species according to the criteria of value yield of round and sawn wood	Exercises, exsam	C2
Use the basic methods of sawing logs	Exercises, exsam	C2
Use the basic methods of sawing the planks	Exercises, exsam	C2
Plan and organize day-to-day sawmilling production.	Exercises, exsam	D1

General competences

- Sawmilling products and sawmilling raw material knowledgment and practical abilities for their gradings and measurements.
- Knowledgment and use of sawmilling machines, sawmilling technologies and sawing logs and sawn woods methods.

- Understanding the criteria for a successful machining of sawlogs and adopting the basic skills of sawmill wood technology.

Type of instruction

Lectures
Auditory lectures are carried out according to weekly curriculum

Exercises
As part of the exercise, there are six computing and drawing exercises related to the content of the lectures. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures and exercises. Designing and reviewing exercises and topics for final papers. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials

Students' obligations:
Regular attendance and active participation in lectures and exercises, making exercises, conducting exams and preparing and presenting final work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30		1
Exercises (E)				45	45	3
Written exam (WE)	100%	70-79%	Sufficient (2)		30	1
		80-89%	Good (3)			
		90-95%	Very good (4)			
		95-100%	Excellent (5)			
*Oral exam (OE)		Percentage of response accuracy ≥70%	Positively			
		Percentage of response accuracy <70%	Negative			
Total Final exam (FE)		FE=WE+1		75	75	5

* Only those students who want a higher final grade than those obtained on a written exam are issued to the oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score. In the case of 70% and more positive answers, the final grade can only be achieved by one step higher than the previously achieved on the written exam.

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from the direct teaching as much as stipulated in the Rulebook on Studying.	Semester (75 hours of direct lecturer and exercies)	-
Exercises (E)	As part of the exercise, 6 counting exercises and drawings are performed. Students with task assignments and tips for making all 6 exercises, and the appearance of the file, card and inserts are downloaded from the subject's web site. When submitting the exercises, the student should explain how to solve the exercises.	Continuously during the term of the semester according to the agreed term. Students who have created and explained all the exercises and those accepted by the teachers can access the exam.	
Written exam	Examinations can be attended by students who have completed, reviewed and explained all exercises. Students on pre-printed exams answer questions asked by rounding off responses, describe images, draw schemes, and solve computational tasks. The written exam is evaluated according to the scale given in the methods of grading.	Exam terms	-
*Oral exame	Only those students who want a higher grade than those obtained on a written exam are issued an oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score. They ask questions from different parts of the program content. In the case of 70% and more positive answers, only one step higher final grade than the previously achieved on a written exam can be achieved.	Exam terms	-

Obligatory literature

1. On the website http://www.pilanarstvo.com there are links to the templates and exercise tips and a wide range of useful information regarding sawmilling technology, created by: Josip Ištvanić
2. Brežnjak, M. 1997: Pilanska tehnologija drva, I dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
3. Brežnjak, M. 2000: Pilanska tehnologija drva, II dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
4. Dević, I.; Ištvanić, J., 2003: Alati i strojevi u obradbi drva 1, Element, Zagreb, 2003.
5. Goglia, V. 1994: Strojevi i alati za obradu drva I dio, Sveučilište u Zagrebu, Šumarski fakultet

Recommended literature

1. Merzelj, F. 1996: Žagarstvo: Udžbenik, Kmečki glas, Ljubljana.
2. Gornik Bučar, D.; Merzelj, F. 1998: Žagarski praktikum, Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za lesarstvo.
3. Nikolić, M. 2004: Prerada drveta na pilanama, udžbenik, Univerzitet u Beogradu, Šumarski fakultet, Beograd

Glues and wood gluing

DT-2419

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Associate professor Goran Mihulja, PhD
Assistant professor Josip Miklečić, PhD

Associate teacher for exercises
Assistant professor Vjekoslav Živković, PhD
Assistant professor Josip Miklečić, PhD

Grading
Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:

Adhesion in general and wood surface wetting. Glue types for final products. The material to be glued. Measuring density of glue. Measuring viscosity of glue. Measuring solid content in glue. Measuring the pH value of glue. Measuring inner stresses in joins. Measuring resistance to high and low temperatures. Production of tests pieces for strength testing. Testing shear strength. Testing bending strength. Testing joins on glued foams. Tension in the joint. Trends and characteristics of bonded joints. Quality of bonded joints. Durability of the bonded joints. Joint characteristics at different humidity, temperature, weather conditions and loads. Formation and anatomy of glue joints, basic gluing parameters. Joint formation at various procedures. Bonding of final products. Geometry of glue joint but. Properties of the glue joints. Properties of adhesion and adhesive depending on the adhesion and bonding regimes and conditions during use. Procedures: Lengthening of wood. Wood gluing. Wood gluing. Chair gluing. Corpus gluing. Surfaces and edge gluing, gluing of veneers, foils and laminates. Bonding of frames and cramped structures. Bonding in production of upholstered furniture. Bonding of bent elements.

Type of course:

- Glues and wood gluing (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the basic theory of adhesion present in wood gluing;	partial or final exam	C6
Distinguish and categorize glue according to source of raw material, hardening method (thermosetting and thermoplastic adhesive groups), and usage (constructive and nonconstructive purposes);	partial or final exam	C6
Repeat the measurement of the basic adhesive properties such as viscosity, density and solid content and explain their significance for the bonding process;	laboratory exercises, corrections, and exercises evaluation	C6
To know, check and control glue factors, substrates, and bond formation processes;	exercises reports, corrections, and exercises evaluation	C6
Suggest the type of adhesive for each material and application of the adhesive assembly;	partial or final exam	C6
Explain the anatomy of the bonded joint, distinguish the factors of strength and durability and formulate their impact on product quality;	exercises reports, corrections, and exercises evaluation	C6
Evaluate the quality of adhesives according to EN and ISO test methods;	laboratory exercises, corrections, and exercises evaluation	C6
Identify, check and recommend basic adhesion parameters (glue application, application uniformity, pressure and compression temperature) and adhesive technology (type of press, adhesive application machines, machines for intensification of curing ...);	partial or final exam	C6

General competences
• Acquiring knowledge about wood adhesives.
• Acquire knowledge and skills on gluing technology.

Type of instruction

Lectures
Mainly auditorial with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.

Exercises
Exercises are an upgrade to knowledge adopted in lectures. It consists of laboratory demonstrations and measurements that are limited by the practical work of the students. The report consists description of the task and measurement procedure, as well as the results and conclusions.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	30%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	30	30	1,5
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	35%	51-64%	Sufficient (2)	1	14	0,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	35%	51-64%	Sufficient (2)	1	14	0,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(E x 30 + PE1 x 35+ PE2 x 35)/100**		47	58	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	51-64% 65-77% 78-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	28	1,5
TOTAL	**100%**	**(FE x 80 + E x 30)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes.	semester (30 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) have to be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Ljuljka, B. 1978: Lijepljenje u tehnologiji finalnih proizvoda, Zagreb, 1 – 219.
2. Mihulja, G.: Ljepila i lijepljenje drva (interna skripta).

Recommended literature

1. Bandel, A. 1995: Gluing wood, CATAS, Udine.

Panels from Fragmented Wood

DT-2420

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work

Lecturer
Prof. Vladimir Jambreković, PhD
Assist. Prof. Nikola Španić, PhD

Associate teacher for exercises
Assist. Prof. Nikola Španić, PhD

Grading

Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:

Introduction to the importance of panel development. Basic panel types. Raw materials for panel production. The basics of panel production. Materials for panel overlaying. Properties and use of panels from fragmented wood. Panels with horizontally oriented particles. Panels with vertically oriented particles (extrusion panels). One layer, three-layer, multi-layer and panels with graduated structure. Light weight, medium-heavy, and heavy panels. Working panels and frontal panels. Postforming variation. Solid panels and extrusion panels with holes. Panels with macro particles (WB, OWB i OSB panels). Stone-wood panels. Lightweight construction panels bonded with plaster. Cardboard panels bonded with plaster. Lightweight construction panels bonded with cement. Concrete particleboards. Particleboards bonded with cement, magnesite or plaster. Particleboards reinforced with synthetic or mineral fibres. Triboard, Woodmat and Spaceboard panels. Lignoplast mouldings. Werzalit mouldings. Collipress mouldings. LSL and LFL panels Fibreboards - hard boards (HB), medium boards, medium boards of low density (MBL), medium boards of high density (MBH), porous boards (SB), dry process (MDF, HDF), lightweight MDF, ultra-lightweight MDF, isolation boards. Tarred fibreboards. Fibreboards bounded with cement. Fibreboard bounded with plaster. Boards coated with veneer, synthetic material, HPL, DPL or CPL decorative laminate, decorative paper impregnated with synthetic resins, varnishes and enamel. Overlays for 3D overlaying. PVC overlays. ABS edge strips and foils.

Type of course:

- Panels from Fragmented Wood (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to explain the significance of fragmented wood panels	laboratory and practical classes, colloquium, final exam	C4
to anticipate the guidelines of panel development	laboratory and practical classes, colloquium, final exam	C4
to interpret the geographic distribution of production areas and panel consumption in the global contexts	laboratory and practical classes, colloquium, final exam	C4
to identify the basic board types	laboratory and practical classes, colloquium, final exam	C4
to identify the basic raw materials for panel manufacturing	laboratory and practical classes, colloquium, final exam	C4
to describe the characteristics and to evaluate the quality of lignocellulosic raw materials	laboratory and practical classes, colloquium, final exam	C4
to select the chemical components for panel manufacturing	laboratory and practical classes, colloquium, final exam	C4
to describe the properties of formaldehyde resins (UF, MF, FF) and other types of binders	laboratory and practical classes, colloquium, final exam	C4
to evaluate the resins for panel manufacturing (formaldehyde, polyurethane , tannin and lignosulfonate based resins)	laboratory and practical classes, colloquium, final exam	C4
to explain the free formaldehyde emission	laboratory and practical classes, colloquium, final exam	C4
to choose an adhesive for production of a certain board type	laboratory and practical classes, colloquium, final exam	C4
to use basic and auxiliary raw materials for panel manufacturing	laboratory and practical classes, colloquium, final exam	C4
to list and explain the specificity of properties and application of mineral binders	laboratory and practical classes, colloquium, final exam	C4
to show basic phases and equipment in particleboard production	laboratory and practical classes, colloquium, final exam	C4
to explain the procedures for obtaining particleboards and fibreboards	laboratory and practical classes, colloquium, final exam	C4
to explain the basics of the fragmented wood panels production	laboratory and practical classes, colloquium, final exam	C4
to analyse the basic technological parameters in panel production	laboratory and practical classes, colloquium, final exam	C4
to identify surface coating materials	laboratory and practical classes, colloquium, final exam	C4
to describe the properties and application of fragmented wood panels	laboratory and practical classes, colloquium, final exam	C4
to show the significance of panels with horizontally oriented particles	laboratory and practical classes, colloquium, final exam	C4
to recognize the specificity of the production and characteristics of the panels with the vertically oriented particles (extrusion panels)	laboratory and practical classes, colloquium, final exam	C4

to explain the structure specificity panels made from macro particles (OSB)	laboratory and practical classes, colloquium, final exam	C4
to identify special types of panels and trusses for construction made of fragmented wood	laboratory and practical classes, colloquium, final exam	C4
to recommend the use of panels coated with natural veneer and decorative synthetic materials (HPL, DPL, CPL, 3D coating foils, ABS foils)	laboratory and practical classes, colloquium, final exam	C4

General competences

- Acquiring of knowledge on production processes in fragmented wood panels industry and use of the knowledge gained for the purpose of independent monitoring and control of production processes in wooden board factories.
- Acquiring of knowledge on the properties of fragmented wood panels and use of the knowledge for the purpose of proper selection and use of panels with optimal characteristics.

Type of instruction

Lectures

Exercises

As a part of the exercises, the characterization of the raw material for the production of particleboards and fibreboards is carried out, and the properties of the industrially produced boards are determined. Additionally, based on raw materials data and the calculation of required components (separate exercise in a computer classroom) experimental particleboards are production and their properties are determined. The exercises are mostly of a practical nature and are carried out in a laboratory, workshop and practicum. Exercises are an upgrade to the knowledge acquired in lectures.

Working methods:

Teachers' obligations:

Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold colloquiums, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises reports within the given time frame. To attend the colloquium and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	15	2
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible and on time	Excellent (5)			
Colloquium (macroscopic identification of certain board type; PC)	10%	The student determines the board types with the great aid from the examiner	Sufficient (2)	-	30	1
		The student determines the board types with the minor aid from the examiner	Good (3)			
		The student individually and logically determines the board types with the minor aid from the examiner	Very good (4)			
		The student individually and logically determines the board types without the aid from the examiner	Excellent (5)			
Theoretical colloquiums (TC)	70%	50-61%	Sufficient (2)	-	30	1
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PCx10 + TCx70)/100**		75	75	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	70 %	50-61%	Sufficient (2)	*2*	*60*	*2*
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(FEx70 + PCx10 + Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (75 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. Through exercises, the students are introduced to the properties of raw materials for fragmented wood panels production and they produce experimental particleboards and determine their properties. In addition they determine the properties of commercially produced particleboards and fibreboards and perform the comparison to the properties of experimentally produced panels. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Colloquium (macroscopic identification of certain board type)	On the basis of the knowledge gained on the exercises and through consultation, the students macroscopically determine the 5 samples of fragmented wood panels. Beside the name of the board, students need to know the basic properties of a certain board type and how and where to use them. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Students who pass the colloquium can access the exam
Theoretical colloquiums	Theoretical colloquiums consist of five theoretical questions related to knowledge gained on the lectures and exercises. The students are given the printed colloquiums and they answer the questions asked. Theoretical colloquiums are evaluated and participate in the final grade of the subject.	in accordance with the agreed terms	-
Written exam	Only the students which have submitted their exercises reports and have passes the colloquium, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **(Ex20 + PCx10 + FEx70)/100**		-

Obligatory literature

1. Jambreković, V.: Drvne ploče i emisija formaldehida, Sveučilišni udžbenik, Šumarski fakultet, Zagreb,
2. 2004.
3. Bruči, V., Jambreković, V.: Ploče iverice i vlaknatice, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 1996.
4. Bruči, V., Janović, Z., Jambreković, V., Brezović, M.: Određivanje formaldehida iz drvnih pločastih materijala perforatorskom metodom, Sveučilišni laboratorijski priručnik, Šumarski fakultet, Zagreb, 1994.
5. Šumarska enciklopedija: Ploče iz usitnjenog drva, Jugoslavenski leksikografski zavod, Zagreb, 692-727, 1983.

Recommended literature

1. Wood Handbook: Wood as an Engineering Material, Forest Products Society, 1999.
2. Jambreković, V., Medved, S., Antonović, A.: Ecological requirements regarding the materials used in the furniture production, proceedings Furniture industry adjustment to European standards, 77-84, Zagreb, October 17th, 2003.
3. Bruči, V., Salah-Omer, E., Jambreković, V.: Certification and quality Attestation of woodbased panels. 1st International Conference "A Perspective of Wodworking-Industrial System in Bosnia and Herzegovina", Proceedings 183-193, Bihać, 1998.

4. Bruči, V., Jambreković, V.: Razvoj proizvodnje, svojstava i primjene OSB ploča, Drvna industrija, 1998, 49(1): 41-49.
5. Jambreković, V., Bruči, V.: Stanje i razvojni trend ploča na bazi drva u svijetu, Drvna industrija, 1997, 48(1): 27-34.
6. Jambreković, V., Bruči, V.: MDF - svjetski trend, Drvna industrija, 1997, 48(2): 96-102.

Field work-2

DT-2421

ECTS 4

Teaching hours 40

Grading

Course content:

Field work is a compulsory course of Undergraduate study and implies a student's workload equivalent to the 4 ECTS. During the IV semester of the Undergraduate Study, it is necessary to complete field work for a total duration of 5 days or 40 hours.

- **Field work I. – Wood technology** (compulsory course IV semester, 2. year)

Learning outcomes and evaluation methods

Ishod učenja (IU)	Način provjere
Differentiate the wood, wooden and other materials in furniture constructions and furnishing. Apply allowed tolerances and fits on wood products. Synhronize constructional solutions according to the available technology.	Field work report evaluation
Organize the storage yard for natural drying and the typical types of stacks used. Calculate the capacity of the sorage yard for natural drying. Develop a kiln scheme with technical description of the process, capacity, and type of stacks. Suggest wood types and regime of drying. List and describe the main and auxiliary equipment of the wood drying kilns.	Field work report evaluation
Differentiate the lignocellulosic raw material, recognize the devices and equipment for the production of panels from fragmented wood. Sketch the production process line, connect theoretical knowledge with the practical work in production.	Field work report evaluation
Differentiate the type and quality of round wood and sawnwood. Differentiate type and different application of sawmilling devices. Calculate the sawmilling efficiacy for different wood species.	Field work report evaluation
Analyze the internal control results of the bonding process. Analyze the impact of adhesive types, machines, equipment and identify constraints that reduce production competitiveness.	Field work report evaluation

General competencies

- Differentiate the wood, wooden and other materials in furniture constructions and furnishing. Apply allowed tolerances and fits on wood products. Synhronize constructional solutions according to the available technology.
- Organize the storage yard types of stacks used for natural drying. Calculate the capacity of the sorage yard. Develop a kiln scheme of different drying process. Suggest wood types and kiln regime.

- Recognize the lignocellulosic raw material, devices and equipment in production of panels from fragmented wood. Connect theoretical knowledge with the practical work in production.
- Differentiate the type and quality of round wood, sawnwood and sawmilling devices.Calculate the sawmilling efficiacy for different wood species.
- Analyze the internal control results of the bonding process. Analyze the impact of adhesive types, machines, equipment and identify constraints that reduce production competitiveness;

Working methods:

2. Teachers' obligations:

Organize field work, design tasks that students will be able to handle independently, and be available for consultation during and after field work. To introduce students to the rules of behavior in the field work. To provide the student with the necessary help and instruction in working on the solution of field work assignments. Review and evaluate field-based reports.

3. Students' obligations:

Active participation in field work. Respect the rules on the field work. Write a report from the field tutorial.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				40	80	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student's skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c)		

teaching	Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

4. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Veneer and veneer plywood

DT-3521

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45

Lecturer
Prof.dr.sc. Mladen Brezović

Associate teacher for exercises
Prof.dr.sc. Mladen Brezović

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Veneers. Wood as a raw material. Plant log storage yard. Log protection in the storage yard. Mechanical process of veneer logs. Defects of veneer logs due to mechanical process. Veneer logs heating by hot water or steaming. Heating process and defects of veneer logs. Veneer slicing. Veneer slicing machine. Defects due to veneer slicing. Veneer peeling. Veneer peeling machine. Veneer peeling - centric. Centring a log. Veneer peeling - eccentric (cutting). Defects due to veneer peeling. Final process of veneer. Veneer jointing. Veneer classification. Veneer storing. Other types of veneer. Coloured veneers. Micro-veneers. Fine line veneers. Sawn veneers. Veneer plywood. Manufacture line of veneer plywood. Adhesives for veneer plywood. Adhesive spreading. Adhesive mixtures. Defects due to adhesive spreading. Pressing of veneer plywood. Presses. Pre-pressing. Parameters of pre-pressing and pressing of a veneer plywood. Final process of veneer plywood. Defects due to final process of veneer plywood. Utilisation of raw material in manufacturing of peeling veneer and veneer plywood. Veneer plywood for specific use. Moulded plywood. Veneer plywood with a non-standard construction. Overlaid plywood. Chemically treated veneer plywood. Optimisation of plywood properties.

Type of course:

Veneer and veneer plywood (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identification, describe and distinguish veneers according to the type of wood from which they are made	exercises, partial exam, short test, final exam	C4
Identify and describe the technological phases, machines, devices and equipment used in the manufacture of veneers and veneer plywood.	exercises, partial exam, short test, final exam	C4
Choose optimum methods and parameters for making a veneer of greater qualitative and quantitative yield.	exercises, partial exam, short test, final exam	C4
Distinguish the malfunction that arise in the particular technological stages of veneer production and identify the causes of these defects.	exercises, partial exam, short test, final exam	C4
Choose, explain adhesive properties and compare synthetic resins used in the production of veneer plywood.	exercises, partial exam, short test, final exam	C4
Identify different types of veneer plywood and explain their properties.	exercises, partial exam, short test, final exam	C4
Apply the rules for stacking the construction of veneer plywood and determine the optimum construction of the veneer plywood.	exercises, partial exam, short test, final exam	C4
Calculate and choose the appropriate parameters for pressing veneer plywood.	exercises, partial exam, short test, final exam	C4
Differentiate the methods and reasons for the optimization of veneer plywood.	exercises, partial exam, short test, final exam	C4

General competences

A course objective is acquisition of knowledge of a manufacturing process in industry of veneer and veneer plywood, as well as usage of that knowledge for the purpose of independent supervision and production control in veneer and veneer plywood. Distinguish the defects that arise in some technological stages of veneer and veneer plywood production, identify their causes and know how to eliminate or reduce their adverse effect

Type of instruction

Lectures

Exercises

Ten calculation exercises and two laboratory exercises are performed. Exercises are an upgrade to knowledge gained in lectures.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Holding partial exam, short tests, written exam, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, passing on short tests, partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30	0	1
Exercises (E)	5%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	36	0	1,2
		Neat, legible, with bigger corrections and on time	Good (3)			
		Neat, readable with minor corrections and on time	Very good (4)			
		Neat, readable, accurate and timely	Excellent (5)			
Partial exam – sliced veneer technology (PE1)	20%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - peeled veneer technology (PE2)	20%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - veneer	20%	60-70%	Sufficient (2)	0	15	0,5

plywood technology (PE3)		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Calculation partial exam (PE4)	20%	60-70%	Sufficient (2)	9	15	0,8
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Short tests (ST)		60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex5+PE1x20+PE2x20+PE3x20+PE4x20+STx15)/100**		75	75	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70%	Sufficient (2)			2,8
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FEx95+Ex5)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Attendance of students is recorded in classes. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (75 hours of direct lecturer)	-
Exercise	Exercises are performed by 10 calculation an 2 laboratory exercises. Before starting the exercises, students will receive training forms. At the end of each exercise, students receive tasks to control the acquired knowledge. The accuracy, precision and the time when the exercise is delivered is evaluated.	According to the appointed time	-

Partial exam (PE1, PE2, PE3)	Partial exam are multiple choice tasks where one or more correct answers are completed. For the correct answer, 3 points are awarded, and for the wrong answer 2 points are deducted.	K1 – 4. week K2 – 8. week K3 – 13.week	-
Partial exam (PE4)	Calculation tasks	15. week	-
Short tests	Duration 15 min. 5 to 10 questions.	Before the beginning of the lecture	-
Written exam	Exam can be accessed by students who have completed exercises and passed short tests. Pre-printed exams round off accurate answers and solve calculation tasks. The written exam is evaluated and participates in the final grade of the course	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the course is obtained according to the formula **Ex5+STx15+WEx65+OEx15/100**		

Obligatory literature

1. Mešić, N.,1998.: Furniri, furnirske i stolarske ploče. Grafika Šaran, Sarajevo
2. Veneer and Veneer playwods. e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=42483

Recommended literature

1. Drvna industrija. Scientific Journal of Wood Technology

Production Organization

DT-3522

ECTS 7

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Assistant professor Krešimir Greger, PhD

Associate teacher for exercises
Assistant professor Kristina Klarić, PhD
Ivana Perić, PhD

Grading

Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Organisation as science and profession; Development of organisation sciences; Organisation as component part of wood technology; Specific features of organisation and technology in wood processing and furniture manufacture. Basics of modern concepts in functioning of industrial firms for wood processing and furniture manufacture; Business and production logistics; Systematic approach to management process in industrial firms for wood processing and furniture manufacture; Process-oriented organisation of structures of wood-processing business systems. Processes in marketing, sales and distribution; Products and services; Analysis of production programmes; Management of sales processes; Logistic management of final product distribution; Processes in research and development; Development of new products; Development of production and business; Development of wood technology. Processes in supply, storage and logistics; Supply preparation; Management of supply processes; Logistics of supply and storage; Specific features of materials in industrial wood processing Basics of production theory; Principles of planning technological systems in industrial wood processing; Planning capacities of technological processes. Characteristic production processes in wood processing; Preparations and management of wood processing production; Characteristic production processes; Work study; Processes in maintenance of devices and machines in industrial wood processing; Concept and model applied in industrial wood processing. Processes in quality assurance and control of products, production and business; Quality control systems; Methods of quality control in wood processing and furniture manufacture; Bookkeeping processes as preconditions of realistic and objective financial reporting as applied to specific conditions of production and production programmes in wood processing and furniture manufacture.

Type of course:

-Production Organization (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the concepts of organization as a science and profession.	exercises, tests, exam	D1
Identify organizational and technological specifics of production in wood processing and furniture manufacturing.	exercises, tests, exam	D1
Plan and analyse the time study.	exercises, tests, exam	D1
Review and recommend the work rationalization.	exercises, tests, exam	D1
Distinguish the characteristic production processes in wood processing.	exercises, tests, exam	D1
Distinguish the processes in research and development and suggest the development of new products.	exercises, tests, exam	D1
Distinguish processes in procurement, storage and logistics, plan procurement, recommend a procurement model, and lead procurement and storage.	exercises, tests, exam	D1
Evaluate the capacities of technological processes.	exercises, tests, exam	D1
Use the principles of designing technology systems in industrial wood processing.	exercises, tests, exam	D1
Prepare production and manage production processes.	exercises, tests, exam	D1
Conceive quality control in the technological process and for finished products.	exercises, tests, exam	D1
Distinguish processes in maintaining devices and plants in the wood processing industry and organize the maintenance of devices and plants.	exercises, tests, exam	D1
Analyze the production program, conduct the sales process and manage the distribution of finished products.	exercises, tests, exam	D1
Evaluate accounting processes.	exercises, tests, exam	D1

General competences

Students gain general and specialist knowledge in the following fields: work study, work rationalisation, quality control in technological processes and final products, supply organisation and stock optimisation, and logistic support.

Type of instruction

Lectures
In the course of lectures, students gain knowledge about production organization in wood industry.

Exercises
As part of auditory exercises and computer exercises, students receive an upgrade the knowledge about production organization gained during the lectures.

Working methods:
Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers, compiling knowledge tests, and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the tests and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	10%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	45	3
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Test 1 (T1)	45%	60-70%	Sufficient (2)	1	37,5	1,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Test 2 (T2)	45%	60-70%	Sufficient (2)	1	37,5	1,25
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		60-70%	Sufficient (2)			
TOTAL	**100 %**	**(Ex10 + T1x45 + T2x45)/100**		90	120	7

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 %	Sufficient (2)			2,5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100	Excellent (5)			
TOTAL	**100 %**	**(FEx90+Ex10)/100**				
*** Students who during the semester do not pass the subject by a written test shall attend the exam, that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students are checked and recorded. Student may justifiably be absent with a maximum of 15 % of direct teaching hours.	semester (90 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. For each exercise, students receive individual templates - tasks. The deadline for the exercise is two weeks and if the exercise is not timely submitted and the positive evaluation is not obtained, the student gets an additional task. The accuracy, tidiness and regularity of exercise are evaluated (time-honoured exercises).	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Test 1	Students who have a positive assessment of the first five exercises and who have not abstained from teaching more than 15% can access the first test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	8^{th} week	Students who pass the first test can access the second test.
Test 2	Students who have a positive assessment of all exercises and who have not abstained from teaching more than 15% can access the second test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	15^{th} week	Students who pass 1^{st} and 2^{nd} test are exempted from the exam.
Written exam	Students who have a positive assessment of all exercises can attend the exam. The exam consists of three computational tasks. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **Ex10+EEIx45+ OE45/100**		-

Obligatory literature

1. Figurić, M. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Greger, K. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja (zbirka zadataka), Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.

Recommended literature

1. Sikavica, P., 2011: Organizacija, Školska knjiga d.d., Zagreb.
2. Inženjerski priručnik IP4, Proizvodno strojarstvo, Organizacija proizvodnje, Školska knjiga 2002.

Final wood processing

DT-3523

ECTS 6

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45

Lecturer
Associate professor Goran Mihulja, PhD
Associate professor Zoran Vlaović, PhD
Associate professor Ivica Župčić, PhD

Associate teacher for exercises
Associate professor Goran Mihulja, PhD
Associate professor Zoran Vlaović, PhD
Associate professor Ivica Župčić, PhD

Grading

Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:

Introduction: basic terms of technological processes, primary and final wood processing, equipment and space for final processing, classification of final products. Shaping wood and other materials: massive wood, boards, fabric, foams. Processing of parts for assembly. Assembling. Material: material used in final products and its technological and exploitation properties - lumber and wood material, synthetic-wood material, soft synthetic foam material, solid synthetic material of porous and solid structure, springs and springy cores, mounts, textile material, leather and other. Process precision: technological base, shaping and dimensioning, factors effecting process precision, substituting, tolerances, hardness of different joints, measuring equipment. Analysis of the cutting and shaping processes: saw shaping, routing, wood turning, drilling, bending and pressing. Edge banding: edges veneering, "postforming", "softforming, mambrane pressing. Upholstering the final products: shaping and joining parts, assembling in parts, covering.Production processes: cabinet furniture, solid wood furniture, chairs and other products.Technology of final products. Technological task. Complex solutions in developing the technological processes. Technological systems.Technology transfer. Development of technology and technological forcasting. Relationship between material technology - equipment. Flexible technology. Perspective technological processes, future equipment. Technology development from an ecological standpoint.

Type of course:

- Final wood processing (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the basic concepts about the technological processes of final wood processing	partial or final exam	C6
Distinguish and categorize basic final products (eg chair, bed, table, wardrobe etc);	partial or final exam	C6
Evaluate, draw up a budget and recommend the quantity of wood and non-woven materials needed for the production of certain final products or elements of final products;	laboratory exercises, corrections, and exercises evaluation	C6
Identify, describe and choose the most technologically acceptable (optimal) formatting (cutting) of wood elements in the production of final products;	exercises reports, corrections, and exercises evaluation	C6
Design the order of joining assemblies and assemblies, and the order of assembling elements into a finished product;	partial or final exam	C6
Use basic measuring equipment eg measuring strip, caliper, micrometer, comparator and line for measuring dimensions and processing accuracy and to know the working principle of modern measuring instruments such as 3D scanners;	exercises reports, corrections, and exercises evaluation	C6
Identify and distinguish factors that have the greatest impact on the quality of a particular wood processing;	laboratory exercises, corrections, and exercises evaluation	C6
Evaluate the possibilities of applying new technologies and technological processes with respect to the production program and existing manufacturing technology of the company;	partial or final exam	C6

General competences

• Acquisition of knowledge on technological processes of final wood processing, material properties important for final processing and necessary skills for conducting technological processes in final wood processing.

Type of instruction

Lectures

Mainly auditorial with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.

Exercises

Exercises are an upgrade to knowledge adopted in lectures. It consists of laboratory demonstrations and measurements that are limited by the practical work of the students. The report consists description of the task and measurement procedure, as well as the results and conclusions.

Working methods:

5. Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.

6. Student's' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	20%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	45	45	3,5
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	40%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	40%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(E x 20 + PE1 x 40+ PE2 x 40)/100**		92	88	6

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	51-64% 65-77% 78-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	43	1,5
TOTAL	**100%**	**(FE x 80 + E x 20)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes.	semester (45 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) have to be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Ljuljka, B.: Tehnologija proizvodnje namještaja, Zagreb, 1980, str. 1-257.
2. Ljuljka, B.: Namještaj, Šumarska enciklopedija II, JLZ, Zagreb, 1983, str. 436-490.
3. Ljuljka, B., Bogner, A., Turkulin, H., Grbac, I., 1986.: Ispitivanje mogućnosti primjene VF struje za plastifikaciju i savijanje masivnog drva. (znanstvena studija), 1-63, Šumarski fakultet u Zagrebu.

Recommended literature

1. Gončarov, N. A.: Tehnologija izdelij iz drevesiny, Moskva, 1990, str. 1-525.

2. Nemec, J., Zeimar, J.: Tehnologija vyroby nabytku, Zvolen, 1983, str. 1-216.

Wood as a building material

DT-3524

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 8

Lecturer
Prof.dr.sc. Hrvoje Turkulin
Doc.dr sc. Vjekoslav Živković

Associate teacher for exercises
Prof.dr.sc. Hrvoje Turkulin
Doc.dr sc. Vjekoslav Živković
Doc.dr.sc. Danijela Domljan

Grading

Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:

Significance of production of wood building components in Croatia and in Europe. Specific requirements for exterior application of wood: synergistic actions of light, climatic and biological degradative factors. Technical properties of importance for building applications, availability of the species: wood properties and durability. Principles of technical design of wood products for their durability: physical protection, technical detailing, surfacing and finishing, renovation of weathered products. Dimensional limitations of wood and laminating technique: technical principles, technical design of components, materials used, basics of the manufacturing process. Basics of building physics and principles of acousitc and thermal insulation of windows, floors, doors, walls. Windows and doors: function and design, forms and types, general functional requirements: ventilation, lighting, passage, insulation, passage. Wooden floors – physical conditions during completion and use for sports and residential floors, materials for gluing and sealing. Review of other classes and types of wood building components and products: houses, laminated beams, wooden structures, bridges, noise barriers, cladding and facades etc.

Type of course:

- Wood as a building material (compulsory course, 5 semester, 3 year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
1. To identify the main families of wood construction products and connect their use requirements with design and construction types. Connect the usable properties of the product with the technical properties of wood.	exam	B3
2. To appoint and explain the ecological features of wood as a building material - carbon sinks, energy tanks, renewables. Explain the importance of maintaining durability and possibilities of recycling wood.	exam	C7
3. To distinguish and group the technical properties of wood essential for construction (mechanical, physical, chemical, fire resistance), to explain the aesthetic, economic and traditional values of wood for construction.	exam	B3
4. To identify, explain and group factors of durability of wood buildings: define the effects of light, water, climatic conditions and biodegradation.	exam	B2
5. To differentiate and describe the measures of surface and structural durability of wood construction elements.	practice exercises, exam	C7
6. To outline and sketch the details of the physical and structural protection of building wood. Draw a detail plan for the integral protection for a pedestrian bridge, wooden paths or terraces, fences, facades. Design and construct a new product and explain the expected durability insurance.	practice exercises, exam	C7
7. To identify groups of surface protection materials for exterior wood, describe the features of their protective function (light, water, dimensional stability, repellency). Demonstrate and recommend the surface system for a particular wood construction product (its degree of exposure and formulation and restoration requirements).	exam	C8
8. To describe and interpret lamination technique for construction wood. Design the process of manufacturing laminated building products.	practice exercises, exam	C6
9. Prepare window and door types. Connect the type of product with basic functional requirements		C7
10. To analyse quality of windows and doors: Shift the parts of the product into the assembly. To connect the influence of materials, construction details and equipment on the performance and durability of windows	practice exercises, exam	C7

and doors.		
11. To detach construction details of windows and doors. Connect the details to a functionally effective product and draw and illustrate the frame.	practice exercises, exam	C7
12. To describe types of wooden floor coverings. Connect the type of product with basic functional requirements	practice exercises, exam	C7
13. To describe the technical properties of the material and arrange the procedures for the manufacture of wooden floor coverings and in the mechanical and aesthetic restoration of floors.	practice exercises, exam	C7
14. To apply standardized quality requirements for wooden floor elements (form and dimensional regularity, physical properties, appearance characteristics).	practice exercises, exam	C7

General competences

Learning about the specific conditions of the use of wood in building applications and its durability, expecially in use out of doors. Survey of the elementary technical detailing for establishment of structural and physical protection of wood. Provision of adequate service reqirements for joinery and other building products. Lerning about the functional requirements, classes and technical details of the main groups of products: windows, doors, floors, and review of other types of wood buioding products.

Type of instruction

Lectures

Exercises

Six practical exercises are performed within laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Field work eg in Maksimir aims to introduce students with specific exterior building products (eg wooden bridges, facades, ...) in terms of learning on examples of (good) practices, studying their constructional and functional details and preparing for exercises in classroom.

Working methods:

Teachers' obligations:

Original teaching - lectures, exercises, field work. Preparing the exercises and preparing the exams and evaluating them. Written and oral exams and consultations. Preparation and development of teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of exercises.

Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	25%	Mostly inaccurate, with major corrections	Sufficient (2)	30	15	1,5
		Mostly accurate, with corrections	Good (3)			
		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Exam (PE)	75%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lxy0+Exy0 + PExy0)/100**		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	60-70%	Sufficient (2)			1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FExy0+Exy0)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and recorded. Exercises are attended by groups. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Partial exam	Exercises are organised in groups. As part of the exercise, 6 practical exercises from the topic of physical and structural protection of wood, surface stability and technological-construction of wood construction products are performed. At the beginning of the first exercise, students are introduced to the rules of preparation, teaching and assessment of exercises.	15. week	

	The accuracy, regularity and regularity (time-honored exercises)		
Written exam	The exam can be attended by students whose exercises were evaluated positively. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	Students get questions from different part of the subject program. Final mark of subject is achieved from the formula: **Ex5+C1x5+C2x15+Ex75/100**		

Obligatory literature

1. Turkulin, H., Ljuljka, B. 1988. Lamelirana građevna stolarija, Šumarski fakultet Zagreb, 1 – 182.
2. Turkulin i dr. 2002: Postojanost drva na pročeljima. Drvna industrija 53(1): 33 – 48 i 53(3): 44 – 54.
3. Tomašević, J. 1996: Drvo u podnim konstrukcijama. Zagreb: naklada autora.
4. *** 2005: Zbirka članaka o postojanosti i površinskoj obradi građevnog drva, Šumarski fakultet.
5. *** 2001. Tehnologija drvenih građevina, Zagreb, Mozaik knjiga.

Recommended literature

1. Liesse, B. 2002: Holzbauteile. Leinfelden-Echterdingen: DRW-Verlag.
2. Erler, K. 2002: Holz im im Aussenbereich. Basel-Boston-Berlin: Birkhäuser Verlag.
3. *** 2002: Wood as an engineering material. Madison, WI: USDA For. Ser., Forest Products Lab.

Marketing of wood products

DT-3525

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Assist.prof. Andreja Pirc Barčić, Ph.D.

Associate teacher for exercises
Prof. Darko Motik, Ph.D.
Assist.prof. Andreja Pirc Barčić, Ph.D.

Grading

Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
General information about trade activities. Activities regarding selling wood and wood products. Wood market. Retail trade and wholesale. Wood products classification. Supply and demand for wood products and Incoterms. Complete processing of inland and foreign trade documentation. Trade operations risks and risks insurance. Customs duty and other restrictions. Products delivery to customers. Forwarding. The marketing and its role in wood industry companies. The enterprise orientation to the market. The management of products and production programs in the furniture industry. Company business strategy. The analysis of marketing possibilities.
Agreements about products brand, branding processing. The development of wood products. Products life cycle in the furniture industry. The structure of production programs in the enterprises for manufacture and sale of wood products. Establishing prices of wood products. Distributional channels in wood trade. Market research and market research plan development in wood industry companies. Data resources. The analysis of customers` behavior. The factors that affect behavior in the process of buying.

Type of course:

- Marketing of wood products (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To carry out a market research process using the customer survey methodology and to evaluate the demand for wood products based on the derived consumption method	Exercises evaluation, partial exams, final exam	D2
To decide about marketing strategies in woodworking and furniture manufacturing companies and design strategic product planning processes	Exercises evaluation, partial exams, final exam	D2
To establish a business portfolio of business attractiveness business and business power of companies and to create a multifactor portfolio matrix	Exercises evaluation, partial exams, final exam	D2
To plan the life span of the best-selling products in the production program	Exercises evaluation, partial exams, final exam	D2
To create a product marketing strategy at each stage of product life cycle	Exercises evaluation, partial exams, final exam	D2
To analyze wood products customers' behavior based on information in the recent years	Exercises evaluation, partial exams, final exam	D2
To develop market prediction of furniture sales and to plan furniture consumption on the basis of determined quantity of products sold in the past period	Exercises evaluation, partial exams, final exam	D2
To design wood products and furniture distribution channels and to recommend the application of the appropriate distribution channels	Exercises evaluation, partial exams, final exam	D2
To suggest cost allocation with respect to stages in the product development process and form the price of a particular product based on price and competitiveness	Exercises evaluation, partial exams, final exam	D2
To develop a promotional plan for a wood industry company	Exercises evaluation, partial exams, final exam	D2
To assess the most common business, merchandise and financial risks in industry company and to suggest a transportation documentation for wood products	Exercises evaluation, partial exams, final exam	D2

General competences

- Student gets knowledge necessary to work in the wood industry companies on work posts with responsibilities in company management in the field of marketing and trade of wood products.
- Student gets competencies for planning, designing and analyzing business documentation in wood industry companies

Type of instruction

Lectures
Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise management in wood processing and furniture manufacturing in the field on wood and wood products trade, market research and data analysis, preparation of marketing mix of products.

Exercises
Exercises on individual assignments with the purpose of applying theoretical settings learned in lectures
Students, besides performing exercises, need to collect data, systematize data and present the results obtained in the form of project tasks for each exercise.

Working methods:

Teachers' obligations:

To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	28	30	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	40%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

Partial exam 2 (PE2)	40%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E20 + PE1x40+PE2x40)/100**		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	51-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FE100)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lecturer)	-
	Exercises are made individually. As part of the exercise, 10 individual tasks are performed (one of 10 exercises, exercise 5 is done in the form of seminar work and is presented in the last term of teaching, before the 2nd semester) At the beginning of the first exercise, students are provided with instructions on how to perform the exercises and the appearance of the collar, liner and insertion sheet in which they will print in the form. The accuracy, regularity and regularity (time-honored exercises) Exercises carry 50 points.	According to a time schedule	
Partial exam I	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. and who have correct and signed exercises 1-5. The 1. Partial exam is 100 points and it covers the issues regarding until the time of partial exam.	6th. week	
Partial exam II	Second partial exam can be attended by students who did not miss more than 15% of lectures and exercises. and who have correct and signed exercises 1-10 and	13th. week	

	who have accomplished more than 50 points in the partial exam I. The II. Partial exam is 100 points.		
Written exam	Students who did not receive a positive assessment from the exercise and the partial exams (less than 51% of the total score) or are not satisfied with a final grade will approach the written exams according to certain examination deadlines. The written exam consists of 3-4 assignments (depending on the complexity of the assignment, with each assignment max number of points)	Exam terms	
Oral exame	The requirement for the oral exam is 51 % on the written exam. The score obtained on the oral exam is the final grade in the 100% ratio. Note: The person who passed the exam via partial exames and obtained the right to a final grade, and is not satisfied with the final grade, can access the oral exam, but in that case may score a grade higher than the grade obtained by passing the exam through a partial exam . The grade given on oral exam is final and it makes 100% of the grade.	Exam terms	

Obligatory literature

1. Kotler, P., Wong, V., Saunders, J., Armstrong, G. (2006). Osnove marketinga. Mate, 4th ed.,
2. Schiffman, L.G., Kanuk, L.L. (2004): Ponašanje potrošača. Mate.
3. Renko, N. (2010): Marketing malih i srednjih poduzeća. Ljevak

Recommended literature

1. Hansen, E., Ranwar, R., Vlosky, R. (2014): The Global Forest Sector. CRC Press.

Field work-3

DT-2316

ECTS 4

Teaching hours 40

Grading

Course content:
Field work is a compulsory course of Undergraduate study and implies a student's workload equivalent to the 4 ECTS. During the V semester of the Undergraduate Study, it is necessary to complete field work for a total duration of 5 days or 40 hours.

Type of course:

- **Field work I. – Wood technology** (compulsory course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Identify the phases of the technological process in the production of veneers and veneer boards. Know the machines and devices, compare the theoretical parameters of veneer and veneer panels production with those found in production and explain possible differences.	Field work report evaluation
Systematically record, analyze, critically review the existing proposed methods of a company's work. Develop and apply an easier and more effective method of shortening time and reducing costs.	Field work report evaluation
Identify and describe the most technologically acceptable (optimal) wood products design of wooden elements in final wood processing. Recognize and describe driven machines in wood working, Identify and describe wood processing machines, operation sequences and basic processing parameters on production lines important for the production process.	Field work report evaluation
Apply knowledge in the field of wood and wood products trade and marketing in wood industry companies as parts required to conduct business processes. Plan, create and analyze business documentation in wood industry companies.	Field work report evaluation
Define product types according to the basic functional requirements. Explain selection and characteristics of wooden elements and other materials in wood products.	Field work report evaluation

General competencies

- Knowledge of the technological process of veneer and veneer panels production, comparison of theoretical parameters with those of real practice.
- Detailed recording and analysis of a company's work method to reduce time and costs.

- Know and optimize the process of shaping wooden elements in the production of final products.
- Planning, producing, and analyzing a business documentation of a company**.**
- Designing projects for making various wood products in construction.

Working methods:

Teachers' obligations:

Organize field work, design tasks that students will be able to handle independently, and be available for consultation during and after field work. To introduce students to the rules of behavior in the field work. To provide the student with the necessary help and instruction in working on the solution of field work assignments. Review and evaluate field-based reports.

Students' obligations:

Active participation in field work. Respect the rules on the field work. Write a report from the field tutorial.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				40	80	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student's skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance		

team during field teaching	with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
   Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Production planing and calculation

DT-3626

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45

Lecturer
Prof. Darko Motik, Ph.D.

Associate teacher for exercises
Assist.prof. Andreja Pirc Barčić, Ph.D.
Prof. Darko Motik, Ph.D.

Grading

Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The analysis of the wood-technology processes system. Basic knowledge of cost management. System connections of financial bookkeeping with management cost bookkeeping. Special features of wood article production. Raw materials and stocks. Semi-products on stock. Finished products on stock. Indicators of business success. Planning concept. Purpose and tasks of production planning. Contents and structure of business plan and production. Use and control of plan. Basic guidelines of financial bookkeeping. Balance. Profit and loss calculation. Money flow. Cost management. Approach to cost management. Costs in business decision. Traditional, aimed, static and active concepts of management costs. Models of production management costs in wood processing and furniture manufacture. Costs. Conceptual determination of costs. Cost division. Specific costs in wood processing and furniture manufacture. Case study. Calculations of products and services. Calculation division in individual production types in wood processing and furniture manufacture. Oppositions of concepts. Absorptive approach to costs vs. marginal approach; Gross profit vs. contribution margin with case study in wood processing and furniture manufacture. Integral management model of production management specific in wood processing and furniture manufacture with emphasis on planning, launching and production cost calculation. Cost calculation per processes and work orders. Covering and recording work/material costs in calculation per processes and work orders. Calculation of real prime costs. Concept and phases of making production

Type of course:

- Production planing and calculation (compulsory, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyze and select the profile of the company's wood processing and furniture manufacturing business for possible business collaboration based on calculated and analyzed performance and safety performance indicators	Exercises evaluation, partial exams, final exam	D2
To analyze a fundamental principles of financial accounting (Balance Sheet, Profit and Loss Account, Cash Flow Statement)	Exercises evaluation, partial exams, final exam	D2
To recommend the type of calculation and to calculate a cost price per unit in wood processing	Exercises evaluation, partial exams, final exam	D2
To recommend the type of calculation and to calculate a cost price per unit in furniture manufacturing	Exercises evaluation, partial exams, final exam	D2
To create a cost price per one unit of wood produces and furniture by applying calculation incomplete costs calculation method	Exercises evaluation, partial exams, final exam	D2
To suggest a method of calculating depreciation as a specific expense of fixed assets	Exercises evaluation, partial exams, final exam	D2
To calculate productivity cost (contribution margin) of selected wood products in wood processing and furniture manufacturing companies	Exercises evaluation, partial exams, final exam	D2
To plan production costs classification in relation to changes in the scope of production activities (fixed costs, variable costs, mixed costs, discretionary costs)	Exercises evaluation, partial exams, final exam	D2
To plan production costs classification according to their natural characteristics (staff costs, material costs, depreciation, service costs, non-material / other costs, financing costs)	Exercises evaluation, partial exams, final exam	D2
To create a relationship model of costs, revenue and change of business activity	Exercises evaluation, partial exams, final exam	D2
To analyze the cost structure of the company and determine cost-related priorities and evaluate the type of calculations that the company applies in forming the cost of the product's cost and decide which type of calculation would be most applicable to the company being monitored.	Exercises evaluation, partial exams, final exam	D2
To select loan repayment models in wood processing and furniture manufacturing companies	Exercises evaluation, partial exams, final exam	D2

General competences

- Student gets knowledge necessary to work in the wood industry companies on work posts with responsibilities in solving problems in planning and production calculation in company management
- Student gets competencies for production planning, calculation of basic indicators of successful business, making basic financial reports, recognizing cost types.
- Student gets competencies for developing a specific calculation models in wood industry companies

Lectures

Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise management in wood processing and furniture manufacturing in the field on business planning, production analysis, business analysis, cost planning and calculation of various wood products.

Exercises

Exercises on individual assignments with the purpose of applying theoretical settings learned in lectures
Students, besides performing exercises, need to collect data, systematize data and present the results obtained in the form of project tasks for each exercise.

Working methods:

Teachers' obligations:

To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	43	20	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	40%	51-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			

		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	40%	51-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E20 + PE1x40+PE2x40)/100**		75	80	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	51-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FE100)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lecturer)	-
	Exercises are made individually. As part of the exercise, 10 individual tasks are performed (one of 10 exercises, exercise 5 is done in the form of seminar work and is presented in the last term of teaching, before the 2nd semester) At the beginning of the first exercise, students are provided with instructions on how to perform the exercises and the appearance of the collar, liner and insertion sheet in which they will print in the form. The accuracy, regularity and regularity (time-honored exercises) Exercises carry 50 points.	According to a time schedule	
Partial exam I	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. and who have correct and signed exercises 1-5. The 1. Partial exam is 100 points and it covers the issues	7th. week	

	regarding until the time of partial exam.		
Partial exam II	Second partial exam can be attended by students who did not miss more than 15% of lectures and exercises, who have correct and signed exercises 1-10 and who accomplished more than 50 points in the partial exam I. The II. Partial exam is 100 points.	15th. week	
Written exam	Students who did not receive a positive assessment from the exercise and the partial exams (less than 51% of the total score) or are not satisfied with a final grade will approach the written exams according to certain examination deadlines. The written exam consists of 3-4 assignments (depending on the complexity of the assignment, with each assignment max number of points)	Exam terms	
Oral exame	The requirement for the oral exam is 51 % on the written exam. The score obtained on the oral exam is the final grade in the 100% ratio. Note: The person who passed the exam via partial exames and obtained the right to a final grade, and is not satisfied with the final grade, can access the oral exam, but in that case may score a grade higher than the grade obtained by passing the exam through a partial exam . The grade given on oral exam is final and it makes 100% of the grade.	Exam terms	

Obligatory literature

1. Figurić, M. (2003): Menadžment troškova u drvno tehnološkim procesima. Šumarski fakultet Sveučilišta u Zagrebu. Zagreb.
2. Motik, D. (2002): Zbirka zadataka ekonomika proizvodnje. Šumarski fakultet Sveučilišta u Zagrebu.Zagreb.
3. Polimeni, R.S., Handy, S.A., Cashin, J.A. (1999): Troškovno računovodstvo. Faber & Zgombić Plus. Zagreb.

Recommended literature

1. Samuelson, P. A., Nordhaus, W. D. (2011): Ekonomija. Mate. Zagreb

Wood finishing

DT-3627

ECTS 5

E-learning R2

Teaching hours
Lectures 30
Exercises 45
Field work 2

Lecturer
Professor Vlatka Jirouš-Rajković
Assistant professor Josip Miklečić

Associate teacher for exercises
Assistant professor Josip Miklečić
Professor Vlatka Jirouš-Rajković

Grading

Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

A history of wood finishing. Trends of development. Wood and wood-bases substrates for finishing. Materials for sanding, materials for filling, materials for degreasing, materials for resins removal, materials for glues removal. Materials for colouring of wood -stains. Materials for bleaching of wood. Organic solvent preservatives, wood primers, stains.The composition and properties of film- forming wood finishes. Natural-resin based materials.Cellulose-based coatings, alkyds coatings, polyesters coatings, acid-cured coatings, polyurethane-coatings, water-borne coatings, epoxy coatings, silicone coatings, thermoplastics -based coatings. Solvents and thinners. Additives. Methods of applying finishes: manual applying , air-assisted spraying, airless spraying, airmix spraying, hot-spraying, two -components materials spraying. Spray equipment, automatic spraying machines, and robots. Electrostatic spraying. Roller coating, curtain coating, flow coating, dipping. Drying and curing techniques of coatings. Convection drying, Cold drying, infrared drying. UV curing for furniture and joinery industry. Microwave drying, Electron Beam (EB) curing.

Type of course:

- Wood finishing (compulsory, VI semester, III year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate the sanding materials for various types of wood, wood materials, wood finishes according to backing, abrasive grain and grain's hardness and toughness, grit size and amount of grains.	laboratory exercises, midterm exams, exam	C8
Differentiate the properties and composition of wood staining materials (water-based stains,alcohol-based stains, oil stains, reactive stains and wood bleaching materials.	laboratory exercises, midterm exams, exam	C8
Compare the properties of a wood coatings based on natural resins, oils and waxes, with coatings based on synthetic resins.	laboratory exercises, midterm exams, exam	C8
Identify the advantages and disadvantages of certain methods of applying varnishes (manual application, applying by spraying, curtain coating, dipping, roller coating, flow coating, vacuum coating).	laboratory exercises, midterm exams, exam	C8, B4
Measure the viscosity of the wood coating material, density, dry solid, the film thickness, application rate.	laboratory exercises, midterm exams, exam	C8,A4
To compare the methods of curing (drying) coatings on wood (convection drying, infrared radiation, microwaves, UV radiation, electron beam irradiation).	laboratory exercises, midterm exams, exam	C8
Calculate the consumption of wood finishing materials	laboratory exercises, midterm exams, exam	C8, A4
To evaluate the safety and health risks in the finishing room (explosiveness, flammability, health hazard, danger to the environment).	laboratory exercises, midterm exams, exam	C8, B4
Write professional paper on a given topic in the field of wood finishing.	seminars	A1, C8, E1

General competences

- Identify the problem and take part in solving the problem
- Teamwork
- Developing responsibility and ethics
- Development of written and spoken communication skills and professional expression

Forms of teaching

Lectures

Exercises

Laboratory exercises are supplement to lectures. Students make 8 exercises according to instructions given in MERLIN. Completed exercises (worksheets) are a condition for obtaining signatures. Exercises must be submitted in pre-defined terms and for this the students earn points.

Field work

2 days of field work in wooodworking factories

Working methods:

Teachers' obligations:
Teaching - lectures, exercises, homework, topics of seminar papers. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and submission of exercises and seminar papers within the deadline. Resolving and delivering homework. Passing partial exams or examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-		-	30	0	1
Exercises (E)	12 %	1 point for each task (worksheet) that was submitted on time, 4 points for project task	-	45	15	2
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points. To gain access to the second partial exam must achieve a minimum of 15 points.	-	1	15	0,5
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points.	-	1	15	0,5
Homeworks	4 %	1 point for each homework that was submitted on time	-	-	4	0,1
Seminar paper	20 %	The maximum possible number of points scored is 20	-	-	22	0,8
Presentation of seminar paper	4 %	4 points for a held presentation	-	-	4	0,1
TOTAL	**100%**	From all the elements of monitoring and checking the student can achieve a maximum height of assessment of 100	-	77	75	5

		points, which makes 100 % of the grade. For the passing grade, the student must have a minimum of 50 points or 50 % of the grades. Scale rating is as follows:				
		50 – 60 %	Sufficient (2)			
		61 -75 %	Good (3)			
		76 – 90 %	Very good (4)			
		91 – 100 %	Excellent (5)			

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60 % 61-75 % 76-9 0% 91-100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of the students is recorded. Students are allowed 20 % absence from lectures and 10 % from excersises. Exercises are attending in groups. Exercises tasks are submitted within a predefined time limit, and timely delivery of the correct work sheets is scored.	semester	-
Submission of worksheets from laboratory work (excercises)	Exercises are attended in groups. Students must submit worksheets in a predefined period of time and timely submitted worksheets are scored.	According to weekly class schedule	-
Partial exams	There are two partial exams. Each brings 30 points. At the first partial exam a student must achieve at least 50 % to gain access to second partial exam.	VIII week XV week	-
Seminar paper	Students choose the theme of the seminar work from the proposed themes in MERLIN. Seminars are scored according to the given criteria.	XIII; XIV week week	-
Presentation	By presenting a seminar, the student receives four additional points	XII; XIV week	-
Homeworks	Each on-time delivered homerwork brings 1 point	According to weekly class schedule	-
Written exam	A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. Prior to exam seminar paper and exercise woorksheets must be submitted for review.	Exam terms	-

Oral exame	Prerequisite for oral exam is minimum score of 50 in written exam	Exam terms	-

Obligatory literature

1. Ljuljka, B. 1990: Površinska obrada drva. Sveučilište u Zagrebu. Šumarski fakultet, Zagreb.
2. Ljuljka, B., Jirouš-Rajković, V., 2006: Osnove površinske obrade drva. Šumarski fakultet & Sand, Zagreb, 2006.

Recommended literature

1. Rothkamm, M., Hansemann, M., Böttcher, P. 2003: LACK Handbuch Holz. DRW-Verlag.
2. Goldschmidt, A.; Streitberger, H.J. 2002: BASF-Handbuch Lackiertechnik. Vincentz Verlag, Hannover.
3. Alić, O. 1997: Površinska obrada drveta. Mašinski fakultet Sarajevo.

Operations Management I

DT-3628

ECTS 3

English language R1

E-learning R2

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
prof. Tomislav Grladinović, PhD
assist. prof. Kristina Klarić, PhD

Associate teacher for exercises
Ivana Perić, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Artifical In intelligence. Virtual world, learn environment. Experts systems. Modell for learning. Intelligence systems.On line decission–Work in Process. Contemporary production concept in wood industry: transfer line, flekxibleproduction line, working centre, working cell, numerically controled machines (NC), computerized numericalcontroled machine (CNC) i direct numerical control machine (DNC). Characteristic technologies in wood industrty.Theoretical hypothesis necessary for manage production processs. System, information and cybernetics theory.Systemic thinking.Modelling as learning. Decission Suppor System. Characteristic conception productionmanagement in wood industry. Production management methods: Reorder Point (ROP), Material RequirementsPlanning (MRP), Management Resourse Planning II (MRP II), Money Resourse Planning (MRP III), CapacityResourse Planning (CRP), Just in Time/Total Quality Control (JIT/TQC), Bussines Requirements Planning (BRP),Enterprice Resource Planning (ERP). Network production. Production preparations aims and orders. Technological,operative production preparations and work distribution. Production preparation as a part of the managementmanagement system. Work order the basic bearer of information for production management. Planning of issuingwork orders, job dispstching, executionand control of their accomplishment. Production documentation as a part ofthe information system. Projection of the information system. Optimisation methods and technique as a support inproduction management modelling process. A development conceptforcomputerization of the production preparationjobs. IT environment. Computer aided buissins in wood industry. Data base. Characteristic necessary of informationsystem. A computer-adied system of plan and development of the product (3D). Product database.Technology fornumerically controled machines. Directly numerically controled machines. Adapt management. Flexble manufacturingsystem management.

Type of course:

Operations Management I (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define production functions and production strategies	Project assignment, oral exam	D1
Analyze concepts for planning and production management	Exercises in computer practicum, project assignment, seminar work, oral exam	D1
Prepare the technical documentation	Exercises in computer practicum, project assignment, seminar work, oral exam	D1
Organize technological, operational preparation of production and distribution of jobs	Exercises in computer practicum, project assignment, written and oral exam	D1
Connect documentation of business and manufacturing systems companies wood processing and furniture production	Exercises in computer practicum, project assignment, written and oral exam	D1
Modeling production process management systems in a wood processing and furniture manufacturing company	Exercises in Computer Practice, Project Task, Oral Exam	D1
Recommend a software solution for integrated production planning and management	Project assignment, seminar work, oral exam	D1
Apply the acquired knowledge and skills from the content of the course items to solve a specific task	Project assignment, seminar work, oral exam	D1

General competences

Apply basic business principles, basic concepts related to management concepts (planning, organizing, control) production processes. Plan and monitor production and projects and optimize resources.

Type of instruction

Teaching - lectures and individual project tasks
Designing seminar papers and compiling knowledge tests and evaluating them.
Providing written and oral exams and consultations.
Creating teaching materials.

Lectures

Through theoretical lectures, students will acquire knowledge and skills on business information systems that are required to work on technological and operational preparation of production processes.

Excercises
Within the exercise, individual project tasks with computer support are performed, through which methods and techniques for planning, optimization, execution, monitoring and analysis of production plans will be applied. Exercises are an upgrade to knowledge adopted in lectures.

Working methods

Teachers obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials. Mentoring in final work.
Students obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	28	0	1
Exercises (E)	25%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	28	0	1
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			
Seminar paper	5%	The student is exhibiting with the help of the examiner	Sufficient (2)	4	10	0,5
		Student Exposes Using Examiner	Good (3)			
		It is self-explanatory and logical with little help from the examiner	Very good (4)			
		Self-explanatory and logical, without any help	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
TOTAL	**100%**	**(Vx25 + Sx5+Ix70)/100**		60	25	3

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Final exam (FE)	100%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	*5*	*15*	*0,7*
TOTAL	**100%**	**(FEx 100) / 100**				

Detailed description of evaluation elements for lecturer, seminars, excercises and final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lectures + Exercises	• The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	• Exercises are attended by groups. • 4 project individual tasks are performed within the exercise. • n the introductory lecture, students will receive instructions on the layout of the exercises - the folder, the jumper and the proposal sheet, in which they will correspond to the set tasks in printed form. • At the beginning of the exercise, students will receive templates for project assignments. Exercises are surrendered gradually after each course. • The accuracy, regularity and regularity are evaluated (time-honored exercises) • Exercises carry 25 points and together with exam scores make up 100 points.	According to the agreed terms	Exceptionally, in the case of a justified reason, student does the absence of a single exercise
Seminars	• Seminar work is done independently • At the beginning of the third lecture, students receive topics that are electronically chosen and instructions and literature related to the work • In the last lecture, each student presents an independent seminar work • Questions are raised from the parts of the seminar work	15 week	
Partial exam	• Exam can be attended by students who have completed, submitted and corrected exercises. • Students on pre-made exams to solve the task.	Exam terms	-

	• Written Exam (We) is evaluated and participates 20% in the final grade of the subject		
Written exam	• Students who pass a written exam are asked for oral questions from different parts of the subject's program content. • The oral exam (Uispt) participates 50% in the final grade of the subject • The total rating is calculated according to the formula: (E x 25+ S x 5+ We x 20 + Oe x 50) / 100	Exam terms	-

Obligatory literature

1. Grladinović T.: Upravljanje proizvodnim sustavima u preradi drva i proizvodnji namještaja, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1999., str. 1-298.
2. Majdandžić, N.: Izgradanja informacijskih sustava proizvodnih poduzeća, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2004.
3. Jelačić, D.: Upravljanje proizvodnim sustavima u drvnoj industriji (zbirka zadataka), Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1995., str. 1-128.

Recommended literature

1. Majdandžić, N., Čuljak, S.: Priprema proizvodnje 1-3, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 1991.
2. Schroeder, R.G.: Upravljanje proizvodnjom, M.E.P., Zagreb, 1996. str. 1- 672.

Technological properties of wood

DT-3629

ECTS 3

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Prof. Tomislav Sinković, PhD.
Assistant prof. Tomislav Sedlar, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambreković mag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Course 'Technological properties of wood' is composed of lectures about wood behaviour over adapting, finishing and mechanical disintegration and properties of wood within this prosses. Wood processing and finishing. Physical and mechanical properties and their influence on technological properties of wood. Theory of cutting and influence of physical and mechanical properties of wood on it. The influence of moisture content on technological properties of wood. The influence of temperature on technological properties of wood. The influence of different temperatures and moisture contents on strains of wood. Counting and analysing results of determination of abrasion resistance. The influence of angle of microfibril towards angle of power on technological properties of wood. The influence of wood defects on technological properties of wood. Comparing technological properties of domestic and foreign commercial wood species.

Type of course:

- Technological properties of wood (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination of the influence of the physical and mechanical properties of wood on the technological characteristics of wood processing	Exercises evaluation, partial exams, final exam	B1
Determination of the impact of wood defects on the technological characteristics of wood processing	Exercises evaluation, partial exams, final exam	B1
Determination of the basic technological characteristics of wood significant for certain types of mechanical wood processing	Exercises evaluation, partial exams, final exam	B1
Evaluation of the technological characteristics of wood for certain types of mechanical wood processing	Exercises evaluation, partial exams, final exam	B1
Practical recognition of technological characteristics on domestic and foreign wood species	Exercises evaluation, partial exams, final exam	B1
Evaluation of wood species according to the technological characteristics of wood	Exercises evaluation, partial exams, final exam	B1

General competences

Type of instruction

The student gains knowledge about the characteristics of wood in the basic process of woodworking. Influence of macroscopic, physical and mechanical properties of wood and wood defects on the technological characteristics of wood. Technological characteristics of some commercial domestic and foreign wood species.

Lectures

Lectures on theoretical basis prepare students for basic knowledge about the macroscopic characteristics and physical properties of commercial types of wood, which facilitate workmanship and complete mastery of the material.

Exercises

Task exercises with the purpose of applying the theoretical knowledge learned in lectures. Work on computer and use of computer programs for making the exercises.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	15	1,5
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	30	0	1
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	14	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex70 + PE1x30)/100**		61	29	3

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semester	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semester	
Written and oral exam	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1.Bađun, S.: Tehnološke karakteristike drva I, skripta, Zagreb, 1979,str.1-50.
2. Govorčin,S.; Sinković,T.: Tehnološke karakteristike drva, interna skripta, Zagreb, 2004, (CD)

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Koh, P.: Processi mehaničeskoj obrabotki drevesini, Moskva, 1969, str. 1-325
3.Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Woodworking machinery II

DT-3630

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Associate Professor Igor Đukić

Grading

Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:

This course studies woodworking machines, division of woodworking machines, kinematics, cutting forces, cutting power and specific cutting energy, specific output, quality of machined surfaces and possibilities for increasing the performance of woodworking machines. We will discuss the persistence of certain machine parts, diagnostic and troubleshooting procedures, and planning and preventive maintenance activities..The following groups of woodworking machines will be studied: band saws, frameasws, circular saws, planing machines, face milling machines, shapers, drills, dowels (chain, oscillatory with circular motion, oscillatory with alternating movement of the tool with a hollow chisel).Wood turning machines (longitudinal and transversal turning with a knife, transversal turning with profile tools, turning of slim rods, longitudinal turning with milling machine of symmetrical rotating parts, longitudinal turning with milling machine of asymmetric rotating parts, turning of the coil). Sanding machines (cylindrical, band, plate-shaped and special). Wood chipping machines.Machines for wood-veneer production (veneer cutting machines, peeling machines).Special wood cutting operations. Wood cutting with laser. Water jet cutting. Presses: mechanical, pneumatic, hydraulic. Division due to the direction of the pressing force: column, chassis and frame presses.

Type of course:

- Woodworking machinery II (elective, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Suggest optimum tool-tip material (high speed steel, hard alloy, hard metal, or diamond) for the default workpiece material and processing parameters.	seminar, final exam	C1
Suggest optimum processing parameters (feed speed, cutting speed ...) for basic woodworking processes.	seminar, final exam	C1
Calculate the energy efficiency of a particular processing method as the ratio of average energy consumed in kWh and unit quyntity of processed material.	seminar, final exam	C1
Comment the results of measured and calculated operating regimes for mechanical woodworking machines with reference to the recommended values.	seminar, final exam	C1
Measure feed per tooth, feed per revolution and cutting speed on band saw, circular saw, planer, moulder, drill, and report the measurement results as a report.	seminar, final exam	C1
Distinguish the causes of tool wear and the tool's sharpness reduction.	seminar, final exam	C1
Analyze the influential factors on tool life according to Taylor and suggest ways of increasing the tool life under the processing conditions.	seminar, final exam	C1
Derive the formula for the calculation of the cutting force, cutting power and theoretical roughness in wood cutting	seminar, final exam	C1
Calculate the cutting speed and tool life for the optimum productivity, analyze influencing parameters, and suggest the economic cutting speed	seminar, final exam	C1
Differentiate the evaluation criteria of wood machinability for different species of wood processed on band saws, circular saws, planers, mills, lathes, drills.	seminar, final exam	C1
Illustrate and measure basic parameters which make up the technical criteria for selection of woodworking machines.	seminar, final exam	C1

General competences

- Acquiring the knowledge for the selection, optimal usage and maintenance of tools and machinery for wood finishing.
- Acquiring the basics which are required for assigning project tasks to the manufacturers of special equipment for wood processing.

Type of instruction

Lectures

Exercises

Numerical exercises related to individual machines and quantities processed in a particular machine group. Laboratory measurements of essential parameters for optimizing the performance of a particular machine and the determination of optimal parameters according to the calculation and recommendations of the tool and machine manufacturer, as well as methodology of noise and vibration measurement on woodworking machines. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

- **Teachers' obligations:**
  Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.
- **Studenats' obligations:**

  Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

Elementi praćenja	Udio u ocjeni	Bodovna skala/ocjena	Ocjena	Broj sati direktne nastave	Broj sati rada prosječnog studenta izvan direktne nastave	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises and seminar (E)	50%	50-60%	Sufficient (2)	30	20	2
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	50%	50-60%	Sufficient (2)	-	30	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(Ex50 + FEx50)/100**		**60**	**60**	**4**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises (E)	Exercise exercises include auditing exercises that handle numerical tasks related to individual chapters and laboratory measurements of key parameters for the optimization of the performance on a particular machine and determination of optimal parameters according to the calculation and recommendations of the tool and machine manufacturer, and methodology of noise and vibration measurements on woodworking machines. Exercises are, as appropriate, attended by groups. The accuracy, regularity and regularity are evaluated. Along with the regularity of lectures and exercises, the lecture and exercise report is delivered in the form of a seminar and is a condition for oral exam.	According to the agreed terms	Exceptionally, in the case of a justified reason for the students absence from the individual laboratory exercise.
Oral exame	The requirement for the oral part of the exam is a passing grade from the seminars and reports from laboratory exercises. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked.	Exam terms	

Obligatory literature

1. Goglia, V. 1994: Strojevi i alati za obradu drva – I dio, Šumarski fakultet Zagreb.
2. Goglia, V. 1994: Strojevi i alati za obradu drva - II dio, Interna skripta.
3. Čevra, A. 1990: Obrada metala II. dio, Školska knjiga Zagreb.
4. Cebalo, R. 1993: Fleksibilni obradni sustavi, Fakultet strojarstva i brodogradnje, Interna skripta.

Recommended literature

1. Lisičan, J. 1996: Teorija a technika spracovania dreva, MAT-CENTRUM, Zvolen.
2. Zdenković, R. 1976: Atlas alatnih strojeva, Fakultet strojarstva i brodogradnje Zagreb.
3. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 1, Školska knjiga Zagreb.
4. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 2, Školska knjiga Zagreb.
5. Prokeš, S. 1998: Obrabeni dreva a novych hmot ze dreva, SNTL Praha.

Construction of Wood Products II

DT-3631

ECTS 3

English language R1

E-learning R2

Teaching hours 60
Lectures 30
Exercises 30

Lecturers
Full Professor Ivica Grbac, PhD
Associate Professor Zoran Vlaović, PhD

Associate teacher for exercises
Associate Professor. Zoran Vlaović, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Introduction to furniture construction (classification, identification, vocabulary). Construction and drawing of the furniture for keeping and supporting objects (furniture made of full wood, furniture made of wooded and other materials), work furniture (office, school and home), furniture for serving meals, sitting furniture and furniture with backrest; upholstered sitting furniture, rest furniture (beds and deck chairs), furniture fitted to the people with special needs, furniture of the exteriors, paper- and cardboard-made furniture. Construction-calculation methods in construction of various types of furniture.

Type of course:

Compulsory course (group B), 6th semester, 3rd year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO

to identify and describe furniture construction, to classify (kitchen furniture, dining room furniture, office and school etc.) and to identify furniture (whose main features are visual, aesthetic and functional elements and inner construction and functional structure) and to use technical terms (rail, panel, hinge etc)	final examination	C4 C5
To design, draw and describe furniture for storage, dining and work (home, office, school) by way of conceiving stage (analysing tasks and dealing with the issue of constructing), designing (selecting the best variant and making a drawing) and by constructional elaboration to parts and assemblies.	exercises in the computer classroom, corrections, exercise evaluation, final examination	C5
To design, draw and describe furniture for sitting and resting in accordance with HRN EN standards.	exercises in the computer classroom, corrections and exercise evaluation	
To draw up the basic construction documentation and to approach systematically to its completion.	exercises in the computer classroom, corrections and exercise evaluation	C5
To design, draw and describe furniture for lying (beds, deck chairs) while considering the user's comfort.)	exercises in the computer classroom, corrections, exercise evaluation, final examination	C5
To design, draw and describe furniture for people with special needs in accordance with anthropometric requirements.	final examination	C5
To design, draw and describe furniture of the exteriors.	final examination	C5
To use CAD systems for making technical drawings or drawings as data carriers in relation to product shape, construction and quality.	exercises in the computer classroom, corrections and exercise evaluation	C5
To define and sketch paper- and cardboard-made furniture	final examination	C5
To deal with calculations for the construction of different furniture types (to dimension construction)	exercises in the computer classroom, corrections and exercise evaluation	C5
To manage the equipping of a facility with furniture for storage, sitting and lying.	final examination	C5
To identify and describe quality factors for the said furniture types.	exercises in the computer classroom, corrections, exercise evaluation, final examination	C5
To identify and distinguish fittings for storage furniture	exercises in the computer classroom, corrections and exercise evaluation	C5

General competences
Knowledge of constructing, constructions and types of furniture, dependence of constructions on the mode of manufacture. Skills in development and implementation of the complete construction system: planning, design, construction and production of technical documentation applied in the production of final product.

Type of instruction

Lectures

Exercises
Within construction exercises, students are expected to do six exercises with individual assignments including taking photographs, sketching and drawing the product and the preparation of technical documentation. Exercises serve as an extension of the knowledge acquired at lectures.

Field work
Visits to factories and manufacturing plants, becoming familiar with technology, production methods, materials and the principles of making furniture and other wood products. Students are expected to take notes based on which they will prepare a report on the visit to a factory, furniture fair or some other related event.

Working methods:

- **Teacher's obligations:**
  to hold original classes – lectures, exercises and field work. To draw up teaching material. To prepare and devise seminars and exercises, to examine and grade them. To conduct examinations and hold consultations.

- **Students' obligations:**
  regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission of seminar papers and exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	30 %	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	30	15	1,5

		Neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, correct, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete and submitted on time				
		Neat, correct, complete, submitted on time	Excellent (5)			
Written exam (WE)	35 %	60-70%	Sufficient (2)	0	3	0,10
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral exam (OE)	35 %	60-70%	Sufficient (2)	0	12	0,40
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(E×30 + WE×35 + OE×35) / 100**		60	30	3

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	according to syllabus	-
Exercises (E)	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade for exercises is the arithmetic mean of grades for individual exercise grades. The requirements for taking the written examination are positively graded exercises.	according to syllabus	-
Written exam (WE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students randomly choose an assignment with the product photograph or given parameters for drawing and designing. Orthogonal projections and characteristic sections are drawn freehandedly, and the component and technical description are filled on forms prepared beforehand. The written examination is graded and included in the final grade .	Exam terms	-
Oral exame (OE)	A requirement for taking the oral examination is to acquire sufficient scores in the written part of the examination. Students' theoretical knowledge and understanding of constructional compositions are examined. The final grade will be calculated by the formula : **(E×30 + WE×35 + OE×35) / 100**	Exam terms	-

Obligatory literature

1. Tkalec, S. (1985): Konstrukcije namještaja, monographie, University of Zagreb, Faculty of Forestry,, Zagreb
2. Grbac, I. (2005): Ojastučeni namještaj – selected university textbook – manuscripts, University of Zagreb, Faculty of Forestry,, Zagreb
3. Nutsch, W. (1981): Handbuch der Konstruktion: Möbel und inbausschraenke, DVA Stuttgart, Njemačka
4. Hennessey J., Papanek, V. (1974): Normadic furniture 2, Pantheon books, Random house Inc. USA

Recommended literature

1. Grbac, I. (2005): Krevet i zdravlje, university textbook – manuscripts, University of Zagreb, Faculty of Forestry,, Zagreb
2. Grbac, I. (2003): Zdrav život, zdravo stanovanje, manual, Spektar media, Zagreb
3. Grbac, I. (1984): Istraživanje trajnosti i elastičnosti različitih konstrukcija ležaja – master thesis, selected chapters, University of Zagreb, Faculty of Forestry,, Zagreb
4. Grbac, I. (1988): Istraživanje kvalitete ležaja i poboljšanje njegove konstrukcije – doctoral dissertation, selected chapters, University of Zagreb, Faculty of Forestry,, Zagreb
5. The Taunton Press (2000): Practical Design Solutions and Strategies, Key advise for sound construction from Fine Woodworking, The Taunton Press Inc. Newtown, USA
6. Catalogues by world furniture fitting produces

Upholstered Furniture

DT-3632

ECTS 3

English language R1

E-learning R2

Teaching hours 60
Lectures 30
Exercises 30

Lecturers
Full Professor Ivica Grbac, PhD
Associate Professor Zoran Vlaović, PhD

Associate teachers for exercises
Associate Professor Zoran Vlaović, PhD
Assistant Professor Danijela Domljan, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to upholstered furniture and history of upholstered furniture. Constructional classification of upholstered furniture (construction types of upholstered furniture for sitting; construction types of upholstered furniture for rest – bed systems; construction types of multipurpose upholstered furniture – sitting, relaxation and laying). Materials for upholstered furniture (materials for frame construction, bases for sitting furniture (seat) and rest (bed bases), materials for elastic layer i.e. seat cores and mattresses, materials for soft surfaces – covering materials, materials for decorative-covering layer, auxiliary materials, specificities of material utilization in upholstered furniture). Relevance of construction for production technology of upholstered furniture, classical construction of upholstered furniture for sitting and rest. Functional requirements for upholstered furniture (anthropometry, health aspects of upholstered furniture, functional dimensions of upholstered furniture, comfort, physiological & hygienic requirements upon upholstered furniture, aesthetic requirements). Quality of upholstered furniture. Flammability of upholstered furniture and the ecological aspect of the production of upholstered furniture.

Type of course:

Elective course (group B), 6th semester, 3rd year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to identify historic periods, styles and development of upholstered furniture	final examination	A1
to design and construct types of upholstered furniture intended for sitting, lying and for multiple purposes (resting and relaxation)	exercises in the computer classroom, corrections, exercise evaluation	C5
to distinguish and recommend materials for making upholstered furniture (such as for making the frame construction, for the elastic layer, for decorative-covering layer…)	final examination	C5
to choose materials for the frame construction; for the base of furniture for siting and lying; for the elastic layer i.e. the core; for surface softness and for the decorative covering layer:	exercises in the computer classroom, corrections, exercise evaluation, final examination	B3, C5
to explain the specificity of material utilisation for upholstered furniture (eg. leather or decorative fabric with a pattern)	final examination	D1
to design furniture and plan its manufacture depending on available technology (classical (hand), machine made, construction technology of bed-mattress…)	final examination	C5
to draw a classical construction of upholstered furniture for sitting and lying	exercises in the computer classroom, corrections, exercise evaluation, final examination	C5
to define and apply functional requirements for upholstered furniture	final examination	C5
to plan. recommend and assess upholstered furniture quality	final examination	D1
to distinguish and compare the resistance to flammability of upholstered furniture	final examination	C5
to recognise and apply ecological production of upholstered furniture	final examination	C5
to differ stages of the technological process of upholstered furniture manufacturing (eg. when producing mattresses, to recognise the process of making the mattress core, making outer layers etc.)	final examination	C5
to recognise the type (quality) of sponge materials (eg. the difference between viscoelastic foam and latex, differences in density (hardness	final examination	C5

General competences

Knowledge of construction, types and functions, requirements in use, dependence of construction upon the production technology of upholstered furniture.

Type of instruction

Lectures

Exercises
Exercises give students an insight into standards important for furniture designing/testing. Students are expected to recognise materials for making furniture, to do at least two exercises with individual assignments including taking photographs, sketching and drawing the product and the preparation of technical documentation. Exercises serve as an extension of the knowledge acquired at lectures.

Field work
Visits to factories and manufacturing plants, becoming familiar with technology, production methods, materials and the principles of making upholstered furniture. Students are expected to take notes based on which they will prepare a report on the visit to a factory, furniture fair or some other related event

Working methods:

- **Teacher's obligations:**
  to hold original classes – lectures, exercises and field work. To draw up teaching material. To prepare and devise seminars and exercises, to examine and grade them. To conduct examinations and hold consultations.

- **Students' obligations:**
  regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission of seminar papers and exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	50 %	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	30	15	1,5
		Neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, correct, complete, not	Very good (4)			

		submitted on time Neat with minor corrections, complete and submitted on time Neat, correct, complete, submitted on time	Excellent (5)			
Oral exame (OE)	50 %	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(E×50 + OE×50) / 100**		60	30	3

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	according to syllabus	-
Exercises (E)	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Seminar and exercises are checked and graded. The grade for the practical part (seminar and exercises) is the arithmetic mean f the seminar and individual exercise grades. The requirements for taking the examination are positively graded exercises and the seminar.	according to syllabus	-
Oral examination (OE)	Students whose exercises and seminar have been graded and who regularly attended classes may take the examination. Students' theoretical knowledge and understanding of certain construction compositions will be examined. The final grade will be calculated by the formula: **(E×50 + OE×50) / 100**	Exam terms	-

Obligatory literature

1. Grbac, I. (2005): *Ojastučeni namješta*j, university textbook – manuscript, University of Zagreb, Faculty of Forestry, Zagreb
2. Grbac, I. i Marinšek, E. (1995): *Vodna postelja – zdravo spanje*, manual-notes, Ljubljana, Slovenija
3. Grbac, I. (2005): *Krevet i zdravlje*, university textbook – manuscript, University of Zagreb, Faculty of Forestry, Zagreb
4. Grbac, I. (2003): *Zdrav život, zdravo stanovanje*, manual, Spektar media, Zagreb

Recommended literature

1. Tkalec, S. (1985): *Konstrukcije namještaja*, monography, University of Zagreb, Faculty of Forestry, Zagreb
2. Grbac, I. (1984): *Istraživanje trajnosti i elastičnosti različitih konstrukcija ležaja* – masterthesis, selected chspters, University of Zagreb, Faculty of Forestry, Zagreb

3. Grbac, I. (1988*): Istraživanje kvalitete ležaja i poboljšanje njegove konstrukcije* – doctoral disseratation, selected chapters , University of Zagreb, Faculty of Forestry, Zagreb
4. Morley, J. (1999): Furniture: The western tradition, History, style, design, Thames & Hudson Ltd., London, United Kingdom
5. Brühl (****): Blick in die Zukunft: Innovative Sitzkonzepte, Brühl & Sippold GmbH, Njemačka
6. Panero, J. i Zelnik, M. (1987): *Antropološke mere i interijer, Zbirka preporuka za standarde u projektiranju*, IRO "Građevinska knjiga", Belgrade

Furniture design

DT-3633

ECTS 3

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Ivica Grbac, PhD, full professor
Danijela Domljan, PhD, assistant professor

Associate teacher for exercises
Danijela Domljan, PhD, assistant professor
Zorn Vlaović, PhD, associate professor

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
History of furniture development. Characteristics of worldwide and European styles in furniture manufacture. Use and purpose of various designs, materials and constructions in different styles throughout history. Contemporary trends in furniture design. Development of modern design. Introduction to product design. Theory of shapes. Shape elements and principles. Aesthetic components of a product. View of a product. Means of expression in industrial design. Industrial design elements – Design principles. Functional principles. Aesthetic principles. Technical-technological principles. Human principles. Economical principles. Ecological principles. Theoretical, practical and methodological design principles. Role and significance of a well designed product. Relation between a designer and a company. Design methods. Design and Interdisciplinarity. Product quality. Design and standardization. Design and ergonomy. Anthropometry. Ergonomical methods. Design and marketing. Design and marketing functions. Validation of design in marketing. Design and visual communication. Role of visual culture in communication with a product. Environmental design. Physical and communication environment. Design and IT. Role of IT in product development. IT applications in furniture design. Furniture vs. dedicated space. Basic principles of interior design. Functional groups of rooms and furniture. Ground-plan communication of rooms with furniture. Elements of architectural design.

Type of course:

Compulsory course (B subjects), 6. semester, 3. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify and apply the features of historical styles and heritage in furniture design.	exercises (project assignment, seminar work)	C4, C8 E1
Follow trends and innovations (internet, magazines, books) in design and apply them in designing new furniture design solutions.	exercises (project assignment, seminar work)	A1 E1
Evaluate the theoretical, practical and methodological goals and design methods of furniture as part of a complex interdisciplinary design process on a given example.	exercises (project assignment), final exam	A1 E1
Identify and apply design elements (expression tools) and principles of industrial design design in contemporary furniture (functional, aesthetic, technical-technological, human, economic, ecological principles, etc.)	final exam	B3 C4, C8 E1
Explain the importance of interdisciplinary approach and the involvement of other professionals in the design of furniture	final exam	B3 C4, C5, C8 E1
Identify and explain the term good design using parameters of good design	exercises (project assignment, seminar work), final exam	B3 C4, C5, C8 E1
Develop and design furniture and other wood products by default features (input data)	exercises (project assignment, seminar work), final exam	B3, B4 C4, C5, C8 E1
Apple design research methods in the design of furniture and wood products (analysis of users and needs, problem analysis, analysis poszojećih solutions (index design), analysis of the concept and communication with potential customers and others.)	exercises (project assignment, seminar work), final exam	A1 D2
Evaluate and compare product quality and valid standards through ideally designed furniture solutions.	exercises (project assignment, seminar work)	A1, A4 B4 C5
Define the characteristics of future products (aesthetic, structural, technical, economic, ergonomic and other) to the needs of the target groups of users	exercises (project assignment, seminar work)	B3, B4 C4, C5, C8 E1
Distinguish and valorise aesthetic components of a product in relation to furniture design	exercises (project assignment, seminar work)	B3 C4, C8
Use innovation and new materials and technologies in shaping the conceptual design of furniture on a given topic.	exercises (project assignment, seminar work)	B3, B4 C4, C5, C8 E1
Apply knowledge of aesthetics, ergonomics, anthropometrics, ecology, new materials, and technology, marketing, and visual identity in designing furniture according to the requirements.	exercises (project assignment, seminar work)	B3, B4 C4, C5, C8 E1
Sketch the design conceptual design of furniture and other wood products using design drawing methods.	exercises (project assignment, seminar work)	C5

Apply appropriate standards and dimensions to designing a new product	exercises (project assignment, seminar work)	B4
Show variants of conceptual furniture solutions with functional design drawing in perspective (space-based or computer).	exercises (project assignment, seminar work)	C5
Choose and explain the optimal design idea of furniture	exercises (project assignment, seminar work)	B3, B4 C4, C5, C8 E1
Define the design-functional, structural-technological and other features of the furniture design.	exercises (project assignment, seminar work)	B3, B4 C4, C5, C8 E1
Apply the knowledge of design drawing and program packages in the presentation of a design solution of molded furniture.	exercises (project assignment, seminar work)	C5
Present the final solution og furniture design in all phases of product development.	final exam	B3, B4 C4, C5, C8 E1

General competences Overcoming and understanding of the theoretical, practical and methodological basis for the design of products as complex interdisciplinary process, and the essence of the design process with the development of skills of independent analytical and creative design and operation.

Tipe of instruction

Lectures

Exercises

Exercises involve the development of major project tasks, minor assignments and seminars. Within the course, the student prepares the main project assignment during the semester, which is submitted at the end of the semester as a map, model and presentation of the default format, with oral defense.

Two seminar papers are submitted, one of them thematic related to the project assignment (a review of the topic or a translation of the thematic unit from the given literature), and another written review of the field part of the lecture (an exhibition, a fair or an important event related to art, production or design furniture). In addition to the main terms of reference during exercises the student develops and smaller tasks / exercises and deliver them in a folder.

Working methods:

4. Teachers' obligations:

Maintaining original teaching - lectures, exercises and field teaching. Creating teaching materials. Designing topics for seminar papers. Preparing and designing exercises for their review and evaluation. Organization and management of field teaching. Maintain consultation and exam and evaluate tasks during exercise and exam.

5. Studeats' obligations:

Regular attendance and active participation in lectures, exercises and field teaching, making and delivering exercises and seminars within the given time frame. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0			30	0	1
Exercises (E)	90%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	30	25	1,8
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			
		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Oral exam (OE)	10%	60-70%	Sufficient (2)	0	5	0,2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E×90 + OE×10) / 100**		60	30	3

Additional note: Due to the specificity of the exercises (project assignment and other tasks) the evaluation criteria are used, which sum up the student activity and the quality of the project design solution.

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	according to silabus	
Excercises	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. During the semester, the student prepares exercises / tasks in team and individual work, monitoring continuous student progress and adopting thematic knowledge and skills, in accordance with the evaluation criteria. The right to sign is obtained by the number of attendance classes and exercises as well as assignments and seminars within the given deadline. It is obligatory to submit each phase of the project task to insight. Submission of the project task is by deadline, by the end of the semester.	according the sylabus	
Oral exame	Requirements for the oral part of the exams are devoted and positively evaluated exercises, ie project assignment, all other assignments and seminar papers. The oral exam consists of verbal defense (presentation) of the project task solution and the understanding of all phases of designing the conceptual and execution solution in the project assignment as well as the understanding and adoption of knowledge in lectures and exercises. The final grade is obtained according to the formula: (V × 90 + + UI × 10) / 100	exam terms	

Obligatory literature

1. Lapaine, B. (1994): Dizajn, Šumarski fakultet Sveučilišta u Zagrebu
2. Quarante, D. (1991): Osnove industrijskog dizajna, Arhitektonski fakultet Sveučilišta u Zagrebu - Interfakultetski studij dizajna, Zagreb
3. Keller, G. (1995): Dizajn, Vjesnik , Agencija za marketing, Zagreb
4. Noblet de, J. (1999): Dizajn, pokret i šestar, Golden marketing, Zagreb
5. Grbac, I. (2003): Zdrav život – zdravo stanovanje, Prvi priručnik iz područja namještaja u funkciji zdravlja,Spektar media, Zagreb
6. Grbac, I (2004): Ojastučeni namještaj, Sveučilišni udžbenik, Zagreb, odabrana poglavlja

Recommended literature

1. Vukić, F. (1996): Stoljeće hrvatskog dizajna, Meandar, Zagreb
2. Papanek, V. (1973): Dizajn za stvarni svijet, M. Marulić, Split
3. Pevsner, N. (1936. i dalje): Pioneers of Modern Design, Penguin, London
4. Neufert, E. (2000): Elementi arhitektonskog projektiranja, Golden marketing, Zagreb
5. Panero, J. i Zelnik, M. (1987): Antropološke mere i interijer, Zbirka preporuka za standarde u projektiranju, IRO "Građevinska knjiga", Beograd
6. Sparke, P. (1986): Design in context, Quatro Publishing, London

Field work-4

DT-3634

ECTS 4

Teaching hours 40

Grading

Course content:
Field work is a compulsory course of Undergraduate study and implies a student's workload equivalent to the 4 ECTS. During the VI semester of the Undergraduate Study, it is necessary to complete field work for a total duration of 5 days or 40 hours.

Type of course:

- **Field work 4. – Wood technology** (compulsory course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Calculate the profitability of the production of a particular product. Create a model of cost, income and change of business activity.	Field work report evaluation
Sketch the technological process of wood finishing. Test material parameters before coating. Adjust parameters before coating in wood finishing. Collect information about materials for surface preparation, materials for staining and varnishing and to calculate their consumption and VOC content in stains and varnishes.	Field work report evaluation
Self-design information-management system, guide all processes in production, project product from idea to realization	Field work report evaluation
Evaluate the impact of physical and mechanical properties of wood on the technological characteristics of wood. Valorize the impact of wood moisture content o and wood temperature on the technological characteristics of wood. Compare the abrasion resistance on different wood sections.	Field work report evaluation
Suggest optimal material of cutting blade and parameters for basic mechanical wood processing. Calculate energy efficiency, cutting speed and durability of tools.	Field work report evaluation
Design, draw and describe furniture in accordance with HRN and EN norms. Compile basic constructional documentation. Estimate construction of different furniture (dimension construction)	Field work report evaluation
Design and construct types of upholstered furniture. Distinguish and suggest materials for making upholstered furniture. Design a classic design of upholstered furniture for sitting and lying.	Field work report evaluation
Design furniture and other wood products. Apply methods of design in shaping furniture and wood products. Define future product characteristics. Sketch and explain the optimally designed conceptual solution for furniture.	Field work report evaluation

General competencies

Field work in production plants completes theoretical knowledge of undergraduate studies with examples from practice. The student is focused on the analytical approach of gathering data on the factors of the manufacturing process or business of the company. Based on calculations and analysis, the student suggests improvements for a more rational and optimal process. The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:

6. Teachers' obligations:

Organize field work, design tasks that students will be able to handle independently, and be available for consultation during and after field work. To introduce students to the rules of behavior in the field work. To provide the student with the necessary help and instruction in working on the solution of field work assignments. Review and evaluate field-based reports.

7. Students' obligations:

Active participation in field work. Respect the rules on the field work. Write a report from the field tutorial.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				40	80	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student's skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written		

during field work	and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave

   Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Undergraduate thesis

DT-33737

ECTS 7

Grading

Course content:
Undergraduate thesis is an individual written work based on research. It is written in a scientific form and implies students' engagement in work that is equivalent to 7 ECTS module. Graduation is usually done during VI semester on undergraduate study and ends with defense (presentation and answering the questions).

Type of course:
- Undergraduate thesis - Wood technology (compulsory course, 6th semester, 3nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
apply the current knowledge to define a scientific and professional problem in choosing the topic of work	Undergraduate thesis
create a schedule of work in accordance with the deadlines of making the undergraduate thesis in stages	Undergraduate thesis
devise a methodology of research work	Undergraduate thesis
apply the methodology of writing a professional and scientific work	Undergraduate thesis
present their work in written and oral form	Undergraduate thesis defense of undergraduate thesis

General competences
Undergraduate thesis is a task in which the student demonstrate knowledge of the background of the profession and of the professional-scientific research work, respectively gathering the literature and interpretation of known facts and their application. Includes knowledge of the content of the curriculum, the ability to find a solution to the problem using available literature, knowledge in writing of professional/scientific work and oral presentation

Type of instruction
A student under the guidance of a mentor conducts research and writes undergraduate thesis on a subject accepted by the master examination Commission. Undergraduate thesis is defended in front of the mentor which completes graduate study.

Working methods:

Teachers' obligations:
Hold consultations every week according to schedule. Provide the student with the necessary help and instructions when submitting themes and planning the graduate thesis. Conduct a student to set up tests, conduct analysis, and collect and analyze data. Introduce the student with the principles of

ethical approach in writing graduate thesis. Review the master thesis and give instructions for refinement before binding. Help the student prepare for public defense diploma work.

Students' obligations:
Report the topic of the undergraduate thesis, conduct research and work in accordance with the Instructions for designing mas**t**er thesis. Come to consultations and present progress in research and work. Observe and follow the instructions of the mentor. Observe the principles of ethical approach to writing master thesis. Prepare the presentation and defend the master thesis in front of the appointed commission.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Undergraduate thesis (UT)	70%	See description	Sufficient (2)		150	5
			Good (3)			
			Very good (4)			
			Excellent (5)			
Defense of undergraduate thesis (UD)	30%	See description	Sufficient (2)		60	2
			Good (3)			
			Very good (4)			
			Excellent (5)			
TOTAL	**100%**				210	7

Evaluation elements	Description	Deadline	Compensation
Undergraduate thesis (UT)	sufficient (2) - There are substantial deficiencies in the work, the basic concepts are superficial and no deeper knowledge of the subject good (3) - Only some of the relevant aspects of the topic are presented in this paper, the literature is processed correctly but only partially. The scientific and professional vocabulary is basic very good (4) - The work is well-structured with facts, relevant theories and up-to-date data are presented, the literature is correctly elaborated, but the approach lacks creativity. excellent (5) - The work is logically well structured factually correct and conceptually well-defined, the entities are related, the relevant and recent literature is used and the approach to the topic from different perspectives is visible.		-
Defense of undergraduate thesis (UD)	sufficient (2) - The presentation is a retelling of the read text, the answers to the questions are scarce. good (3) - The presentation is clear and informative, but without the ability to link theory to practice. Ability to answer only simple questions. very good (4) - The presentation is clear and substantive, the answers to the questions are just correct and do not indicate a deeper reflection on the topic. excellent (5) - The presentation is clear, highly informative, answers the questions right and creative.		

Obligatory literature

2. Pravilnik o izradi i obrani diplomskog rada na diplomskim sveučilišnim studijima Šumarskog fakulteta
3. Obrazac DS-1 Zamolba za odobrenje teme i mentora diplomskog rada
4. Upute o izgledu i sadržaju diplomskog rad
    1. Dostupno na http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=43

Graduate study
G. WOOD TECHNOLOGY PROCESSES

In accordance with the needs of Croatian wood industry, and primarily, due to introduction of new technologies of wood production and processing and a need of the integral use of a wood mass, in order to product final products whose price and quality will guarantee competition in local and foreign markets, the educational system in wood technology has to be adapted. Since Croatia had signed the Bologna Declaration, the existing Law on Scientific Activity and Higher Education decrees that an in-depth reform be carried out by the academic year 2005/2006. The Commission for the Studies Reform of the Faculty of Forestry has worked out new curricula in two educational cycles, out of which we now present the graduate studies of wood technology processes programme.

The use of new technologies increases the efficiency of processes, starting from the harvest and production of primary wood products, through mechanical processing, production of furniture and other wood products, and ending in marketing and selling. This is what makes the profession perspective and significant for Croatian economy.

Faculty of Forestry has 155 employees, 60 of whom work as academic staff and associate fellows. It houses 8 laboratories and 5 training and experimental forest facilities stretching over 3500 ha. Employees of the Department of Wood Technology are in charge of several scientific projects directly financed by the Ministry of Science and Education, along with some scientific and expert projects that were contracted with the economy sector and government administration. They also participate in international scientific COST actions projects. They dispose of all necessary knowledge and skills required in implementation of the proposed studies.

The proposed studies programme can be mostly compared to similar graduate studies (MSc) in Europe that are involved in wood technology processes and entrepreneurship in wood industry. Organization and implementation of the studies is adapted to our conditions, and their programme (larger part of the courses) can be compared to those of the BOKU University (Magisterstudiums Holztechnologie un Management, Universität für Bodenkultur Wien, Austria) and of the University of Brno, the Czeck Republic (Drevarske inženyrstvi, Lesnicka a drevarska fakulta, Mendelova zemedelska a lesnicka univerzita v Brne). Collaboration with other European faculties has always been rewarding (bilateral agreements), and was of great help in designing of a new and up-to-date studies programme, whose important characteristic is compatibility and possibility of free fluctuation of subjects within the European educational system.

The main focuses of the study programme are wood technology processes, manufacturing of wood materials and of final products. The graduate study programme in Wood Technology Processes develops the competencies necessary for analysis and resolution of the most complex engineering problems. This is based on exceptional knowledge about wood, wooden and non-wooden materials, technological properties and processes, computer application in production, as well as on the exceptional knowledge of organization and economics. In the first year of study, students acquire basic knowledge in quantitative methods for operations research and automation and measurement in wood working industry. They focus all of their previous insights into acquiring knowledge on technological processes in sawmilling technology, hydrothermal treatment of wood, technology of panels made from fragmented wood, veneer and plywood technology. In processes, emphasis is also placed on material handling. Through the field of production management, students acquire knowledge in operations management. Through optional and optional compulsory subjects from a list submitted in the study programme, students have the opportunity to broaden their knowledge. Through fieldwork in project centres and wood processing plants they acquire the necessary practical experience. In the third semester of the second year, students improve process techniques in the field of wooden products for building purposes and wood finishing technological processes. Furthermore, they upgrade their knowledge in wood protection techniques and processes. Applied statistics allows them practical usage, and basics for scientific research work. The forth semester is dedicated exclusively to research related to the master's thesis. Students acquire competencies for performing the most complex jobs in the wood industry and for continuation of education in doctoral and specialist studies by individually writing the master's thesis. Defending the master's thesis is a requirement for the conclusion of studies.

DESCRIPTION OF THE PROGRAMME

List of compulsory and elective courses

I YEAR

Code	Course unit	L*	PW	FW	ECTS
	1st semester				
WP-1134	HYDROTHERMIC PROCESSING OF WOOD	2	2		5
WP-1135	SAWMILLING TECHNOLOGY II	2	2		5
WP-1136	QUANTITATIVE METHODS FOR OPERATIONS RESEARCH	2	1		4
WP-1137	PRODUCTION MANAGEMENT	2	1		4
	ELECTIVE COMPULSORY COURSE	2	1		4
	ELECTIVE COURSE**	2	1		4
DP-1142	FIELD WORK I			6	4
	Total:	12	8		30
	Elective compulsory courses				
WP-1138	WOOD MODIFICATIONS	2	1		
WP-1139	FOREST UTILISATION	2	1		
WP-1140	OPERATIONS MANAGEMENT II	2	1		
WP-1141	INDUSTRIAL SOCIOLOGY	2	1		
	2nd semester				
WP-1242	VENEER AND PLYWOOD TECHNOLOGY	2	2		5
WP-1243	TECHNOLOGY OF PANELS MADE FROM DISINTEGRATED WOOD	2	2		5
WP-1244	AUTOMATION AND MEASUREMENT IN WOODWORKING INDUSTRY	2	1		4
WP-1245	MATERIAL HANDLING	2	1		4
	ELECTIVE COMPULSORY COURSE	2	1		4
	ELECTIVE COURSE**	2	1		4
WP-1250	FIELD WORK II			6	4
	Total:	12	8		30
	Elective compulsory courses				
WP-1246	WOOD FIBERS AND PAPER TECHNOLOGY	2	1		
WP-1247	SPECIAL METHODS OF WOOD DRYING	2	1		
WP-1248	CNC TECHNIQUES IN WOODWORKING	2	1		
WP-1249	WOOD INDUSTRY POWER SUPPLY	2	1		

* L– lectures (classes/week); PW – practical work (classes/week); FW – field work (days/semester)
**That can be chosen from a list of courses at their own studies or from other studies.

II YEAR

Code	Course unit	L*	PW	FW	ECTS
	3rd semester				
WP-2350	TECHNOLOGY OF WOOD BUILDING COMPONENTS	2	2		5
WP-2351	PROCESSES OF WOOD FINISHING	2	2		5
WP-2352	WOOD PROTECTION II	2	1		4
WP-2353	APPLIED STATISTICS	2	1		4
	ELECTIVE COMPULSORY COURSE	2	1		4
	ELECTIVE COURSE	2	1		4
DP-2357	FIELD WORK III			6	4
	Total:	12	8		30
	Elective compulsory courses				
WP-2354	QUALITY MANAGEMENT AND INSURANCE	2	1		
WP-2355	DESIGNING WOOD INDUSTRY PLANTS	1	2		
WP-2356	PROTECTION OF INDUSTRIAL ENVIRONMENT	2	1		
	4th semester				
WP-2457	MASTER THESIS				30

* L– lectures (classes/week); PW – practical work (classes/week); FW – field work (days/semester)
**That can be chosen from a list of courses at their own studies or from other studies.

The learning outcomes of the study program of graduate study Wood Technology Processes

With the knowledge acquired during the study programme, a Master of Engineering in Wood Technology Processes is able to:

A) WITH GENERAL ENGINEERING COMPETENCE
— A1: Explain the position and trends of the wood industry in the country and worldwide,
— A2: Independently gather data, statistically process, present and analyses gathered data, discuss and make conclusions based on analysed data and distinguish the possibilities of different, interpretation of the same problem analysed in different ways,
— A3: Apply simpler methods of operation research.

B) WITH FOCUSED ENGINEERING COMPETENCE
— B1: Apply current technical regulations in planning and managing systems, managing production and managing and assuring quality of wood, wooden materials and final products,
— B2: Apply scientific insights on wood as a renewable material and optimise wood usage through the application of techniques and technologies for reuse of wood excess,
— B3: Manage procedures and processes of improving natural wood disadvantages using chemical, physical and enzymatic modifications,
— B4: Plan and analyse material handling, solve problems of transport, storage and selection of transport technique, analyse factors influencing the efficiency and expenses of wood and wooden, materials transport and storage.

C) WITH TECHNOLOGICAL ENGINEERING COMPETENCE
— C1: Apply technological processes of mechanical and thermo-chemical wood refinement in the manufacturing of wood fibers and paper,
— C2: Manage wood technology processes in the field of sawmilling, hydrothermal treatment of wood, wood protection, technology of veneer and wooden board manufacturing, technology of products for building purposes, furniture and other wood products, and guide processes of wood and wooden products finishing,
— C3: Design technologies for primary and final wood treatment, develop, improve and optimize production, and apply knowledge from the field of technique and management in the wood industry,
— C4: Measure and evaluate quality parameters of wooden products (for building purposes) and interpret their size and meaning,
— C5: Choose and apply the CNC technique in final wood treatment,
— C6: Enhance existing technologies as well as implement new technologies in the wood industry,
— C7: Manage the industrial environment of wood processing and the wooden, chemically protected wood waste and excess.

D) WITH ORGANISATIONAL ENGINEERING COMPETENCE
— D1: Recommend resource usage through the management of a process which consists of planning, organizing, directing and controlling,
— D2: Perform tasks in the field of industrial management in wood refinement and furniture manufacturing, micro planning, assignment distribution, optimization of manufacturing decisions, production management and work control,
— D3: Organize and manage tasks of wood materials trade and transfer,
— D4: Manage and perform tasks in wood industry entrepreneurship,
— D5: Perform the most complex tasks in all types of companies dealing with processing, refinement and wood trade, as well as in consultancy and engineering companies.

E) WITH OTHER ENGINEERING COMPETENCE
— E1: Perform tasks of scientific and professional associates in scientific research institutions in the field of wood and wood technology,

— E2: Upgrade their professional and scientific competencies through different forms of education and postgraduate studies,
— E3: Gather, process and interpret reference sources and prepare simpler professional or scientific papers,
— E4: Conduct courses in vocational secondary school and other similar schools,
— E5: Perform activities and tasks in publicist writing and the media related to the wood profession.

The link of the learning outcomes of the courses with the learning outcomes of the program

Code	General engineering competence			Focused engineering competence				Technological engineering competence							Organisational engineering competence					Other engineering competence				
	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	E1	E2	E3	E4	E5
DP-1134									+															
DP-1135									+	+	+		+											
DP-1136			+				+			+					+	+								
DP-1137															+	+		+	+					
DP-1138						+							+											
DP-1139					+		+				+		+		+	+								
DP-1140															+	+			+					
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DP-2357	+	+		+		+			+	+	+		+	+	+				+			+		
DP-2457	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Hydrothermal processing of wood and wood materials

WP-1134

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Professor Stjepan Pervan, PhD

Associate teacher for exercises
Miljenko Klarić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:
Physical, anatomical and chemical basics of hydrothermal processing of wood and wooden materials, hygroscopic properties of wood, anisotropy of shrinkage and swelling in hydrothermal processing of wood, control and determination of moisture content by standard and nonstandard methods, determination of macro and microclimate conditions for air drying, conventional kiln drying with and without air exchange – construction details, kiln drying schedules – analysis and modification, the types of drying control systems – drying parameters control, introduction of drying quality standards, steaming of solid wood, mechanism of moisture and heat transport in steaming and heating processes of raw material for veneer production, criteria for determination of wood bending parameters considering production demands, thermodynamics of drying of chipped wood, thermodynamics of moisture movement in veneer drying process, wood defects in hydrothermal processes and their inhibition.

Type of course:
Hydrothermal processing of wood and wood materials (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Maintain optimal drying procedures of all types of wood.	exercises, lectures, exam	C2
Estimate the allowable value reduction level based on standard drying.	exercises, lectures, exam	C2
Calculate the required drying time for commercial wood species.	exercises, lectures, exam	C2
Calculate the energy needs of the process according to the specifications of the technology.	exercises, lectures, exam	C2
Evaluate and select the appropriate level of drying technology according to production requirements.	exercises, lectures, exam	C2
Distinguish process defects on the material.	exercises, lectures, exam	C2
Distinguish process parameter errors.	exercises, lectures, exam	C2
Maintain and assemble the optimum procedures for steaming and bending of all types of wood.	exercises, lectures, exam	C2
Calculate the required steaming time and measure and analyse obtained color.	exercises, lectures, exam	C2
Calculate the parameters with respect to the required radius of sample bending.	exercises, lectures, exam	C2
Distinguish the steaming and bending process errors on the material.	exercises, lectures, exam	C2
Distinguish the steaming and bending process errors.	exercises, lectures, exam	C2
Calculating the drying kiln filling coefficient.	field work	C2
Calculate the energy consumption in the drying process.	field work	C2
Calculate the costs of drying the wood.	field work	C2

General competences
The aim of the course is to qualify the expert for self-governing monitoring, control, analysis and modification of all hydrothermal processes of logs, sawn wood, veneer and choped wood.

Type of instruction
Lectures
In the course of lectures, students gain knowledge about wood drying, steaming, and bending of wood.
Exercises
As part of auditory exercises, laboratory exercises and practical exercises, students receive an upgrade to the knowledge gained during the lectures.

Working methods:
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the colloquia and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	30	2
Exercises (E)	20 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	30	2
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE)	80 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(Ex20 + PEx80)/100**		60	90	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100 %**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 10 % of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. At the beginning of the first exercise, students will receive templates. Exercises are written by hand. For each exercise, the term in which the exercise is handed and evaluated positively, is defined. If the exercise is not handed within the defined time frame or if the exercise is not evaluated positively, then that exercise will be reviewed later after semester ends and the student will receive the seminar assignment and additional computational tasks for each exercise. The accuracy, tidiness and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Written exam	Exam can be attended by students who have completed the exercises. The exam consists of theoretical questions, computational tasks and of the sample that students must describe. For passage students must collect at least 60 % of points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **(FEx80+Ex20)/100**		-

Obligatory literature

1. Pervan, S. (2000): Priručnik za tehničko sušenje drva. 272 p. SAND 2000.
2. Pervan, S. (2009): Tehnologija obrade drva vodenom parom. 166 p. SAND 2009.
3. Krpan, J. (1965): Sušenje i parenje drva. Šumarski fakultet Zagreb, 363 p.

Recommended literature

1. Gorišek, Ž., Geršak, M., Velušček, V., Čop, T., Mrak, C. (1994): Sušenje lesa. Lesarska založba, Ljubljana. 235 p.
2. Niemz, P. (1993): Physil des Holzes und der Holzwerkstoffe. DRW – Verlag, Leinfelden. 243 p.
3. Trebula, P., Klement, I. (2002): Sušenie a hydrotermicka uprava dreva. Tehnicka univerziteta vo Zvolene. 449 p.
4. ***: Die Schnittholztrocknung. Dipl.ing. R. Brunner. Hannover. 322 p.

Sawmilling technology II

WP-1135

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Assistant professor Josip Ištvanić, Pd.D.

Associate teacher for exercises
Assistant professor Josip Ištvanić, Pd.D.

Grading
Sufficient (2) 70-79%
Good (3) 80-89%
Very good (4) 90-95%
Excellent (5) 96-100%

Course content:
Saw blade arrangement. Methods of creating the saw blade arrangement. Conversion of fir and spruce logs. Conversion of beech logs. Conversion of oak logs. Conversion of the other wood species. Types of sawmills, Log yard, Transportation means and other facilities in the log yard, Sawmill building, Sorting of sawn wood, Timber yard, Storage and delivery of sawn wood, Designing a sawmilling plant.

Type of course:
Sawmilling technology II (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Suggest optimum saw blades arrangement for round wood sawing of our most important wood species.	Exercises, exam	C2
Suggest optimum saw blades arrangement for possible further sawn wood processing.	Exercises, exam	C2
Suggest a plan for sawing for individual wood species.	Exercises, exam	C2
Evaluate and compare the success of sawing of our most important wood species according to the criteria of round and sawn wood quantitative yield	Exercises, exam	C4
Evaluate and compare the success of sawing of our most important wood species according to the criteria of round and sawn wood value yield	Exercises, exam	C4
Design and suggest possible technological improvements in some obscure sawmill production.	Exercises, exam	C6

Active participation in designing new sawmill plants.	Exercises, exam	C3
Plan and organize production in sawmills on a monthly and annual basis	Exercises, exam	C2
Adjust the capacities of machines in sawmill	Exercises, exam	C2
Review and evaluate the current technological state of production in sawmill.	Exercises, exam	C6

General competences
Knowing of saw blade arrangement and practical abilities for their applications. Theoretical and practical knowledge conversion of our most important wood species. Approach to designing a sawmill plant.

Type of instruction
Lectures
Auditory lectures are carried out according to weekly curriculum.
Exercises
As part of the exercise, there are six computing and drawing exercises related to the content of the lectures. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:
Maintaining original teaching - lectures and exercises. Designing and reviewing exercises and topics for final papers. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises, making exercises, conducting exams and preparing and presenting final work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30		1
Exercises (E)				30	45	2,5
Written exam (WE)	100%	Percentage of exam resolution 70-79%	Sufficient (2)		45	1,5
		Percentage of exam resolution 80-89%	Good (3)			
		Percentage of exam resolution 90-95%	Very good (4)			
		Percentage of exam resolution 95-100%	Excellent (5)			
*Oral exam (OE)		Percentage of response accuracy ≥70%	Positively			
		Percentage of response accuracy <70%	Negative			
Final exam (FE)				60	90	5

* Only those students who want a higher final grade than those obtained on a written exam are issued to the oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, close to the score of the achieved score. In the case of 70% and more positive answers, the final grade can only be achieved by one step higher than the previously achieved on the written exam.

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from the direct teaching as much as stipulated in the Rulebook on Studying.	Semester (60 hours of direct lecturer and exercises)	-
Exercises (E)	As part of the exercise, 7 computer exercises from the teaching subjects are performed. Students with task assignments and instructions for making all 7 exercises, as well as the appearance of the fascicles, liners and inserts, are downloaded from the subject's web site. When submitting the exercises, the student should explain how to solve the exercises.	Continuously during the term of the semester according to the agreed term. Students who have created and explained all the exercises and those accepted by the teachers can access the exam.	
Written exam	Examinations can be attended by students who have completed, reviewed and explained all exercises. Students on a pre-printed print exam solve a complex computational task based on the simulation of one of the abridged blotting methods. The written exam is evaluated according to the scale given in the evaluation method = exam.	Exam terms	-
*Oral exam	Only those students who want a higher grade than those obtained on a written exam are issued an oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, close to the score of the achieved score. They ask questions from different parts of the program content. In the case of 70% and more positive answers, only one step higher final grade than the previously achieved on a written exam can be achieved.	Exam terms	-

Obligatory literature

1. On the website http://www.pilanarstvo.com there are links to the templates and exercise tips and a wide range of useful information regarding sawmilling technology, created by: Josip Ištvanić
2. Brežnjak, M. 1997: Pilanska tehnologija drva, I dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
3. Brežnjak, M. 2000: Pilanska tehnologija drva, II dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
4. Dević, I.; Ištvanić, J., 2003: Alati i strojevi u obradbi drva 1, Element, Zagreb, 2003.
5. Goglia, V. 1994: Strojevi i alati za obradu drva I dio, Sveučilište u Zagrebu, Šumarski fakultet

Recommended literature

1. Merzelj, F. 1996: Žagarstvo: Udžbenik, Kmečki glas, Ljubljana.
2. Gornik Bučar, D.; Merzelj, F. 1998: Žagarski praktikum, Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za lesarstvo.
3. Nikolić, M. 2004: Prerada drveta na pilanama, udžbenik, Univerzitet u Beogradu, Šumarski fakultet, Beograd

Quantitative methods for operations research

WP -1136

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. Ksenija Šegotić, PhD

Associate teacher for exercises
Prof. Ksenija Šegotić, PhD

Grading
Sufficient (2) 50%
Good (3) 60%
Very good (4) 75%
Excellent (5) 90%

Course content:
Development of operations research. Mathematical models. Examples from the wood industry. Basic linear algebra. Systems of linear equations. Matrix inverse. Linear programming. LP model. Graphical method. Simplex method. Sensitivity analysis. Transportation problems: stepping-stone method, MODI, distribution method. Integer programming. Graph theory. Shortest path problem. Decision tree. Decision theory. Game theory. Multiple-criteria decision-making. Goal programming. Queuing theory. Elements of mathematical economics.

Type of course:
Quantitative methods for operations research (compulsory, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyzing and solving mathematical problems based on learned mathematical concepts and modeling situations outside a mathematical context.	participating in class problems, solving problems, partial exams, seminar, exam	A3
Connecting quantitative methods with engineering practice.	participating in class problems, solving problems, partial exams, seminar, exam	A3
Using linear algebra to calculate the matrix inverse.	participating in class problems, solving problems, partial exams, seminar, exam	A3
Solving a system of m linear equations with n unknowns.	participating in class problems, solving problems, partial exams, seminar, exam	A3

Solving a constrained maximization or minimization problem.	participating in class problems, solving problems, partial exams, seminar, exam	C3, D2
Using the graphical method to solve a standard minimization problem.	participating in class problems, solving problems, partial exams, seminar, exam	C3, D2
Organizing optimal production using linear programming.	participating in class problems, solving problems, partial exams, seminar, exam	C3
Solving the transport problem.	participating in class problems, solving problems, partial exams, seminar, exam	B4
Distinguishing multiple-criteria methods: multiple goal methods and optimal choice methods.	participating in class problems, solving problems, partial exams, seminar, exam	C3, D2
Recommending a multiple-criteria method when making decisions in the wood industry.	participating in class problems, solving problems, partial exams, seminar, exam	D1
Constructing a decision tree for a given problem.	participating in class problems, solving problems, partial exams, seminar, exam	D2
Recognizing situation types when making decisions.	participating in class problems, solving problems, partial exams, seminar, exam	D2
Comparing criteria importance in multiple-criteria decision-making.	participating in class problems, solving problems, partial exams, seminar, exam	D2

General competences
Assigning mathematical objects to real world objects through examples from the wood industry. Formulating and solving mathematical models of practical problems. Mastering and applying some methods of operations research.

Type of instruction
Lectures
Exercises
Exercises serve as an upgrade and addition to knowledge obtained in the lectures. Exercises are auditory and practical, computer-based.

Working methods:
Teachers' obligations:
Teaching in class – lectures and exercises. Formulating the exercises and tests, as well as grading them. Creating and guiding practical seminar work. Organizing partial exams, exams, oral exams and office hours. Producing teaching materials.
Students' obligations:
Regular attendance and active participation in class, both in lectures and exercises. Practical seminar work. Taking partial exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	15	1.5
Exercises (E)	-	-	-	13	17	1
Partial exam 1 (PE1)	50%	50-59%	Sufficient (2)	1	21	0.75
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-59%	Sufficient (2)	1	22	0.75
		60-74%	Good (3)			
		75-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**PE1+PE2**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100%	50-59% 60-74% 75-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			2
TOTAL	**100%**	**FE**				

*students who do not pass the course through partial exams can take the exam during exam terms. The exam consists of a written and oral part. Students need to achieve at least 50% on the written part in order to take the oral part of the exam. The oral part of the exam can be replaced with a seminar paper.

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance is checked during class. Attendance and participation are necessary for obtaining the lecturer's signature and attending partial exams and exams.	semester (45 hours of direct lectures)	-
Partial exam 1	Students solve problems from the coursework of the first part of the semester. The exam is in written form.	8th week	Under extraordinary circumstances and with a valid excuse, the student can take the exam at a later date.
Partial exam 2	Students solve problems from the coursework of the second part of the semester. The exam is in written form.	15th week	Under extraordinary circumstances and with a valid excuse, the student can take the exam at a later date.
Written exam	The exam includes coursework from the entire semester. Students who obtained the lecturer's signature can take the exam.	Exam terms	
Oral exam	The exam includes coursework from the entire semester. Students who passed the written exam can take the oral exam. The final grade is obtained by combining the results of the written and oral exams.	Exam terms	

Obligatory literature

1. Kalpić, D., Mornar, V.: Operacijska istraživanja, DRIP, Zagreb, 1996.
2. Neralić, L..: Uvod u matematičko programiranje 1, Element, Zagreb, 2003.
3. Zadnik,L.: Operacijska raziskovanja, Biotehnološka fakulteta, Ljubljana, 1992.

Recommended literature

1. Elezović, N.: Linearna algebra, Element, Zagreb, 2003.
2. Vadnal, A.: Primjena matematičkih metoda u ekonomiji, Informator, Zagreb, 1980.
3. Winston Wayne, L.: Operatins Research, Duxbury Press, Belmont, California, 1994.

Production management

WP-1137

ECTS 4

English language R1

E-learning R2

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
prof. Tomislav Grladinović, PhD

Associate teacher for exercises
Ivana Perić, PhD
Assist. prof. Kristina Klarić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Basics of the theory and practice of production management; Production management as science, theory and practice. Industrial management; Functions of industrial engineering; Planning of processes and operations; Value analysis engineering; Organisation of industrial engineering; Planning methods; Tools and methods of industrial engineering. Strategy planning: nature and purpose of planning; vision, mission and targets; strategies, policies, and planning estimates in wood-technological processes. Organisation: nature of organisation and enterprise; organisation structure; organisation system projects; organisation functioning; efficient organisation and organisation culture. Staff management: human resource management; evaluation of results and strategies in a career; staff supplementing in the world; salaries and manner of salary calculation. Leadership: human factors and motivation; leadership; boards and group decision, communication. Controlling: system and procedure; techniques of control and information technology; controlling of production functions; total control.

Type of course:
Production management (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the underlying economic concepts, and the concepts and functions of management.	Project assignment, oral exam	D2
Explain the underlying economic concepts, and the concepts and functions of management.	Project assignment, seminar work, oral exam	D2
Know production systems and parts of production systems	Project assignment, written and oral exam	D2

Apply appropriate analytical methods, modeling procedures, system parts, or processes	Project assignment, exercises in computer practicum, written and oral exam	D4
Identify and apply microeconomic and macroeconomic models	Project assignment, written and oral exam	D2
Prepare project documentation and technical reports using modern technology	Seminar work, Computer Practice Oral Exam	D5
Know to use literature, databases and other sources of information	Project assignment, computer practicum, oral exam	D2
Take a public oral presentation, prepare a written report, and present the project results	Seminar, oral exam	D1
Identify, formulate and solve engineering problems by using familiar methods and procedures	Project assignment, computer practicum, oral exam	D5

General competences

Students gain general and specific knowledge from the field of industrial management, adjusted to specific issues of the production in wood processing and furniture manufacture. Particular attention is given to the knowledge in the field of micro planning, job distribution, optimisation of production decisions, production management and work control.

Working methods

Teaching - lectures and individual project tasks. Designing seminar papers and compiling knowledge tests and evaluating them. Providing written and oral exams and consultations. Creating teaching materials.

Lectures

Through theoretical lectures students will acquire knowledge and skills in the field of industrial management.

Exercises

Creating micro-project tasks and macro-organizational structure of enterprises (designing the manufacturing process through phases: process selection, technology selection, process flow analysis, and spatial distribution of production resources). Strategic Business Positioning - SWOT and PESTEL analysis. Creating questionnaires. Plan capacities using forecasting methods, aggregate planning and termination of production, and project planning.

Working methods

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials. Mentoring in final work.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0	-	-	30	6	1,2
Exercises (E)	25%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	21	1,2
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			
Seminar paper	5%	The student is exhibiting with the help of the examiner	Sufficient (2)	3	21	0,8
		Student Exposes Using Examiner	Good (3)			
		It is self-explanatory and logical with little help from the examiner	Very good (4)			
		Self-explanatory and logical, without any help	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	3	21	0,8
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex25 + Sx5 + Ex70) / 100**		51	69	4

Detailed description of evaluation elements for lecturer, exercises and final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + Exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	Semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended by groups. 5 project individual tasks are performed within the exercise. In the introductory lecture, students will receive instructions on the layout of the exercises - the folder, the jumper and the proposal sheet, in which they will correspond to the set tasks in printed form. At the beginning of the exercise, students will receive templates for project assignments. Exercises are surrendered gradually after each course. The accuracy, regularity and regularity are evaluated (time-honored exercises) Exercises carry 25 points and together with exam scores make up 100 points	According to the agreed terms	Exceptionally, in the case of a justified reason, student does the absence of a single exercise
Seminar	Seminar work is done independently At the beginning of the third lecture, students receive topics that are electronically chosen and instructions and literature related to the work In the last lecture, each student presents an independent seminar work Questions are raised from the parts of the seminar work The seminar paper carries 5 points and together with the marks of the exam make a total of 100 points	in the 15th week	
Partial exam	Exam can be attended by students who have completed, submitted and corrected exercises. Students on pre-made exams to solve the task. Written Exam (We) is evaluated and participates 20% in the final grade of the subject	Exam terms	-
Written exam	Students who pass a written exam are asked for oral questions from different parts of the subject's program content. The oral exam (Uispt) participates 50% in the final grade of the subject. The total rating is calculated according to the formula: (E x 25+ S x 5+ We x 20 + Oe x 50) / 100	Exam terms	-

Obligatory literature

1. Sikavica, P., Bahtijarević-Šiver, F., Pološki Vokić, N.: Temelji menadžmenta, Školska knjiga, Zagreb, 2008.
2. Jacobs, R. F., Chase, R. B.: Upravljanje operacijama i lancem opskrbe, XIII izdanje, MATE, Zagreb, 2017.

Recommended literature

1. Schroeder, R.G.: Upravljanje proizvodnjom, IV izdanje, MATE, Zagreb, 1999

Wood modifications

WP-1138

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Prof. Hrvoje Turkulin, PhD
Prof. Vlatka Jirouš-Rajković, PhD
Assoc. prof. Goran Mihulja, PhD

Associate teacher for exercises
Assist. prof. Vjekoslav Živković, PhD
Assoc. prof. Marin Hasan, PhD
Assoc. prof. dr. sc. Bogoslav Šefc, PhD

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:
Analysis of reasons for modification of wood properties (natural disadvantages - hygroscopicity, climatic and biological degradation), and improvement of properties - mechanical, thermal, acoustic, adhesion and permeability. Overview of modification technologies: surface modification (physical - roughness and plasma, application of chemicals, radiation, coatings), volume modification (heat treatment, acetylation, densification, filling structure, cell wall saturation, encymmetric modification). Theoretical and practical implementation of wood modification by heat treatment, acetylation, surface treatment (NaOH, citric acid, DMDHEU, HALS and UV component), impregnation (PEG, oil): measurements of dimensional stability, hygrophobicity, color stability, surface integrity, biological resistance. Overview of commercial options for application of modified wood.

Type of course:
Wood modifications (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate unmodified wood from modified as well as modified from chemically protected and explain their advantages and disadvantages.	practice exercises, exam	B3
Differentiate the different types of wood modification (thermal, chemical, ...) and the essential parameters of the modification regime.	exam	B3

Select those properties of modified wood that are important for a particular product (eg, durability in external floors, dimensional stability in flooring in the interior).	exam	B3
Recommend the type of wood and type of modification for a given product according to the hazard classes (HRN EN).	practice exercises, exam	B3
Recommend the tests and independently test the selected properties of modified wood (test for loss of mass modification, examine biological resistance, hygroscopic properties, ...), interpret the obtained results and determine the durability class according to HRN EN norms.	practice exercises, exam	B3
Compare the examined properties of modified wood and select the optimum for the desired product (eg loss of mass, dimensional stability, hardness, bending strength or tension, modulus of elasticity, loss of mass due to the action of fungi).	practice exercises, exam	B3
Review the most important parameters and compare the effect of some modification parameters to suggest correction of modification regime to achieve the required properties (eg, correction of the temperature or treatment time required to achieve a certain degree of durability or color change level in thermal modification in the water vapor).	exam	C6
Individually or in a team, make a durability insurance project for a new product from modified wood in terms of its use, to recommend the optimum modification procedure while respecting the ecological principles (eg, application of additional chemicals) and economic requirements (eg energy needs) and present it to a group of people.	practice exercises, exam	B3

General competences
Information about the potential for hindering of natural shortcomings or for improvement of wood technical properties by chemical, physical and enzymatic modifications. Learning about the basic principles of wood modifications and the processes. Practical performance of laboratory methods of physical and chemical modifications, measurement of improvement in relevant wood properties.

Type of instruction
Lectures
Exercises
Six practical exercises are performed within laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:
Original teaching - lectures, exercises, field work. Preparing the exercises and preparing the exams and evaluating them. Written and oral exams and consultations. Preparation and development of teaching materials.
Students obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	25%	Mostly inaccurate, with major corrections	Sufficient (2)	15	30	1,5
		Mostly accurate, with corrections	Good (3)			
		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Exam (PE)	75%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex25+ PEx75)/100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and recorded. Exercises are attended by groups. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are organised in groups. As part of the exercise, 6 practical exercises from the topic subject of technological and structural development of construction products made of wood. At the beginning of the first exercise, students are introduced to the rules of preparation, teaching and assessment of exercises. The accuracy, regularity and regularity (time-honored exercises)	15. week	
Written exam	The exam can be attended by students whose exercises were evaluated positively. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students get questions from different part of the subject program. Final mark of subject is achieved from the formula: **(Ex25+ PEx75)/100**		

Obligatory literature

1. Turkulin, H. (2002): Drvo – suvremen tehnički materijal. Zbornik savjetovanja «Materijali i tehnologijski razvoj» Zagreb: Akademija tehničkih znanosti.
2. Zbirka članaka o modifikacijama drva iz časopisa Drvna industrija: Rep, G.; Pohleven, F. 2001: 52 (2) 71-76, Rapp, A., Sailer, M. 2001: 52 (2) 63-70
3. Modifiziertes Holz: Eigenschaften und Märkte. Beč: Institut fuer Holzforschung der Universitaet fuer Bodenkultur. (prijevod odabranih poglavlja).
4. Zbirka naputaka za provođenje vježbi Modifikacije drva: Šumarski fakultet Zagreb

Recommended literature

1. ***: Zbirka članaka i izvoda iz znanstvenih knjiga iz područja modifikacija drva. Šumarski fakultet Zagreb
2. Hill, C. (2006) Wood Modification – Chemical, Thermal and Other Processes. John Wiley & Sons, Ltd.

Forest utilisation

WP-1139

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Professor Tomislav Poršinsky, PhD

Associate teacher for exercises
Assistant professor Andreja Đuka, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
The subject is structurally divided into several rounded off subunits, so in this way the problem of tree felling and processing works is separately analysed, as well as wood skidding and long-range transport, but also their interdependence and interaction in contemporary technologies of logging. The study of work and time in forest utilisation is the basis of planning and work preparation and payment of completed works. Costs in forest utilisation are considered, as well as adequate laws, regulations and instructions. The exercises consider standards and models of manufacturing, models of effects and cost analyses and a breakeven point of the use of technical means and technologies of tree felling, processing and transport as well as models of optimum traffic net density in opening of forest stands.
Exercises refer to the standing tree evaluation, tree felling and processing of forest products, standardisation of forest products, trunk utilisation in felling and sorting, waste and waste structure, bark, the effect of cross-cutting by a motor chain saw, planning of tree felling, sorting and transport works, calculation of costs of machines used in forest utilisation.

Type of course:
Forest utilisation (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To differentiate and correlate the limiting and influential factors of the forest utilisation in the environment (legal restrictions, proprietary relationships, terrain and stand characteristics).	Exercises, Final exam	B4, D2
Link the theory and procedures in tree felling: finding the tree marked for felling, determine the felling direction, prepare the surrounding environment, shape the butt swelling, create and	Exercises, Final exam	D1

control the cuts, place cutting wedges and guide the tree to the fall, release blocked trees. Explain the concept of tree cutting, the mechanisation level in tree cutting, working with the motor chainsaw in different conditions.		
Differentiate between methods of timber processing and connecting them with terrain characteristics and vehicle types, cutting branches, measuring assortments and bucking, scaling and pilling forest residue.	Exercises, Final exam	D1
Analyse and compare old HRN-JUS and new HRN-EN standards for round wood of broadleaved species and conifers.	Exercises, Final exam	B2, C4
Compare mechanised tree felling and processing with motor-manual felling (pros and cons of harvesters, limitations, productivity, factors of efficiency and environmental benefits, mechanised felling in Croatia).	Exercises, Final exam	C6
Compare and link the theoretical approach and division of timber transport: collecting, extracting and long distance transport, timber transport cycles, the basic parameters of forest accessibility through: road density, the distance between forest roads and the average extraction distance.	Exercises, Final exam	B4
Calculate the optimal distance between forest roads and the dependence of the distance between forest roads on costs based on the theoretical model for determining optimal forest accessibility, the calculation of the costs of forest road construction and the costs of timber extraction.	Exercises, Final exam	B4
Evaluate ground-based timber extraction systems with regard to mechanisation level (manual, animal or mechanised system) and evaluate the features, limitations and benefits of individual vehicles (adopted agricultural tractor, tractor with trailer, cable skidder, grapple skidder, clam-bunk skidder, forwarder, rigid and flexible tracks skidder). Calculate the cost of machine work and productivity of the system.	Exercises, Final exam	B4
Evaluate the aerial timber extraction systems – forest skyline and helicopter. Assess the suitability of both systems with respect to stand conditions and environmental acceptability. Distinguish the features of the highlead and forest skyline, analyse the characteristics of forest skylines considering the direction of timber extraction, the number of lines, mobility of the skyline, length of yarding corridor, payload and mobility of the system. Re-examine the application of helicopters, efficiency factors, requirements for landing sites and helipads, noise pollution.	Exercises, Final exam	B4
Explain the division and features of the long distance timber transport, the types of landing sites, the characteristics of the timber transport by waterways, railway and by trucks.	Exercises, Final exam	B4
Calculate costs of long distance truck transport, analyse the factors affecting the transport in the form of legal restrictions in public transport, features and characteristics of trucks and load.	Exercises, Final exam	B4
Re-examine the utilisation of forest biomass through the analysis of fuel wood as a traditional energy supplier compared to other energy sources. Valorise the features of forest biomass for energy, influential factors of the utilisation technologies for forest biomass.	Exercises, Final exam	B2
Compare the systems and benefits of forest biomass utilisation: chipping, chipping on landing sites – open and closed production chain, bundling, biomass from short-rotation cultures, chipping in the plant.	Exercises, Final exam	B2, D1
Comparison of forest utilisation systems in Croatian forestry and worldwide (system definitions and models – mathematical model Löffler (1989), theory of production systems simulation (Heiniman (2003)).	Exercises, Final exam	B4, D1

Examine the environmental suitability of timber harvesting systems regarding stand damage and pollution (soil, water, standing trees, young growth). Identify the causes of damage and pollution and select the measures for their avoidance or reduction.	Exercises, Final exam	D1
Differentiate the level of planning operation in forest utilisation (from strategic to operational level – harvesting plan and working-site study).	Exercises, Final exam	D1

General competences
The topic of the subject is oriented to the ideas necessary for the educational profile, and they primarily refer to the knowledge of forest products of round wood, which are a raw material base for the wood processing and methods and characteristics of techniques and technologies of their obtaining and transport to the wood processing plants.

Type of instruction
Lectures
Lectures cover 12 units according to the teaching plan.
Exercises
11 exercises are performed in the form of practicum and field practice. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers obligations:
Maintaining original teaching: lectures, exercises and field teaching. Consultation, written exams and oral exams. Creating teaching materials.
Students obligations:
Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	60-70%	Sufficient (2)	15	15	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam (FE)	80%	60-70%	Sufficient (2)	0	60	2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + FEx80)/100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who have completed exercises and field teaching. The students in the printed exam answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content.	Exam terms	-

Obligatory literature

1. Predavanja (CD) i najnovije objave u domaćim i stranim stručnim i znanstvenim časopisima (Mehanizacija šumarstva, Šumarski list, Drvna industrija, Glasnik za šumske pokuse, FTI, Holzzentralbllat, FERIC i drugi).
2. Krpan, A.P.B., Zećić, Ž., Poršinsky, T., Šušnjar, M., 1998: Osnove sječe i izradbe s normama za oblo drvo (skripta). Šumarski fakultet Sveučilišta u Zagrebu, 1-98.
3. Winkler, I., Košir, B., Krč, J., Medved, M., 1994: Kalkulacije stroškov gozdarskih del. Strokovna in znanstvena dela 113, Biotehnička fakulteta v Ljubljani – Oddelek za gozdarstvo, Inštitut za gozdno in lesno gospodarstvo, 1 – 69.
4. Krpan, A.P.B, 1992: Iskorišćivanje šuma (Forest exploitation). Monografija "Šume u Hrvatskoj", Šumarski fakultet Sveučilišta u Zagrebu i „Hrvatske šume" p.o. Zagreb, 153 – 170.

Recommended literature

1. FBVA, 2003: CDR "500 Forstmaschinen – Maschinenbeschreibung und Seibstkostenrechnung". Bundesampt und Forschungszentrum für Wald - Abteilung für Forsttechnik.
2. Dykstra, D.P., Heinrich, R., 1996: FAO model code of harvesting practice. FAO, Rome, 1 – 85.
3. Anon., 1993: Manuel d'exploatation forestière, Tome I. ARMEF & CTBA, Paris, 1-442.
4. Berg, S., 1992: Terrain Classification System for Forestry Work. Forest Operations Institute "Skogsarbeten", 1 – 28.
5. Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.
6. Grammel, R., 1988: Holzernte und Holztransport. Verlag Paul Parey, Hamburg - Berlin, 1 – 242.
7. Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219.

Operations Management II

WP-1140

ECTS 4

English language R1

E-learning R2

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
prof. Tomislav Grladinović, PhD

Associate teacher for exercises
Ivana Perić, PhD
assist. prof. Kristina Klarić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Information technological environment. Virtual system (virtualization) concept. Computer-aided business in wood processing and furniture manufacture. Computer-aided information engineering (CASE). Designing of information management system in wood processing and furniture manufacture. CASE information engineering. A CASE approach in designing of information wood processing and furniture manufacture. Application of CASE in projecting information systems. Computerization of the production management jobs in wood processing and furniture manufacture. A development concept for computrizaton of the production preparation jobs in wood processing and furniture manufacture. A computer-added system of plan and development of the product (3D). Product database. Program equipment for engineering jobs. Computer-aided phases of the planning process. Computer-aided system of planning and technology making. Technological database. Computer-added planning of technological procedures. Technology for numerically controlled machines. Technological processes of the production with computerized numerical control. Basic of operation processes programming. Manage a manipulator. Flexible manufacturing system management. Expert technological systems. Computer-aided planning system, product and resource preparation in wood processing and furniture manufacture. Production resource database build-up.

Type of course:
Operations Management II (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Suggest a production management system.	Project assignment, oral exam	D1
Design an information system for production management.	Project assignment, exercises in computer practicum, oral exam	D2
Suggest the application of Computer Aided System Engineering (CASE) in designing information systems.	Project assignment, exercises in computer practicum, oral exam	D2
Build CASE Information Engineering.	Project assignment, oral exam	D5
Plan business and manufacturing database models (warehouse base, raw materials, basic assets, merchandise, etc.).	Exercises in Computer Practice, Project Task, Written and Oral Exam	D2
Prepare a computer supported machine and production management system.	Exercises in Computer Practice, Project Task, Written and Oral Exam	D5
Develop an expert technological system (team work with project developer).	Exercises in Computer Practice, Project Task, Written and Oral Exam	D5
Maintain a computer supported machine and production management system.	Exercises in Computer Practice, Project Task, Written and Oral Exam	D2
Manage a computer supported machine and production management system.	Exercises in Computer Practice, Project Task, Written and Oral Exam	D2

General competences
Apply the knowledge and skills of resource coordination that includes planning, management, routing, and control.

Working methods
Teaching - lectures and individual project tasks. Designing and compiling tests and evaluating them. Providing written and oral exams and consultations. Creating teaching materials.

Lectures
Through theoretical lectures, students will acquire knowledge and skills on computer use in designing the process of preparing and managing production in wood processing and furniture manufacturing.
Exercises
Within the exercise, individual project tasks are performed with work on computers, through which they will apply methods and techniques of reengineering business processes. Design and build information (document). Exercises are an upgrade to knowledge adopted in lectures.

Working methods
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials. Mentoring in final work.
Students' obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0	-	-	30	15	1,5
Exercises (E)	30%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	30	1,5
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	5	25	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(L x 30 + E x 70) / 100**		50	70	4

Detailed description of evaluation elements for lecturer, exercises and final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + Exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	Semester (65 direct teaching hours)	-
Exercises (E)	Exercises are attended by groups. 4 project individual tasks are performed within the exercise. In the introductory lecture, students will receive instructions on the layout of the exercises - the folder, the jumper and the proposal sheet, in which they will correspond to the set tasks in printed form. At the beginning of the exercise, students will receive templates for project assignments. Exercises are surrendered gradually after each course. The accuracy, regularity and regularity are evaluated (time-honored exercises). Exercises carry 30 points and together with exam scores make up 100 points.	According to the agreed terms	Exceptionally, in the case of a justified reason, student does the absence of a single exercise
Partial exam	Exam can be attended by students who have completed, submitted and corrected exercises. Students on pre-made exams to solve the task. Written Exam (We) is evaluated and participates 20% in the final grade of the subject	Exam terms	-
Written exam	Students who pass a written exam are asked for oral questions from different parts of the subject's program content. The oral exam (Uispt) participates 50% in the final grade of the subject. The total rating is calculated according to the formula: $(V \times 30 + I_{pis} \times 20 + U_{ispt} \times 50) / 100$	Exam terms	-

Obligatory literature

1. Grladinović T.: Upravljanje proizvodnim sustavima u preradi drva i proizvodnji namještaja, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1999., str. 1-298.
2. Burmec, j., Burmec, S.: Modeliranje poslovnih procesa, Školska knjiga, Zagreb, 2017.
3. Jelačić, D.: Upravljanje proizvodnim sustavima u drvnoj industriji (zbirka zadataka), Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1995., str. 1-128.

Recommended literature

1. Majdandžić, N.: Izgradanja informacijskih sustava proizvodnih poduzeća, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2004.
2. Majdandžić, N., Čuljak, S.: Priprema proizvodnje 1-3, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 1991.
3. Schroeder, R.G.: Upravljanje proizvodnjom, M.E.P., Zagreb, 1996. str. 1- 672.

Industrial sociology

WP-1141

ECTS 4

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Assist. Prof. Anđelina Sviličić Gotovac, PhD

Associate teacher for exercises
Assist. Prof. Anđelina Sviličić Gotovac, PhD

Grading

Course content:
Students will get to know the history of work, from the first tools to the machines, from the antique, feudalism, mercantilism, up to the industrial revolution. Then, they will learn about the distribution of work in the industrial society, development of professions as acts, work distribution, development phases of the industrial technologies, industrial and postindustrial society (ford ism and post-ford ism), changes in the structure of work as a result of craft, manufactural, mechanic, automatic, microelectronic, electronic and biotechnological revolution. Afterwards, they will get acquainted with the liberalization of neo-liberalism and globalization processes followed by the functioning of an individual in an organization through organizational behavior in the global context through the theories of motivation, familiarization with formal and informal organizations, and the development of modern organization (mcdonaldisation or post-ford ism). Then, they will learn about groups and group management, communication and decision making. Finally, they will get to know leadership styles and theories, power and politics, confrontations and organizational culture and the organizational changes and development.

Type of course:
Industrial sociology (elective course, 1st semester, 1st year)

General competences
The goal is to familiarize students with the beginnings of the industrial society and technologies, with the economy starting from the mercantilism, liberalism to neo-liberalism and globalization processes and also with the organizational behaviorism of human needs, aspirations, motivations, theories of leadership and organizational culture.

Obligatory literature

1. A.Eggebrecht,J.Fleming, i dr. ur.H.Sschneider(1987):POVIJEST RADA,GZH, Zagreb
2. Bhtijarević-Šiber, F. (1999): Management ljudskih potencijala, Golden marketing, Zagreb
3. Stephen.P.Robbins (1995): Bitni elementi organizacijskog ponašanja, MATE, Zagreb
4. D.C.Miller-V.H.Form(1966):Industrijska sociologija,Panorama, Zagreb

Recommended literature

1. C.Walker (1968): Moderna tehnologija i civilizacija, Naprijed, Zagreb
2. Ritzer,G. (1999): Mcdonaldizacija društva, Zagreb, Naklada Jasenski i Turk
3. 3.N.C. Siropolis (1995): Menedžment malog poduzeća, MATE, Zagreb
4. 4.Lester, C.Thurov (1997): Budućnost Kapitalizam, MATE, Zagreb
5. 5.Srića, V. (1994): Inventivni menedžer, Zagreb, Croman:MEP Consult

Field work I – Wood technology processes

WP-1142

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 1st semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:
Field work I – Wood technology processes (compulsory course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Standardize capacity (effects) machines in the sawmill. Connect different kind of sawmill machines in sawmill technology.	Field work report evaluation	C2
Evaluate and compare the success of cutting of our most common types of wood species according to the criteria of quantitative utilization of round wood and sawn wood.	Field work report evaluation	C2, C3, C4, C6, B2
Evaluate and compare the success of cutting of our most common types of wood according to the criteria of qualitative utilization of round wood and sawn wood. Calculate the parameters of sawdust products based on their measurement.	Field work report evaluation	C2, C3, C4, C6
Calculating the drying kiln filling coefficient, the energy consumption in the drying process and the costs of drying the wood.	Field work report evaluation	C2
Collect data for macro and micro designing. Identify the management level process (planning, organization, staffing, management, controlling), organizational structure of the management (centralized, line, functional, matrix, project, hybrid, collegial, amorphous).	Field work report evaluation	D1, D2, D4
Collect information on changes and innovations, create a learning organization, communication, human resource management, problem solving and decision-making, cross-border culture management, global business leadership, work in cultural differences, work beyond rational knowledge, skills and abilities beyond rational knowledge, skills and ability.	Field work report evaluation	A1, D1, D5
Record a computer-supported machine and production management system, notice the benefits and disadvantages, and suggest possible changes.	Field work report evaluation	D2, D5
Carry out the supervision of round wood production during selling/buying timber volume of standing trees.	Field work report evaluation	B4, C3, D3

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of gathering data on the factors of the manufacturing process or business of the company. Based on calculations and analysis, the student suggests improvements for a more rational and optimal process. The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:
Teachers' obligations:
Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.

Students' obligations:
Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student's skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
   Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Veneer and plywood technology

WP- 1242

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Prof. Mladen Brezović, PhD

Associate teacher for exercises
Prof. Mladen Brezović, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Veneers. Technological systems for manufacturing of slicing veneer. Technological systems for manufacturing of peeling veneer. Criteria for selection of mechanical process depending on raw materials. Technological parameters of veneer slicing. Capacity of a veneer slicing machine. Technological parameters for veneer peeling. Capacity of a veneer peeling machine. Planning of a system of veneer manipulation. Veneer drying. Processing of veneer by a clipper. Planning of veneer storage. Planning of technological process for manufacture of slicing and peeling veneers. Continuous production processes for slicing and rotary cut veneer, with a high level of automatisation. Continuous semiautomatic systems for a slicing veneer production. Veneer jointing. Planning of a veneer-jointing line. Veneer plywood. Planning of a technological process for a veneer plywood manufacture. Designing of a veneer plywood property using different construction solutions. Polar diagram. Coefficient of quality. Adhesives for a veneer plywood production. Selection of adhesive and adhesive mixture. Laminated veneer lumber (LVL). Structural LVL. Long grained plywood. Moulded plywood. HF Presses. Composite plywood. Reinforced plywood. Synthetic materials for manufacturing reinforced and, composite plywood. Adhesives for manufacturing reinforced and, composite plywood. Core plywood. Solid wood panels. Analysis of a plywood structural elements interaction. Non-destructive methods for analysing of plywood properties. Numerical methods for analysing of plywood properties. Optimisation

Type of course:
Veneer and plywood technology (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze and organize the technological systems for the production of veneer and plywoods.	Exercise, Seminar, Partial exam, Final Exam	C2
Analyze the selection criteria for technological solutions in veneer and plywood production and propose the most optimal solution.	Exercise, Seminar, Partial exam, Final Exam	C2
Calculate and analyze the existing ones and design optimum technological parameters for veneer and plywood production.	Exercise, Seminar, Partial exam, Final Exam	C2
Calculate the production line capacity for veneer production and suggest improvements.	Exercise, Seminar, Partial exam, Final Exam	C2
Design the technological phases of production and determine the optimum parameters for veneer and plywood production.	Exercise, Seminar, Partial exam, Final Exam	C6
Plan and organize veneer production processes with high degree of automation.	Exercise, Seminar, Partial exam, Final Exam	C2
Analyze the interaction of the constructional elements of the plywood and design the optimum construction of the ply wood according to the requirements.	Exercise, Seminar, Partial exam, Final Exam	C6
Determine and calculate material properties of plywood materials and propose procedures for optimizing these properties.	Exercise, Seminar, Partial exam, Final Exam	C6
Apply numerical methods in the analysis of plywood properties (basics) and propose methods of production and methods of testing properties of optimized plywood.	Exercise, Seminar, Partial exam, Final Exam	C2

General competences
Lead and manage technology of veneer and plywood production. Design of technological processes applying new scientific knowledge with the aim of upgrading existing technologies and introducing new technologies in the veneer and plywood industry.

Type of instruction
Lectures
Exercises
Ten project exercises are carried out from the design of the veneer and veneer plywood technology process. Exercises are an upgrade to knowledge gained in lectures.

Working methods:
Teachers obligations:
Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Holding partial exam, seminar, written exam, oral exams and consultations. Creating teaching materials.
Students obligations:
Regular attendance and active participation in lectures and exercises, write and present seminar, passing on partial exams and final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				30	0	1
Exercises (E)	15%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	21	6	0,9
		Neat, legible, with bigger corrections and on time	Good (3)			
		Neat, readable with minor corrections and on time	Very good (4)			
		Neat, readable, accurate and timely	Excellent (5)			
Seminar (S)	20%	8 ≤ x < 10 points	Sufficient (2)	9	30	1,3
		10 ≤ x <14 points	Good (3)			
		14 ≤ x < 18 points	Very good (4)			
		18 ≤ x < 20 points	Excellent (5)			
Calculation partial exam (PE)	15%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral exam (OE)	50	60-70%	Sufficient (2)	0	39	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex15 + Sx20+PEx15 + OEx50)/100**		60	90	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	65	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,8
TOTAL	**100%**	**(FEx65+Ex15+Sx20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	Attendance of students is recorded in classes. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercise	Exercises are performed by 10 project exercises. Before starting the exercises, students will receive training forms. At the end of each exercise, students receive tasks to control the acquired knowledge. The accuracy, precision and the time when the exercise is delivered is evaluated.	According to the appointed time	-
Seminar	Students write a seminar paper from a selected topic. A written copy, oral and a PowerPoint presentation, and answers to questions are evaluated.	12-14. week	-
Partial exam	Calculation tasks	15. week	-
Written exam	Exam can be accessed by students who have completed exercises and a written and presented seminar. Pre-printed exams round off accurate answers and solve calculation tasks. The written exam is evaluated and participates in the final grade of the course	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the course is obtained according to the formula **Ex15+S20+PEx15+FEx50/100**		

Obligatory literature

1. Baldwin, R.F., 1995.: Plywood and veneer based products. Forest Product Society. Madison, Wisconsin.
2. Mešić, N.,1998.: Furniri, furnirske i stolarske ploče. Grafika Šaran, Sarajevo
3. Veneer and plywood technology. e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=42494

Recommended literature

1. Kljak, J., Grubišić, I., Brezović, M., Trajković, J.: Brodograđevna furnirska ploča. Brodogradnja, 50(2002)2, 213-218.
2. Brezović, M., Jambreković, V., Kljak, J.: Utjecaj karbonskih vlakana na neka relevantna svojstva furnirskih ploča. Drvna industrija, 53(2002)1, 23-31.
3. Brezović, M., Jambreković, V., Pervan, S.: Bending properties of carbon fiber reinforced plywood. Wood research, 48(2003)4, 13-24.
4. Kljak, J., Brezović, M., Jambreković, V.: Plywood stress optimisation using the finite element method. Wood Research, 51(2006.)1, 1-10.
5. Brezović, M.; Kljak, J.; Pervan, S.; Antonović, A. (2010): Utjecaj kuta orijentacije sintetičkih vlakana na savojna svojstva kompozitne furnirske ploče. Drvna industrija, 61 (2010) 4, 239-243.
6. Brezović, M., Pervan, S., Petrak, J., Prekrat, S.: Metoda procjene svojstava uslojenog drva. Drvna industrija, 69 (2018) 1, 49-54.

Technology of Panels from Fragmented Wood

WP-1243

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Prof. Vladimir Jambreković, PhD
Assist. Prof. Nikola Španić, PhD

Associate teacher for exercises
Assist. Prof. Nikola Španić, PhD

Grading
Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:
Technical regulations. Production technologies. Management of technological processes. Definition of properties of panels made from fragmented wood. Panel characteristics planning. Raw material preparation. Particles and fibres characteristics planning. The influential factors of characteristics of bounding materials and chemical additives. Planning of characteristics of chemical components. The raw material characteristics influence on properties of panels. The elaboration of technological parameters in production processes. The significance of fractionating and particles dosage. Specificities of dosage of fibres and chemical components. Structure and quality of „mats“ from disintegrated wood. Technological processes in hot and cold pressing. The influencing factors of pressing on quality of panels. Specificity of continuous pressing processes. Final processing of raw panels. Conditioning and moisture content equalisation. Classification of raw panels. Technological conditions at overlaying of panels with veneers. Stability of panels overlaid with synthetic materials. The influential factors of overlaying quality. The influence of overlaying on properties of panels. Quality assurance. Control and management of technological phases of panel production. The methods of technological parameters monitoring. Analysis and presentation of production process parameters. Optimisation of panel properties with correction of technological parameters. The development of new technologies in production of panels from fragmented wood.

Type of course:
Technology of Panels from Fragmented Wood (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to identify production technologies	laboratory and practical classes, project task, final exam	C2
to list and recognize the properties of fragmented wood panels	laboratory and practical classes, project task, final exam	C2
to design the characteristics of particles and fibres	laboratory and practical classes, project task, final exam	C2
to list the influential factors on the properties of adhesives and chemical additives	laboratory and practical classes, project task, final exam	C2
to design the characteristics of chemical components	laboratory and practical classes, project task, final exam	C2
to design the characteristics of fragmented wood panels	laboratory and practical classes, project task, final exam	C2
to explain the influence of raw material characteristics on panel properties	laboratory and practical classes, project task, final exam	C2
to recommend methods of capturing the technological parameters	laboratory and practical classes, project task, final exam	C2
to determine the technological legitimacy of production processes	laboratory and practical classes, project task, final exam	C2
to manage the technological processes in production of disintegrated wood panels	laboratory and practical classes, project task, final exam	C2
to evaluate the significance of fractionating and particles dosage	laboratory and practical classes, project task, final exam	C2
to explain the specificity of fibres and chemical components dosing	laboratory and practical classes, project task, final exam	C2
to evaluate the structure and quality of so called fragmented wood particles mats	laboratory and practical classes, project task, final exam	C2
to evaluate the influential factors at pressing on panel quality	laboratory and practical classes, project task, final exam	C2
to optimize panel properties by correcting the technological parameters	laboratory and practical classes, project task, final exam	C2
to evaluate the continuous pressing processes	laboratory and practical classes, project task, final exam	C2
to recommend the methods for final processing of raw panels	laboratory and practical classes, project task, final exam	C2
to prepare the conditions for conditioning and moisture content equalisation	laboratory and practical classes, project task, final exam	C2
to classify raw panels	laboratory and practical classes, project task, final exam	C2
to recommend the technical conditions for the panel overlaying	laboratory and practical classes, project task, final exam	C2
to evaluate the influential factors affecting the overlaying quality	laboratory and practical classes, project task, final exam	C2
to determine the panel quality according to technical standards	laboratory and practical classes, project task, final exam	C2
to apply the technical regulations for wooden boards	laboratory and practical classes, project task, final exam	C2
to design new technologies in the production of fragmented wood panels	laboratory and practical classes, project task, final exam	C2

General competences
Acquiring of knowledge on technical regulations, planning and production management and particle and fibreboard quality assurance of boards produced without bonding material, with synthetic or mineral bonding material, in dry and wet processes, by cold or hot pressing or using moulding pressing matrices.

Type of instruction
Lectures
Exercises
As part of the exercises, two theoretical / mathematical exercises related to the calculation of the required amounts of basic (wood) and auxiliary raw materials (adhesives, catalysts, hydrophobic agents) for the production of particleboards alongside the defining the technological parameters of panel pressing (e.g. pressing diagram) are performed. In addition, two practical exercises in the workshop and laboratory are carried out, in which the experimental boards made out of wood and alternative lignocellulosic raw materials are made and their properties determined. The aim of laboratory exercises is to experimentally determine the influence that wood raw material has on panel properties, the influence of chip / fiber characteristics on panel properties, the impact of adhesive type on panel properties, and the influence of adhesive formulation receptors and pressing parameters on particleboard and fiberboard properties. Overlaying of panels with veneer and/or synthetic materials are also done on exercises and the properties of thus finished panels are determined. Exercises are an upgrade to the knowledge acquired in lectures.

Working methods:
Teachers' obligations:
Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold written and oral exams and consultations. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises report and project task reports within the given time frame. To attend the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	15	1.5
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible and on time	Excellent (5)			
Project task (PT)	10%	Partially disordered, incomprehensible and illogically conceived text, with major corrections and on time	Sufficient (2)	-	45	1.5
		Orderly, legible and logically conceived text, with major corrections and on time	Good (3)			
		Orderly, legible and logically conceived text, with minor corrections and on time	Very good (4)			
		Orderly, legible and logically conceived text, without corrections and on time	Excellent (5)			
Exam (EX)	70%	50-61%	Sufficient (2)	-	30	1
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PTx10 + EXx70)/100**		60	90	5

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. There are 4 exercises in total. Exercises 1 and 2 are conducted in practicum and are of computational type. Exercises 3 and 4 are of a practical character and are carried out in a workshop / laboratory. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Project task	In their Project tasks the students examine specific areas of fragmented wood panels' technology. Practical part of the project task is done by the students during the course (on exercises) which are carried out in the workshop / laboratory. Theoretical part is performed through the study of relevant literature that they define in coordination with the course lecturer. The project task is submitted at the end of the semester, in the form of a written report.	15. week	Students who submit and their project task report is evaluated positively can access the exam
Written exam	Only the students which have submitted their exercises reports and whose project task report is evaluated positively, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **(Ex20 + PTx10 + EXx70)/100**		

Obligatory literature

1. Jambreković, V.: Drvne ploče i emisija formaldehida, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 2004.
2. Bruči, V., Jambreković, V.: Ploče iverice i vlaknatice, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 1996.
3. Bruči, V., Janović, Z., Jambreković, V., Brezović, M.: Određivanje formaldehida iz drvnih pločastih materijala perforatorskom metodom, Sveučilišni laboratorijski priručnik, Šumarski fakultet, Zagreb, 1994.
4. Šumarska enciklopedija: Ploče iz usitnjenog drva, Jugoslavenski leksikografski zavod, Zagreb, 692-727, 1983.

Recommended literature

1. Deppe, H. J., Ernst, K.: Taschenbuch der Spanplattentechnik, 4. überarbeitete und erweiterte Auflage. DRW-VErlag. Leinfelden-Echterdinger, 2000.
2. Deppe, H. J., Ernst, K.: MDF – Mitteldichte Faserplatten, DRW-Verlag, Leinfelden-Echterdingen, 1996.
3. Maloney, T. M.: Modern particleboard & dry-process fiberboard manufacturing, Forest Products Society Madison, Wisconsin, 1993.
4. Jambreković, V.: Utjecaj međudjelovanja karbamid-formaldehidne smole i parafinske emulzije na kakvoću ploča iverica, Drvna industrija, 1996, 47(4): 131-141.

5. Jambreković, V., Brezović, M., Bruči, V.: Međuovisnost fizikalnih svojstava ploča iverica tipa V20 izrađenih s različitim vrstama i količinama hidrofobnih sredstava, Drvna industrija, 1998, 49(1): 21-30.
6. Medved, S., Jambreković, V.: The influence of the structure of three-layer particle boards on the thickness and density of surface layer, Drvna industrija, 2000, 51(1): 9-18.

Automation and measurement in woodworking industry

DP-1244

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Associate Professor Igor Đukić

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:
Basic concepts of measurement technique. Types of measurement errors (systematic, coarse and random). Measurement uncertainty and accuracy. Measurement error of indirectly measured quantity. Measurement systems. Units, measures and standards. Basic notions on measurements of non-electric quantities. Measurement chains and transducers. Transducers of mechanical quantities. Displacement, speed and acceleration transducers. Liquid and solid level transducers. Force transducers and strain gauges. Pressure transducers for gaseous and liquid media. Gaseous and liquid media flow transducers. Temperature and heat transducers. Electrical measurement of mechanical quantities. Basic concepts of control systems. Construction of control circuits. Regulated processes. Regulators, amplifiers and motors (pneumatic, hydraulic and electric). Static and dynamic characteristics of control system elements. Regulators. Feedback in control systems. Application of computers and programmable logic controllers in automatic process control. Numerically controlled machines in mechanical woodworking processes (mills, drills, lathes, machining centers). Applying numerical control to the design of conventional machine work space. Structure of Numerically Controlled Machines (control, adaptation and mechanical system). Main and auxiliary movements in numerically controlled machines. Assistive functions of numerically controlled machines. Higher levels of automation in numerically controlled machines (direct control, adaptive control, flexible machining cells and flexible machining lines). The basics of CAM and CIM system, their features, trends of development and application.

Type of course:
Automation and measurement in woodworking industry (compulsory, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Calculate the accuracy of the analog and digital instrument.	partial exam, final exam	C2
Distinguish measurements errors due to their origin.	partial exam, final exam	C2
Determine the components of the measurement uncertainty and calculate the measurement uncertainty of the directly measured quantity for simpler cases and express the measurement result.	partial exam, final exam	C2
Calculate simpler examples of measurement uncertainty and express the measurement result.	partial exam, final exam	C2
Describe the role of the individual components of the control system and measurement chain.	partial exam, final exam	C2
Differentiate the basic transfer characteristics of measurement transducers and analyze them on the example of frequently used transducers in the wood industry.	partial exam, final exam	C2
Measure and process the results of selected transfer characteristics of a transducer.	partial exam, final exam	C2
Sketch the systems static characteristic and calculate system sensitivity.	partial exam, final exam	C2
Graphically calculate the static characteristic of connected units in the control system.	partial exam, final exam	C2
Identify the basic dynamic characteristics of the system.	partial exam, final exam	C2
Analyze the basic parameters of the first order system.	partial exam, final exam	C2
Analyze the basic parameters of the second order system.	partial exam, final exam	C2
Draw the basic elements of the CNC machining axis.	partial exam, final exam	C2
Demonstrate the principle of "ON-OFF" control .	partial exam, final exam	C2
Expose the basic PID control features.	partial exam, final exam	C2

General competences
Acquiring the knowledge for the selection of measurement equipment in given accuracy classes. Automated systems management in wood sawing and wood finishing plants. Design of simpler control systems for automatic process control.

Type of instruction
Lectures
Exercises
Numerical exercises related to individual topics and quantities being studied. For the part of the numerical exercises, measurements are performed, and measurement results are used as data for computational exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	13	20	1,1
Partial exam 1 (PE1)	50%	50-60%	Sufficient (2)	1	25	0,9
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-60%	Sufficient (2)	1	30	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	**100%**	**(PE1x50 + PE2x50)/100**		**45**	**75**	**4**

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	50-60% 61-75% 76-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	55	1,9
TOTAL	**100%**	**(FEx100)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Partial exam 1 (PE1)	The partial exam can be accessed by all students.	9. week	
Partial exam 2 (PE2)	The second partial exam can be accessed by students who have passed the first partial exam. Students who get enough points from both partial exams get a final score.	14. week	
Written exam	The written exam consists of five numerical tasks. For the passage it is necessary to have at least 50% of the total number of points.	Exam terms	
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked. The final grade is obtained according to the formula **(FEx100)/100**	Exam terms	

Obligatory literature

1. Kovačić Z., Bogdan S. 2004: Elementi automatizacije procesa 2, Fakultet elektrotehnike i računarstva Zagreb, interna skripta.
2. Cebalo, R. 1993: Fleksibilni obradni sustavi, Fakultet strojarstva i brodogradnje, interna skripta.
3. Božičević, J. 1992: Temelji automatike, II. knjiga – Mjerni pretvornici i mjerenje, [kolska knjiga, Zagreb

Recommended literature

1. Ostojić, B. 1983: Digitalna automatizacija alatnih strojeva. Tehnički fakultet Rijeka.
2. Rajić, F. 1980: Osnove automatike I dio – Mjerenje neelektričnih veličina, Zagreb.
3. Rajić, F. 1980: Osnove automatike II dio – Automatsko reguliranje procesa, Zagreb.

Material handling

WP -1245

ECTS 4

English language

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Prof. Ružica Beljo Lučić, PhD
Assist. Prof. Matija Jug, PhD

Associate teacher for exercises
Prof. Ružica Beljo Lučić, PhD
Assist. Prof. Matija Jug, PhD

Grading
Sufficient (2) 60 %
Good (3) 70 %
Very good (4) 80 %
Excellent (5) 90 %

Course content:
General theory of material handling. Basic material handling principles. Principle of the cost-effectiveness of transport, cost-effectiveness of power and energy, cost-effectiveness of speed, safety issues, technological principle. The flow of material. Methodological bases of the analysis and resolving of material flows. Types of transport systems in wood industry. Computer based flows of material and flows of information. Information systems for monitoring of material handling. Transport technique and industrial logistics. Transport systems in automated production. Resolving of transport related issues. Transport analysis. Minimizing of transport costs. Material handling project. Project factors. Transport design projects. Computer application in transport design projects. Design of the system of air conveyors. Calculation elements related to conveyors. Choice of ventilators and electromotors. Choice of wood dust separators. Power analysis of transport systems. Unit cost of power consumption. Efficiency of transport systems. Storage facilities in relation to material handling. Design of storage facilities. Transport equipment for storage facilities. Utilization factors of storage facilities. Transport and storage of logs and sawn timber, semi-finished products, wooden products and waste. Transport and storage of bulk wood materials. Definition of characteristics of bulk wood materials. Types of log yards and storage facilities for bulk wood material. Packing. Packing material. Basic types of transport packing in wood industry.

Type of course:
Material handling (compulsory, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Collect and analyse relevant information and research results on the subject related to material handling in wood processing and furniture production.	prepared presentation on the particular subject	A2, B4, E3
Present in a clear and concise way professional information related to handling materials in wood processing and furniture production.	performing of prepared presentation, communication with other students	A2
Investigate, measure or calculate the properties of bulk wood materials and analyze the influencing factors on properties of materials important for their transport, storage and packaging (bulk density, bulk angle, granulation).	practical work, processing of measurement results, presentation of results and analysis of influential factors, final oral exam	A2, B4
Plan and conduct research related to material handling (transport, storage, packaging) by surveying participants in wood processing industry and furniture production	development of a survey questionnaire, analyses of questionnaire results	A2, B4
Self-study the task of material handling and suggest technical and organizational solutions in certain time and financial conditions.	solving a project task, calculation needed for project designing, presenting a project, final oral exam	A2, B4, C3
Calculate the required size of the storage facilities depending on the type, quantity, layout of the material, used transport equipment etc.	solving a project task, calculation needed for project designing, presenting the project, final oral exam	A2, B4, C3
Create and use simple Excel tables to keep track of the stock of material in the storage facilities.	designed tables in Excel	A2, B4, C3
Produce self-conceptual design of dust and chips extraction and transportation system using the data of manufacturers of pipes, fans, electric motors and wood particle separators.	solving a project task, calculation needed for project designing, presenting a project, final oral exam	A2, B4, C3

General competences
Communication skills, teamwork, presentation skills, creativity, critical evaluation and self-evaluation, basic methodology of scientific research.
General technical and technological knowledge for project and analysis of material handling in wood industry, solving of issues associated with transport and storage, as well as the choice of transport equipment.

Type of instruction
Lectures
Beside the “ex cathedra” lectures different teaching methods, such as, debating, learning in pairs, quizzes, presentation, discussions etc. are used.
Exercises
As part of the exercise, practical exercises are carried out on materials handling projects using Excel and AutoCAD computers. The exercises gain practical skills and additional knowledge that is an upgrade to the knowledge gained in the lecture.

Working methods:
Teachers' obligations:

Teaching - lectures, exercises. Applying different teaching methods to help students gain knowledge and acquire learning outcomes. Designing topics for group work of students. Providing consultations and oral exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, creation and presentation of projects related to material handling. Attending final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	28	0	1
Self-done projects (PR)	60%	Partly untidy and incomprehensible, with major corrections and on time	Sufficient (2)	15	45	2
		Tidy, comprehensible, with major corrections and on time	Good (3)			
		Tidy, comprehensible, with minor corrections and on time	Very good (4)			
		Tidy, comprehensible, without corrections and on time	Excellent (5)			
Presentation (P)	10%	Student presents with occasionally reading, collected data are not comprehensive	Sufficient (2)	2	15	0,5
		Students are presented without reading, the collected data are comprehensive but not logically presented	Good (3)			
		The student presents without reading, the collected data are comprehensive and logically presented, the student does not emphasize and insufficiently clarifies key data and basic principles	Very good (4)			
		Student presents without reading, collected data are comprehensive and logically presented, student clarifies and highlights key data and basic principles	Excellent (5)			
Oral exam (OE)	30%	min. 60 % correct answers to the questions asked	Sufficient (2)		15	0,5
		min. 70 % correct answers	Good (3)			
		min. 80 % correct answers	Very good (4)			
		min. 90 % correct answers	Excellent (5)			
TOTAL	**100%**	**(PRx60 + Px10 + OEx30)/100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. Students prepare a presentation or work on the project of material handling according to the given task.	semester (45 hours of direct lecture and exercises)	-
Designing projects (DP)	Students in groups of two work on selected projects of material handling, partly during exercises and partly at home. As a rule, students need to create two project of material handling, one project of storage facilities, and one project of dust and chip extraction system. The needed data and documents for project development are available by eLearning on Merlin or should be taken by web browsing. Precision, tidiness and creativity of the project are evaluated.	in accordance with the agreed terms	There is no possibility of compensation
Presentation (P)	Students collect data on the particular subject and prepare the presentation. The comprehensiveness and relevance of the collected data and the way of presentation are assessed.	15. week	There is no possibility of compensation
Oral exam (OE)	Students who have finished projects and had a presentation on a particular subject can access the oral exam. They are asked questions about the projects they have created and about the presentations of other students. The final grade of the subject is obtained according to the formula **(DPx60 + Px10 + UIx30)/100**		

Obligatory literature

1. Sever, S. 1988: Transport u drvnoj industriji, autorizirani rukopis, Zagreb.
2. Oluić, Č. 1991: Transport u industriji, Rukovanje materijalom I. dio. Sveučilišna naklada, Zagreb, 1 – 278.
3. Rukovanje materijalom e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=41660

Recommended literature

1. Mađarević, B. 1972: Rukovanje materijalom, Tehnička knjiga, Zagreb, 1 – 476.
2. Koharić, V. 1989: Uvod u mehaničke operacije, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje.
3. Koharić, V. 1994: Mehaničke operacije, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje.
4. *** 1973: Praktičar, Strojarstvo 2, Školska knjiga, Zagreb.
5. Sandor, N. 2002: Woodshop Dust Control, The Taunton Press.
6. Dzurenda, L. 2004: Vzduchotechnicka doprava a separacia dezintegrovanej drevnej hmoty, Technicke univerzity vo Zvolene.

Wood Fibres and Paper Technology

WP-1246

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
Prof. Vladimir Jambreković, PhD
Assist. Prof. Nikola Španić, PhD

Associate teacher for exercises
Assist. Prof. Nikola Španić, PhD
Assoc. Prof. Alan Antonović, PhD

Grading
Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:
The quality of wood fibres depending on the wood species. Technological processes of wood delignification. Impact of basic and modified methods of delignification on the quality of wood fibres. Thermo-mechanical and chemi-thermo-mechanical defibration. Defibration procedures and their impact on the quality of ground wood. Technological processes of producing semi-cellulose. Neutral sulphite delignification. Cold alkaline delignification. Technological processes of sulphite cellulose production. Comparison of sulphite and natrone procedures. Comparison of discontinuous and continuous chips cooking methods. Influence of white liquor composition and technological parameters on defibration efficiency. Methods and procedures of fibres bleaching. Wood fibres quality insurance. Influential efficiency factors of black liquor regeneration. Technological processes for production of recycled fibers. Wet-end and dry-end procedures of paper manufacturing technology. Paper surface protection and pigment coating methods. Paperboard and cardboard technologies. Paperboard and cardboard surface treatment, dispersion and extrusion protection and lamination methods. Mechanical and electronic printing methods. Technological processes control and paper quality insurance. Technological processes development in paper manufacturing. Methods of improving the properties of paper and fiber base products.

Type of course:
Wood Fibres and Paper Technology (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to compare and evaluate the quality of wood fibres as depending of the wood species	laboratory and practical classes, project task, final exam	C1
to manage the technical processes of delignification	laboratory and practical classes, project task, final exam	C1
to assess the impact of the basic and modified delignification method on the quality of wood fibres	laboratory and practical classes, project task, final exam	C1
to explain the thermo-mechanical and chemi-thermo-mechanical defibration	laboratory and practical classes, project task, final exam	C1
to evaluate the defibration processes and their impact on ground wood quality	laboratory and practical classes, project task, final exam	C1
to describe technological processes of semi-cellulose production	laboratory and practical classes, project task, final exam	C1
to recommend technological processes of sulphite cellulose production	laboratory and practical classes, project task, final exam	C1
to manage the neutral sulphite processes of wood delignification	laboratory and practical classes, project task, final exam	C1
to prepare the cold alkaline process of wood delignification	laboratory and practical classes, project task, final exam	C1
to compare sulphate and natrone procedures	laboratory and practical classes, project task, final exam	C1
to compare discontinuous and continuous chips cooking methods	laboratory and practical classes, project task, final exam	C1
to re-examine the effect of the white liquer composition and technological parameters on the effectiveness of defibration	laboratory and practical classes, project task, final exam	C1
to recommend the methods and bleaching procedures	laboratory and practical classes, project task, final exam	C1
to determine and ensure the quality of wood fibres after production	laboratory and practical classes, project task, final exam	C1
to evaluate influential factors affecting the black liquor regeneration	laboratory and practical classes, project task, final exam	C1
to manage technological processes for production of recycled fibres	laboratory and practical classes, project task, final exam	C1
to recommend wet and dry processes in paper production technology	laboratory and practical classes, project task, final exam	C1
to select paper surface protection and pigment coating methods	laboratory and practical classes, project task, final exam	C1
to recommend paperboard and cardboard production technologies	laboratory and practical classes, project task, final exam	C1
to manage paperboard and cardboard surface treatment, dispersion and extrusion protection and lamination methods	laboratory and practical classes, project task, final exam	C1
to evaluate mechanical and electronic printing methods	laboratory and practical classes, project task, final exam	C1
to organise technological processes control and paper quality insurance	laboratory and practical classes, project task, final exam	C1
to develop technological processes in papermaking	laboratory and practical classes, project task, final exam	C1
to improve the properties of paper and fibre based products	laboratory and practical classes, project task, final exam	C1

General competences
Acquiring of knowledge about wood fibres structure, technological processes of wood fibres preparation, regeneration and regeneration products, paper manufacturing processes and paper treatment with an aim of autonomous monitoring and controlling manufacturing processes in mechanical pulp, semi-cellulosic, cellulosic and paper industry.

Type of instruction
Lectures
Exercises
As part of the exercise, alongside the selection of raw materials, the relevant properties of wood fibres prepared by different methods and for different uses, including their chemical analysis, are determined. On the samples of prepared wood fibers, characteristic numbers (κ, Björkmann, Cu) of cellulose and its polymorphism (α-, β- and γ-cellulose) are also determined. The paper testing field is also covered with exercises where paper is observed as a final product of wood processing, with the determination of mechanical and optical properties of papers for printing, cardboard and packaging. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:
Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold written and oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises report and project task reports within the given time frame. To attend the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	15	1
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible and on time	Excellent (5)			
Project task (PT)	10%	Partially disordered, incomprehensible and illogically conceived text, with major corrections and on time	Sufficient (2)	-	30	1
		Orderly, legible and logically conceived text, with major corrections and on time	Good (3)			
		Orderly, legible and logically conceived text, with minor corrections and on time	Very good (4)			
		Orderly, legible and logically conceived text, without corrections and on time	Excellent (5)			
Exam (EX)	70%	50-61%	Sufficient (2)	-	30	1
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + PTx10 + PEx70)/100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. All exercises are of practical character and are carried out in laboratory. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Project task	In their Project tasks the students examine specific areas of wood fibres and paper technology. Practical part of the project task is done by the students during the course (on exercises) which are carried out in the laboratory, as well as in plants and internal laboratories of cellulose and paper factories. Theoretical part is performed through the study of relevant literature that they define in coordination with the course lecturer. The project task is submitted at the end of the semester, in the form of a written report.	15. week	Students who submit and their project task report is evaluated positively can access the exam
Written exam	Only the students which have submitted their exercises reports and whose project task report is evaluated positively, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **(Ex20 + PTx10 + EXx70)/100**		

Obligatory literature

1. Fengel, D., Wegener, G.: Wood - Chemistry, Ultrastructure, Reactions. Walter de Gruyter, New York, 1989.
2. Neimo, L.: Papermaking Chemistry. Fapet Oy, 2000.
3. Sjöström, E., Alén, R. (Eds.): Analytical Methods in Wood Chemistry, Pulping and Pepermaking. Springer-Verlag, 1999.
4. Paluparo, H., Karlsson, M., Jokio, M.: Papermaking – Stock Preparation and Wet End, Drying and Finishing. Fapet Oy, 2000.

Recommended literature

1. Hon, D.N.-S., Shiraishi, N.: Wood and Cellulosic Chemistry. Marcel Dekker Inc., New York-Basel, 2000.
2. Lewin, M., Goldstein, I. S.: Wood Structure and Composition. Marcel Dekker Inc., New York, 1991.
3. Sertić, V.: Kemija drva. Interna skripta. Sveučilište u Zagrebu, Šumarski fakultet, 2000.
4. Stenius, P.: Forest Products Chemistry. Fapet Oy, 2000.
5. Oittinen, P., Saarelma, H.: Printing. Fapet Oy, 2000.
6. Sundholm, J., Gullichsen, J., Fogelholm, C.J., Göttsching, L., Pakarinen, H.: Mechanical and Chemical Pulping, Recycled fiber and deinking, 2000.

Special drying methods of wood

DT-1247

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Professor Stjepan Pervan, PhD

Associate teacher for exercises
Miljenko Klarić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:
Physical basics of special drying methods – drying with EM waves, convenctional drying, drying in low air pressure, vacuum drying – technological details, condensation drying – technological details, vacuum-press process – technological details, VF drying – technological details, microwave drying – technological details, measurement of drying parameters in special drying methods, drying schedules for special methods, modification of drying schedules for special methods, wood drying defects in special methods, advantages and disadvantages of special drying methods, special drying methods costs.

Type of course:
Special drying methods of wood (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Maintain and assemble special drying processes of all types of wood.	exercises, lectures, exam	C2
Estimate the allowed level of value reduction based on the drying standard.	exercises, lectures, exam	C2
Calculate the required drying time for commercial types of wood in special dryers	exercises, lectures, exam	C2
Calculate the energy needs of the special drying process according to the specifications of the technology.	exercises, lectures, exam	C2
Evaluate and select the appropriate level of special drying technology according to production requirements.	exercises, lectures, exam	C2

Distinguish process errors on the material during special drying.	exercises, lectures, exam	C2
Distinguish the errors of special drying processes.	exercises, lectures, exam	C2

General competences
The aim of the course is to qualify the expert – specialist for self-governing: complete work on monitoring, controlling, analysing and modification in every area of unconventional drying processes of solid wood.

Type of instruction
Lectures
In the course of lectures, students gain knowledge about special drying methods of wood.
Exercises
As part of auditory exercises, laboratory exercises and practical exercises, students receive an upgrade to the knowledge gained during the lectures.

Working methods:
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the colloquia and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			30	30	2
Exercises (E)	20 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	15	1
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE)	80 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(Ex20 + PEx80)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	**100%**	**(FEx80+Ex20)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 10 % of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. At the beginning of the first exercise, students will receive templates. Exercises are written by hand. For each exercise, the term in which the exercise is handed and evaluated positively, is defined. If the exercise is not handed within the defined time frame or if the exercise is not evaluated positively, then that exercise will be reviewed later after semester ends and the student will receive the seminar assignment and additional computational tasks for each exercise. The accuracy, tidiness and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Written exam	Exam can be attended by students who have completed the exercises. The exam consists of theoretical questions, computational tasks and of the sample that students must describe. For passage students must collect at least 60 % of points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **(FEx80+Ex20)/100**		-

Obligatory literature

1. Pervan, S. (2000): Priručnik za tehničko sušenje drva. 272 p. SAND 2000.
2. Pervan, S. (2009): Tehnologija obrade drva vodenom parom. 166 p. SAND 2009.
3. Krpan, J. (1965): Sušenje i parenje drva. Šumarski fakultet Zagreb, 363 p.

Recommended literature

1. Niemz, P. (1993): Physik des Holzes und der Holzwerkstoffe. DRW – Verlag, Leinfelden. 243 p.
2. Trebula, P., Klement, I. (2002): Sušenie a hydrotermicka uprava dreva. Tehnicka univerziteta vo Zvolene. 449 p.
3. ***: Die Schnittholztrocknung. Dipl.ing. R. Brunner. Hannover. 322 p.

CNC techniques in final wood processing

DP-1248

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Associate professor Goran Mihulja, PhD

Associate teacher for exercises
Assistant professor Vjekoslav Živković, PhD

Grading
Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:
Basic operating principles. NC and CNC machines. The application of CNC techniques in final wood processing. Types of NC and CNC machines: tenoning and mortising machines, grinders, drills, lathes, routers and sanders. Machining centres. NC and CNC led machines or lines of assembly, format circle saws, band saws, veneer pack edge shears, machines for assembling veneer, machines for edge banding, machines for drilling and doweling, lines for wood finishing, automatic varnish spraying machines, robots. Choice of production operations on NC and CNC machines. Positioning working piece and plan of executing operations. Creating a template for positioning and fixing working piece. Introduction to programming DIN 66025. Programming of CNC machines: Machine programming, Programming with the NC programming package, Graphical programming, Programming with digitalization, Teach in programming, Programming with CAD system.

Type of course:
CNC techniques in final wood processing (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the principles of operation and the possibility of using NC and CNC machines in final wood processing	partial or final exam	C5
Differentiate and categorize the basic types of NC and CNC machines based on their capabilities (saw blades, planers, milling machines, machining centers, ...)	partial or final exam	C5
Suggest the application of various CNC machines to produce final products based on the production program	exercises reports, corrections, and exercises evaluation	C5

Plan optimum use of CNC machining centers to produce final products	partial or final exam	C5
Design the order of performing the processing operations of the final product elements on the CNC machining center	exercises reports, corrections, and exercises evaluation	C2
Organize the machining center tool database	laboratory exercises, corrections, and exercises evaluation	C2
Prepare CNC machining using different programming methods of processes and suppresses (programming on the machine, by digitization, using CAD, using graphical programming ...).	partial or final exam	C5
Conduct reverse engineering using 3D digitization	laboratory exercises, corrections, and exercises evaluation	C5
Design the optimum fastening method for complex shapes on the CNC machining center	partial or final exam	C5

General competences
Acquire knowledge about the possibilities of using CNC techniques in final wood processing. Acquiring knowledge and skills about programming of machines and application of machines for performing operations.

Type of instruction
Lectures
Partially auditorial with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.
Partially it is active process for students which acquire new knowledge about implementation of CNC technology in woodworking production through the programming of woodworking processes.
Exercises
Exercises are an upgrade to knowledge adopted in lectures. It consists of independently prepared machining operations that are checked by simulator and by practical work on the machining centre. The report consists of a description of the task and the procedure for setting production operations and the possibility of further correction by the operator on the machine, and a digital part containing a CNC machine program for running the CNC working centre or other CNC machine.

Working methods:
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.
Studenats' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	30%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	15	30	1,5
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	35%	51-64%	Sufficient (2)	1	21	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	35%	51-64%	Sufficient (2)	1	22	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(E x 30 + PE1 x 35+ PE2 x 35)/100**		47	73	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	70 %	51-64% 65-77% 78-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	43	1,5
TOTAL	**100%**	**(FE x 70 + E x 30)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes. Each active lecture students are monitored and evaluated by the preparedness and skills of using the software. Final grade is the arithmetic mean of the grade of all attended active lectures.	semester (30 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) must be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Vindšnurer, D.: NC in CNC v lesarstvu, Ljubljana,1988.
2. Madison, J.: CNC MACHINING HANDBOOK, Ind. press INC. 1996.

Recommended literature

1. Bogner, A., l982.: Numerički upravljani strojevi za obradu drva. Drvna industrija 33, 7/8, 187-188.
2. Bogner, A., 1983.: Numerički upravljani (NC i CNC) strojevi. Drvna industrija 34, 9/10, 253-255.

Wood industry power supply

WP-1249

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Prof. Stjepan Risović, PhD

Associate teacher for exercises
Assist.prof. Branimir Šafran, PhD
Marko Rastija, mag. ing. mech.

Grading
Sufficient (2) 50 - 67 %
Good (3) 68 - 78 %
Very good (4) 79 - 89 %
Excellent (5) 90 - 100 %

Course content:
Introduction to wood industry power supply. Definition of basic concepts related to energy and power supply in wood industry. Energy forms and carriers. Accumulated, transition, primary, transformed and useful forms of energy. Electrotermic in wood industry. Direct and indirect heating with electric resistance, IR radiation and electrical induction. Heating with dielectric losses, high frequency and low frequency heating. High-frequency generators. Power plants in wood industry. Energy characteristics. Load and electric power consumption diagrams in WI plants. Appropriate thermal power plants for wood industry. Electric power system. Electro energetic systems. The advantages of connecting the power plants. The energy and power requirements of the electrical energy system. Determining the need and construction of new power plants. Frequency and voltage regulation in the system. Electric motor drives (EMD) in wood industry. Types of electro motors and their features. EMD set. Dynamic state of EMD. Selection of electric motor for the EMD's in wood industry. Rationalization of energy consumption on the electrical equipment and devices in wood industry. Application of mechanical power in woodworking plants. Hydraulic and pneumatic drives. Preparation of medium. Elements of hydraulic and pneumatic drives and their application in wood industry. Forest biomass as an energy source in WI plants. Balance of available wood residues in sawmill production and final wood processing and its use in bioenergy production. Biomass combustion. Boiler equipment in the wood industry plants (preparation of biomass, biomass transport system, stokehole ...). Working principles of steam piston motors, Stirling motors, gas and steam turbines. Gasification. Simultaneous production of heat and electricity in WI plants. Efficiency of plants that use biomass as an energy source. Economic indicators of the use of biomass as energy source. Application of thermal energy for devices and heating. Heat transfer and heat exchanger. Heating by: saturated steam, warm and hot water, hot oil and hot air. Heat recuperation in wood industry plants. Energy production in wood industry plants. Rational energy production and consumption in WI. Real energy systems in wood industry. Energy issues of typical wood industry technologies. Characteristic energy transfer in wood industry plants. Briquettes and

pellets - energy and economic analysis. Ecology and energy. Waste water. Chimney gases. Ash. Sludge. Technical and other procedures for pollution reducing. Norms and standards.
The state and trends of using renewable energy sources in the EU and Croatia. Renewable energy sources laws. Biorafineries and cascade use of forest biomass. Systems for the use of forest biomass in combination with other sources of energy.

Type of course:
Wood industry power supply (elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Introduce the importance of using heat energy in woodworking processes	written exam, oral exam	A3
Calculate the savings of electricity when using a motor with frequency and voltage regulation	written exam, oral exam	A3
Create a plan for selecting hydraulic and pneumatic systems in the wood industry	written exam, oral exam	A3
Predict the amount of wood residue that is generated in the wood processing industry by machining	written exam, oral exam	A3, B2
Prepare a report on the advantages and disadvantages of the steam turbine Stirling facility for a selected woodworking plant in relation to the existing	written exam, oral exam	A3
Combine the advantages and disadvantages of simultaneous generation of heat and electricity up to 2 MW_{el}	written exam, oral exam	A3
Design a system for the production of thermal energy for the needs of the technological process on the basis of current consumers as well as planned in the strategic development	written exam, oral exam	A3
Present and explain the costs of investment and profits in the production of densified wood from most commonly croatian hardwood	written exam, oral exam	A3, B2
Improve the method of disposal of ash produced during combustion of biomass	written exam, oral exam	A3
Submit the technical, economic and environmental protection report - the reason for using a flue gas purification filters	written exam, oral exam	A3
Improve the current investment and position of the Republic of Croatia in the environment of the European Union countries in renewable energy sources	written exam, oral exam	A3, B2
Present the economic model of energy utilization in wood industry facilities in trade in emissions in the Republic of Croatia and the EU	written exam, oral exam	A3
Write a feasibility study for investments in other renewable energy sources in combination with biomass generated in WI	written exam, oral exam	A3, B2

General competences
Acquiring knowledge, skills and knowing the laws of the correct and optimal use of energy with identifying and solving problems in the field of energy use in the wood industry. In addition, within the study program will include skills in overcoming the practical tasks in WI, either by control measurements, calculations and tests.

Type of instruction
Lectures
Exercises
Exercise part of the teaching program is carried out in a laboratory where on the basis of specific measurements the calculations of observed systems and principles are carried out. The second part of the exercises are calculation tasks where the theoretical knowledge adopted in the lectures is upgraded with aim of better understanding of the subject.

Working methods:
Teachers' obligations:
Maintaining original lessons - lectures, exercises. Providing oral exams and consultations. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises. Laying the exams.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	15	0	0,5
Written exam (WE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1,5
Oral exam (OE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1,0
TOTAL	**100 %**	**(WEx50 + OEx50)/100**		**45**	**75**	**4**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercises	The teaching attendance is checked and recorded. Students may be absent with a maximum share of 20 % of direct teaching.	semester (45 hours of direct lecturer)	-
Written exam	Exams can be attended by students who have sufficient teaching attendance. Students solve tasks and answer asked questions. The written exam is evaluated and participates in the final grade.	Exam terms	-
Oral exam	Students who pass written exam are asked for questions from different parts of the teaching program content. The final grade is obtained according to the formula: **(WEx50 + OEx50/100**		

Obligatory literature

1. Hamm, Đ. 1980: Energetika drvne industrije, Šumarska enciklopedija, LZ. “Miroslav Krleža”, Zagreb.
2. Požar, H. 1992: Osnove energetike I, Školska knjiga, Zagreb.
3. Požar, H. 1988: Osnove energetike II, Školska knjiga, Zagreb.
4. Požar, H.1992: Osnove energetike III, Školska knjiga, Zagreb.
5. Čikič, A.: Doprinos racionalizaciji korištenja toplinske energije u drvnoj industriji, magistarski rad, Fakultet strojarstva i brodogradnje, Zagreb, 1992.

Recommended literature

1. Gulič, M., Brkić, Lj., Perunović, P.: Parni kotlovi, Univerziter u Beogradu, 1991
2. Loo van S., Koppejan, J. 2002: Handbook of Biomass Combustion and Co-Firing, Twente University Press, Enschede.
3. Kaltschmitt, M., Hartmann, H. 2001: Energy aus Biomasse – Grundlagen, Techniken und Verfahren, Springer (Berlin,Tokio).
4. Figurić M., Risović S. 2003: Šumska biomasa, Akademija tehničkih znanosti Hrvatske, Zagreb.
5. Matić, M. 1995: Gospodarenje energijom, Školska knjiga, Zagreb.
6. Udovičić, B. 2002: Energija i okoliš u globalizaciji, Vlastita naklada, Zagreb.
7. Jurković, B. 1990: Elektromotorni pogoni, Školska knjiga, Zagreb.
8. Elčić, Z.: Parne turbine, ABB, Karlovac, 1995.

Field work II – Wood technology processes

WP-1250

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 2th semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:
Field work II – Wood technology processes (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Analyze the influence of technological parameters on chipboard properties. Manage the technological processes for the production of chipboards and woodworking panels.	Field work report evaluation	C2
Recommend techniques for enhancing technological parameters. Analyze test results of internal laboratories.	Field work report evaluation	A2, C2
Recognize and distinguish the technological systems of production of veneer layered wood. Determine the suitability of certain technological solutions in veneer and wood production.	Field work report evaluation	C2
Record and analyze the technological parameters essential for the production of veneer and wood.	Field work report evaluation	A2, C2
Collect the necessary data individually and make analysis and rationalization of material flow in woodworking processes. Analyze and control the performance of the extrusion system in the wood processing plant.	Field work report evaluation	A2, B4, C3
Analyze the influence of technological parameters on the properties of wood fibers. Suggest the arrangement of plant and equipment in the production of NSSC semichemical cellulose.	Field work report evaluation	B1, C1
Prepare chemicals for cooking wood chips. Select the technological parameters for cooking wood chips. Recommend methods for waste water.	Field work report evaluation	B1, C1
Choose and / or compile an optimal list of quality machining programs and subroutines for CNC machining based on the default manufacturing program of the company or a set of final products.	Field work report evaluation	C5

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of gathering data on the factors of the manufacturing process or business of the company. Based on calculations and analysis, the student suggests improvements for a more rational and optimal process. The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:

Teachers' obligations:
Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.
Students' obligations:
Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The students' skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature
1. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Technology of wood building components

DT-2350

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Prof. Hrvoje Turkulin, PhD

Associate teacher for exercises
Assist. Prof. Vjekoslav Živković, PhD
Prof. Hrvoje Turkulin, PhD

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:
Wooden windows and doors: function, general service requirements, types of products. Building physics – technical details in design of acoustic and thermal isolation of windows, doors, walls, floors. Principles of technical design and detailing of the most important types of windows and doors. Processes of small-scale manufacturing and large industrial production processes for windows and doors: choice of machines and equipment, material, accessories, analysis of specific machining operations. Technical design, detailing and specific production operations in manufacturing of entrance doors, panel doors, wooden floors, wooden laminated beams, bridges, wooden prefabricated houses. Stages in transportation, building, maintenance and restoration.

Type of course:
Technology of wood building components (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Appoint and interpret the technical properties of wood for construction, technological ways of eliminating wood shortcomings when used as a building material and link them with the technical requirements for individual construction products	exam	B1
Describe and interpret the features of traditional wood construction in Croatia and link them with the technical features of modern wood products for constructions - beams and profiles, truss girder, laminated beams, cross laminated panels, stairwells and cassette walls, bridge elements, special construction panels.	exam	B1

Define and explain the fundamentals of building physics: describe and interpret acoustic, thermal and hygrotechnical phenomena in construction. Categorize and design the models of walls, roofs, windows, doors, floors according to construction-insulation requirements.	practice exercises, exam	C4
Appoint and compare the window and door functions according to its purpose, the opening mode, according to the construction types and to associate them with the usage values: illumination, visual, psychological and physical connection to the environment, ventilation, climate, sound, heat insulation.	exam	B1
Interpret the link between the function, the economy and the technical concept of the product - windows or balcony doors, interior doors, entrance doors by sketching the structure of window and door frames: details and dimensions of the frame profile, the door leaves of the type and properties of corner joints, auxiliary parts and materials on the windows; doors: gaskets, gaskets and whales, glass, anchors and connectors, ventilation and shading elements.	practice exercises, exam	C3
Connect and interpret the link between the construction and the technology of windows and doors in different window and door production processes, production and furnishing with additional window elements; selecting and recommending materials and technological processes for lacing, spinning, surface finishing, sealing and spinning, packaging and transportation, as well as window and door installation	exam	C3
Formulate the technological process (technological map and description of operations) in industrial window and door manufacturing - Calculate and propose technical or technological parameters in industrial window or door manufacturing and formulate a way of measuring technological parameters in production.	exam	C2
Appoint, define and compare the technical properties of interior floor components (structural support, heat insulation, sound and water vapor, substrate, coating, binder, top layer) and connect them to the inner floor panel with individual elements of wood flooring: floor boards, lamel flooring, lam parquet, finished / finished parquet elements, prisms, laminate flooring. Special floor coverings - mosaic floors, cork, laminate, combination with metals and mineral coatings.	exam	C4
Appoint and interpret the technological parameters of production, measure the technological parameters and evaluate the approximation of measured dimensions (dimensional and shape accuracy, surface smoothness, density, moisture content and hardness of wood, glue application, pressure temperature and duration of adhesive hardening, surface treatment and hardening dynamics in the production of floor elements of wood.	exam	C2
Define, analyse and evaluate the physical conditions of wooden floors - substrates, insulation layers, wood flooring, surface treatment, ambient conditions: air humidity, equilibrium moisture content, temperature, dimensional changes.	practice exercises, exam	C4
Design, evaluate and valorise the compatibility of technological features of different interior floor finishes (screed-glue-classical parquet, screed-floor-finished parquet, floor-wood-flooring, sports floor, floor): compare functionality, technology and cost-effectiveness of the floor.	exam	C3
Appoint and interpret the basic functional properties of different types of beams (load bearing capacity, stability, compatability with room function, compatibility with other building elements, safety requirements, fire resistance and protection).	exam	B1
Demonstrate the technical principles and the design of the laminated structure and the general technological process of making a wooden house: mechanical processing and surface treatment, transportation, construction, supervision and control in use.	practice exercises, exam	C2

General competences
Understanding of the connection between the function, service compliance and technical detailing of particular wood building components: windows, balkony doors, entrance doors, panel doors, wooden floors, laminated beams, bridges, houses. Learning and understanding the specific technological operations in manufacture, composition, building, durability provision and maintenance of wood building products.

Type of instruction
Lectures
Exercises
Six practical exercises are performed within laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:
Original teaching - lectures, exercises, field work. Preparing the exercises and preparing the exams and evaluating them. Written and oral exams and consultations. Preparation and development of teaching materials.
Studenats' obligations:
Regular attendance and active participation in lectures and exercises, preparation and presentation of exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching ours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	25%	Mostly inaccurate, with major corrections	Sufficient (2)	30	45	2,5
		Mostly accurate, with corrections	Good (3)			
		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Exam (PE)	75%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex25+ PEx75)/100**		60	90	5

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and recorded. Exercises are attended by groups. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are organised in groups. As part of the exercise, 6 practical exercises from the topic subject of technological and structural development of construction products made of wood. At the beginning of the first exercise, students are introduced to the rules of preparation, teaching and assessment of exercises. **The accuracy, regularity and regularity (time-honored exercises)**	-	
Written exam	The exam can be attended by students whose exercises were evaluated positively. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students get questions from different part of the subject program. Final mark of subject is achieved from the formula: (**Ex5+PEx75)/100**		

Obligatory literature

1. Turkulin, H.; Ljuljka, B. 1988. Lamelirana građevna stolarija, 182 p. Šumarski fakultet Zagreb
2. Tomašević, J. (1999): Drvo u podnim konstrukcijama. Zagreb: naklada autora
3. Šimetin, V. (1983): Građevinska fizika. Zageb: Liber
4. Žagar, Z. 2002. Drvene konstrukcije. Zagreb: Pretei

Recommended literature

1. Mayyer-Bohe (1980): Fussböden. DRW Verlag: Stuttgart
2. *** (1988): Informationsdienst Holz: Lamellierte Holzfensterprofile. Muenchen: Deutsche Gesellschaft fuer Holzforschung.e.V.
3. Liesse, B. (2002): Holzbauteile. Leinfelden-Echterdingen: DRW-Verlag
4. Erler, K. (2002): Holz im im Aussenbereich. Basel-Boston-Berlin: Birkhäuser Verlag
5. *** (2002): Wood as an engineering material. Madison, WI: USDA Ffor. Ser., Forest Products Lab.

Processes of wood finishing

WP-2351

ECTS 5

E-learning R2

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
Professor Vlatka Jirouš-Rajković, PhD

Associate teacher for exercises
Assistant professor Josip Miklečić, PhD
Professor Vlatka Jirouš-Rajković, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:
Composition and properties of different wood coatings. The base of forming the film. Rheological properties of wood finishes. Wood coating interaction: surface energy, wetting and adhesion. Internal stresses. Preparation of wood surface for finishing. Microgeometry of surface. The methods of roughness testing. The sanding systems. Finishes sanding. Processes of wood staining. Processes of wood bleaching. Technological processes of furniture and interiors finishing. Processes of finishing with solvent-based wood coatings. Processes of finishing with waterborne wood coatings. Process of coating drying. Intensification of drying process with heat. Intensification of drying with radiation. Finishing of exterior wood. Wood and coating properties that affect durability. Wood coatings failures. The causes of failures and methods of eliminating and preventing. The methods of removing old coatings from wood surface. Maintenance and durability of coating of exterior wood. Health and environmental protection. Compliant wood coatings. Powder coatings for wood-based materials. Legislation and perspective in wood finishing sector. Testing of finishes before application. Testing of finishes during application. Testing of hard tough films**.**

Type of course:
Processes of wood finishing (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish the composition and properties of decorative coatings ("do it yourself") and industrial coatings for wood.	Laboratory work, partial exam, exam	C2
Explain surface phenomena at the coating-wood interface and connect their influence (wetting, spreading, surface tension, surface energy, penetration coating adhesion).	Laboratory work, partial exam, exam	C2

Distinguish the adhesion theories and the method of measuring the coating adhesion on the wood.	Laboratory work, partial exam, exam	C2
Analyze the causes of internal stresses in coatings.	Laboratory work, partial exam, exam	C2
Recommend materials for finishing of exterior wood products and design the technological process of building joinery elements (windows) finishing.	Laboratory work, partial exam, project task, exam	C2, C6
Design the technological process of living room and bedroom furniture finishing, the technological process of kitchen furniture finishing, the technological process of chairs finishing.	Laboratory work, partial exam, project task, exam	C2,C6
Recommend materials for finishing of wooden floors and design a technological process.	Laboratory work, partial exam, project task, exam	C2, C6
Recommend environmentally friendly technological processes of surface treatment.	Laboratory work, partial exam, exam	C7,C6,C2
Analyze the causes of failures on the coated wood surfaces	Laboratory work, partial exam, exam	C2, C4, B1
Use equipment to test the quality of coated surfaces	Laboratory work, partial exam, exam	C4, C2, B1
Differentiate the test methods for the durability of exterior coatings and examine the durability of exterior coatings for wood.	Laboratory work, partial exam, exam	C4, B1
Suggest measures for reduction of volatile organic compounds (VOCs) in finishing room.	Laboratory work, partial exam, exam	C7,C6,C2
Collect information about the professional topic, synthesize and present them.	seminar	A2, E3

General competences
Development of written and spoken communication skills and professional expression. Identifying problems, participating in problem solving, and logical linking of facts. Teamwork. Development of responsibility and ethics. Applying the acquired knowledge and self-expanding knowledge.

Forms of teaching
Lectures
Exercises
Laboratory exercises are supplement to lectures. Students make 10 exercises according to instructions given in MERLIN. Completed exercises (worksheets) are a condition for obtaining signatures. Exercises must be submitted in pre-defined terms and for this the students earn points.

Teachers' obligations:
Teaching - lectures, exercises, homework, topics of seminar papers. Providing colloquia, written and oral exams and consultation. Creating teaching materials.
Students' obligations:
Regular attendance and active participation in lectures and exercises, preparation and submission of laboratory worksheets and seminar papers within the deadline. Resolving and delivering homework. Passing partial exams or examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	15 %	1,5 points for each task (worksheet) that was submitted on time	-	30	10	1,3
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points. To gain access to the second partial exam must achieve a minimum of 15 points.	-	1	24	0,7
Partial exam (PE)	30 %	Students can achieve a maximum of 30 poin7s.	-	1	22	0,8
Homework	5 %	1 point for each homework that was submitted on time	-	-	5	0,2
Seminar paper or project task	20 %	The maximum possible number of points scored is 20	-	-	30	1
TOTAL	**100%**	From all the elements of monitoring and checking the student can achieve a maximum height of assessment of 100 points, which makes 100 % of the grade. For the passing grade, the student must have a minimum of 60 points or 60 % of the grades. Scale rating is as follows:		**62**	**88**	**5**
		60 % - 70 %	Sufficient (2)			
		71 % - 80 %	Good (3)			
		81 % - 90 %	Very good (4)			
		91 % - 100 %	Excellent (5)			

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)*	100 %	60-70 % 71-80 % 81-90 % 91-100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	43	1,5
UKUPNO	**100%**					

***** A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. The exam consists of a written and oral part. Prior to exam seminar paper and exercise worksheets must be submitted for review.

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is recorded. Students are allowed 20 % absence from lectures and 10 % from exercises. Exercises are attending in groups. Exercises tasks are submitted within a predefined time limit, and timely delivery of the correct work sheets is scored.	semester	-
Submission of worksheets from laboratory work (exercises)	Exercises are attended in groups. Students must submit worksheets in a predefined period of time and timely submitted worksheets are scored.	According to weekly class schedule	-
Partial exams	There are two partial exams. Each brings 30 points. At the first partial exam a student must achieve at least 50 % to gain access to second partial exam.	VIII week XV week	-
Homework	Each on-time delivered homework brings 1 point	According to weekly class schedule	-
Seminar paper/project task	Students choose the theme of the seminar work from the proposed themes in MERLIN. Seminars are scored according to the given criteria.	According to weekly class schedule	-
Written exam	A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. Prior to exam seminar paper and exercise worksheets must be submitted for review.	Exam terms	-
Oral exam	Prerequisite for oral exam is minimum score of 60 in written exam	Exam terms	-

Obligatory literature

1. Ljuljka, B. 1990: Površinska obrada drva, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Ljuljka, B., Jirouš-Rajković, V. 2006: Osnove površinske obrade drva. Šumarski fakultet, Sand, 2006.

Recommended literature

1. Bulian, F. 2004: Verniciare il legno, CATAS, Udine.
2. Cox, R.M. 2003: Building An Industrial Wood Finish, Forest Products Society, Madison, WI.
3. Goldschmidt, A., Streitberger, H.-J. 2002: BASF-Handbuch Lackiertechnik, Vincentz Verlag, Hannover.
4. Graystone, J. 2004: Performance of Exterior Wood Coatings. 4th International Woodcoatings Congress: Developments for a Suistainable Future, The Hague 2004. Paper 3. The Paint Research Association, Teddington, UK.
5. Rothkamm, M., Hansemann, M., Böttcher, P. 2003: LACK Handbuch Holz, DRW-Verlag.
6. Roux, M.-L. 2004: Environmentally Friendly Finishes for High Performance Wood for Indoor Uses. 4th International Woodcoatings Congress: Developments for a Suistainable Future, The Hague 2004. Paper 1. The Paint Research Association, Teddington, UK.

Wood protection II

WP-2352

ECTS points 4

English language R1

E-learning R1

Hours of classes 45
Lectures 30
Exercises 15
Field work 1 day

Lectures teacher
Associate Prof. Marin Hasan, PhD

Exercises teacher
Associate Prof. Marin Hasan, PhD

Grades
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
The latest scientific achievements from wood protection (new protection procedures and wood preservatives). Traditional methods of monitoring and controlling of wood health. Preventive protection of wood and wooden products during technological processes (warehouse – sawmill – drying chambers – rough and fine machining – final processing – warehouse of semi-finished and finished products). Application of more environment-friendly preservatives and protection methods, especially regarding to soil, water and air protection. Wood modifications (natural and artificial, fossilization, petrifying, active and passive, chemical, thermal and enzymatic modification, esterification, etherification, acetylation, wood heating processes without air, heating in oils, physical modification, ...). Lectures and exercises at Faculty and outside the Faculty (old and new facilities, museums, churches, restoration workshops, wood processing plants). Learning on sterilization and repressive protection of wooden objects and objects of cultural heritage, 'anoxi' procedures. Wood waste and recovered wood, possibility of reconstruction and reuse of old preservative treated wood, wood waste and residues from chemically protected wood (old poles and sleepers, thresholds, wooden elements of building constructions, old wooden buildings, old wooden joinery). Classification, storage, recycling and recovery of products from chemically protected wood which service life have expired. Phytosanitary sterilization (sterilization of wooden packaging in international trade).

Type of the course:
Wood Protection II (compulsory course, 3th semester, 2nd year)

Learning Outcomes and Methods of Verification

Learning Outcomes (LO)	Evaluation methods	Connection with the study program LO
Based on the results of laboratory tests, independently determine the biological resistance of wood to the	exercises 1 and 2, 1st colloquium, final exam	C5

applicable standards and to recommend hazard class in which such wood can be used.		
Assess the risk of using biodegraded wood in the production and / or use of wooden products.	exercises 1 and 2, 1st colloquium, final exam	D6
Explain the difference between decontamination and wood protection procedures and propose the required procedure in the given example.	exercises 3 – 7, 1st colloquium, final exam	B4
Differentiate and define wood preservatives according to the aggregation state, the origin of the active component and the nature of the solvent.	exercises 3 – 7, 1st colloquium, final exam	C4
Propose the appropriate wood preservative and procedure for the given product (in the given hazard class), respecting the ecological principles of wood protection and describe the advantages and disadvantages of the proposed.	exercises in general, 2nd colloquium, final exam	D6
For the selected product and the conditions of use, in which the wood product is used, to recommend adequate physical, structural (and chemical) protection.	exercises in general, 2nd colloquium, final exam	D5
Recommend steps of restoration, adequate preventive or repressive protection procedures and choose adequate protective agent(s) depending on the type of wood product(s), the place of use and the degree of destruction.	exercises in general, 2nd colloquium, final exam	D6
Distinguish modified wood from natural and explain their advantages and disadvantages.	exercise 6, 2nd colloquium, final exam	C5
When designing new products from wood to anticipate the conditions of its use and possible mechanisms of degradation and to choose wood with needed natural resistance and to the recommend needed protection.	exercises in general, 2nd colloquium, final exam	D6
Independently or in a team develop a project (expert opinion) and present it in front of a group of people.	seminar paper, final exam	D6

General Competencies

Folowing of the quality and soundness of the wood raw material from the beguining (felling trees) to the final product. The recognition of the «mistakes» caused by all causes; the use of methods and preservatives of wood sterilization and protection. The wood waste and recovered wood management, particularly with the wood treated with chemical preservatives.

Type of instruction

Lectures

Lectures are held in the classroom or in the field work according to ERR guidelines, with explicit insistence on the more active participation of students in the learning process.

Exercises

Part of calculation exercises as well as some of the exercises on introduction to laboratory work are held in classroom and student practice room, and laboratory measurement exercises on prepared wooden specimens are held at the Laboratory for Anatomy and Wood Protection.

Working methods:

Teachers' Responsibilities:

Maintaining the original teaching – lectures, exercises and field work. Developing exercises and topics of seminar papers, collecting literature for seminar papers, compiling knowledge tests and evaluating them. Reviews of written exercises and of seminar papers. Providing colloquia, oral exams, consultations and seminars. Creating teaching materials.

Students' responsibilities:

Regular attendance and active participation in lectures and exercises, making and delivering exercises and seminars within the given time frame. Passing the colloquia, written and oral exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	–	–	–	30		1
Making Exercises (E)	20%	Correct exercises with less than 15 % of acceptable deficiencies	Sufficient (2)	15	30	1.5
		Correct exercises with less than 10 % of acceptable deficiencies	Good (3)			
		Correct exercises with less than 5 % of acceptable deficiencies	Very good (4)			
		Correct exercises with less than 1 % of acceptable deficiencies	Excellent (5)			
1st and 2nd Colloquium in written form	40%	60-70%	Sufficient (2)	2	28	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam – oral exam (OE) or Seminar paper – SEM*	40%	60-70%	Sufficient (2)	2	13	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		Seminar paper with less than 8 % of acceptable deficiencies	Very good (4)			
		Seminar paper with less than 1 % of acceptable deficiencies	Excellent (5)			
TOTAL	**100%**	**(E×20 + (C1+C2) ×40 + OE×40) / 100 or (E×20 + (C1+C2) ×40 + SEM×40) / 100**		49	71	4
***** students who pass all three colloquia and choose to do seminar papers don't need to complete the final exam; the defended seminar paper changes the final oral exam.						

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final Exam* (FE) Written part (W) + Oral part (O)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	43	1.5
TOTAL	**100%**	**(E×20 + FE×80) / 100**				
***** students who don't pass all three colloquia during the semester have to take final exam consisting of a written and oral part, and they make up to 80 % of the total grade, while the remaining 20 % make a grade of exercises						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + Exercises (laboratory work)	The presence of students is checked and recorded during the lectures. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (45 direct teaching hours)	-
Making Exercises (E)	Exercises are attended by groups. As part of the exercise, 7 practical exercises are carried out, of which 2 are part of field work. At the beginning of the first exercise, students will receive templates with the look of the file, inserts and worksheets on which the students will handle and teach their exercises. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted within the probationary period (the student has the right to submit a maximum of two exercises within the probationary period, otherwise the right to sign the course is lost).	according to the agreed delivery dynamics	One probationary period for submitting the exercises for revision.
First Colloquium (C1)	The first colloquium contains the following material: the methods and role of monitoring the wood health, wood preservatives, preventive and repressive protection of wood. Both colloquia have 20 questions and each question equals one point. Partially correct answers (semi-points) or negative points does not exist. The minimum number of points for passage the colloquium is 12 (12 of 20 = 60%).	6th week	-
Second Colloquium (C2)	Second Colloquium are available to students who have passed the first colloquium. The second colloquium contains the following material: Wood modification and sterilisation, phytosanitary standard, classification, reuse and recycling of chemically preserved wood waste. Both colloquia have 20 questions and each question equals one point. Partially correct answers (semi-points) as well as negative points does not exist. The minimum number of points for the passage each colloquium is 12 (12 points of 20 = 60%). Both colloquia are scored with a total of 40 points, with a total minimum of 24 of 40 points being needed for the pass (60%). Students who get enough points from both colloquia only access the oral part of the exam, and if they successfully defend the seminar paper (the minimum grade is very good (4)), they get a final grade on the subject with no need of taking oral part of the exam. The final grade is the sum of Exercises (E), Colloquia (C1 and C2) and Oral Exam (OE) or Seminar (SEM): **(E×20 + (C1+C2) ×40 + OE×40) / 100** **or** **(E×20 + (C1+C2) ×40 + SEM×40) / 100**	14th week	-
Seminar paper	Seminar work are available to all students. Seminar work is submitted for review by arrangement with the teachers throughout the semester. The final version is submitted to the 14th week and defending in the 14th or 15th week of the semester, provided that the student has passed both colloquia. A written part of the seminar and oral presentation are evaluated (defence in front of the whole group of students). Overall rating of the seminar paper should not be less than very good (4) in order to replace the oral exam. The final grade is the sum of Exercises (E), Colloquia (C1 and C2) and Seminar (SEM) **(E×20 + (C1+C2) ×40 + SEM×40) / 100**	14th and 15th week	-
Final exam (FE) written part	The written exam consists of 40 questions, and each question carries one point. Partially correct answers (half-	examination periods	-

	points) and negative points does not exist. The minimum number of points for the passage is 24 (24 of 40 = 60%). After completing the written part of the exam, students have a break (how much is needed for the teacher to review the written assignments) and afterwards (the same day) students that passed written part of exam approach the oral part of exam in groups of two to four students.		
Final exam (FE) oral part	The requirement for the oral part of the exam is enough points collected either in colloquia or on the written part of the exam. Theoretical and practical knowledge of the student is checked through questions from practical examples / real problems. The final grade is obtained according to the formula: **(E×20 + FE×80) / 100**	examination periods	-

Compulsory literature

1. Unger, A., Schniewind, A.P., Unger, W.: CONSERVATION OF WOOD ARTIFACTS, Springer, 2001.
2. Richardson, B.A.: WOOD PRESERVATION second edition, E & FN SPON, London, 1993, (selected chapters).
3. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom. (selected chapters).
4. Proceedings of the International scientific conferences: WOOD IN THE CONSTRUCTION INDUSTRY, (Despot, R. i Jambreković, V. Editors); (publication years: 2000 – 2004), Zagreb: Faculty of Forestry.
5. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom (selected chapters).
6. Bravery, A. F., Berry, R. W., Carey, J. K., Cooper, D. E.: RECOGNISING WOOD ROT AND INSECT DAMAGE IN BUILDINGS, BRE Bookshop, Second edition, 1992. Garston, Watford, United Kingdom (selected chapters).

Recommended literature

1. Hasan, M., Despot, R.: ZAŠTITA DRVA I – Abiološki čimbenici, lignikolne bakterije i gljive, ksilofagni kukci i morski štetnici. Skripta za studente drvne tehnologije iz predmeta Zaštita drva I i Patologija drva. Sveučilište u Zagrebu, Šumarski fakultet, 2018. (at the web page: http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the course Zaštita drva I (Wood protection I), there is a link to download the script).
2. Reinprecht, L.: PROCESY DEGRADACIE DREVA, Technicka Univerziteta vo Zvolene, Zvolen, 2001. (selected chapters).
3. Reinprecht, L.: REKONŠTRUKCIA OBJEKTOV Z DREVA, Monografia, Technicka Univerziteta vo Zvolene, Zvolen, 2000. (selected chapters).
4. Špoljarić, Z: ZAŠTITA DRVA (Impregnacija), skripta za slušače DT odsjeka VII stupnja nastave Šumarski fakultet Zagreb, 1973.
5. Glavaš M.: GLJIVIČNE BOLESTI ŠUMSKOG DRVEĆA. Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, 1999. (selected chapters).
6. Vasić, K.: ZAŠTITA DRVETA 1: KSILOFAGNI INSEKTI, Naučna knjiga, Beograd, 1971 (selected chapters).
7. Petrović, M.: ZAŠTITA DRVETA 2: TRULEŽ I OBOJENOST DRVETA, Naučna knjiga Beograd, 1980. (selected chapters).

Applied statistics

WP-2353

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Professor Anamarija Jazbec, PhD

Associate teacher for exercises
Assistant professor Maja Moro, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Tests of Hypotheses. Testing for the Population Mean. Testing Proportion. Testing Variance. Difference between two Population Proportions. Difference between two Population Variances. Difference between two Population Means. T-test. Nonparametric Mann Whitney test. Analysis of Variance. Perason`s and Spearman rank Correlation. Linear Regression. Least Squares Method. Estimation of Regression Coefficients. Coefficient of Determination. Model building. Methods of Model building. Univariat and Multivariate Models. Modelling Interactions. Chi square test. Fisher`s exact test. Cluster analysis.

Type of course:
Applied statistics (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify, implement and perform a statistical test based on sample for testing population mean	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test based on sample for testing population proportion	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test based on sample for testing population variance.	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing difference between two population proportions (test of proportions)	Partial exams, written and oral exam	A2

Identify, implement and perform a statistical test for testing difference between two population variances (F test)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing difference between two population means (t test, Mann Whitney test)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing equality more than two population means (ANOVA)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing two dependent population means (t paired test)	Partial exams, written and oral exam	A2
Calculate population correlation and estimate coeficient of the correlation and preforme statistical test (Pearson's and Spearman rank correlations) with computer support..	Partial exams, written and oral exam	A2
Analyze and interpret the results of univariate and multivariate linear regression with the help of computer support.	Partial exams, written and oral exam	A2
Analyze the contingency table implement the chi2 test	Partial exams, written and oral exam	A2

General competences
Collect, statistically analysed, display collected data. Discuss and make conclusions based on the already analysed data. Writing a compliance report for a product. Self-preforming statistical quality control.

Type of instruction
Lectures
Exercises
Exercises are an upgrade to knowledge adopted in lectures.

Working methods:
Teachers' obligations:
Preforming original lessons - lectures, exercises. Preforming Partial, Written and Oral Exams and Consultations. Creating teaching materials. Correcting Exercises.
Students' obligations:
Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preparing, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-		-	30	15	1,5
Exercises	-	-	-	15	30	1,5
Partial exams	100%	65-74	Sufficient (2)	4	26	1
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
TOTAL	100%			49	71	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam	100%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	3	27	1
TOTAL	**100%**					

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of students on lectures and exercises is checked. The student may not attend a maximum of 4 hours of lecture classes and 4 hours of. Exercises.	semester (45 hours of direct lecturer)	-
Partial exams	During the course, students write two partial exams each with 5 tasks total 100 (2 * 50) points. The minimum number of points that can be obtained by the partial exam is 20. If they collect at least 65 points in two partial exams they can pass exam without the final exam.	During the semester	
Written exam	Exams can be accessed by students who have received a signature. The written part of the exam consists of 5 tasks totaling 100 points.	Exam terms	
Oral exam	Students who have passed the written part of the exam access the oral exam.	Exam terms	

Obligatory literature

1. Basic statistics e-course na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=36296
2. Jazbec A. 2009: Osnove statistike, 2 ed. Šumarski fakultet, Zagreb

Recommended literature

1. Bahovec V, Erjavec N ur. 2015: Statistika, Element, Zagreb
2. Jazbec A. 2009: Osnove statistike, 2 ed. Šumarski fakultet, Zagreb
3. Montgomery D.C.2005: Statistical Quality Control, 5ed. Wiley, NewYork.
4. Duncan, A. J. 1974: Quality Control and Industrial Statistics, Irwin, Homewood, Illinois.

Quality management and assurance

WP-2354

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Assistant professor Krešimir Greger, PhD

Associate teacher for exercises
Assistant professor Kristina Klarić, PhD
Ivana Perić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:
Introduction. Basic concepts of quality management and quality assurance. Development of quality control. Standards and standardisation (national and international). Normative determination of quality in wood processing and furniture manufacture. Implementation of quality and production process. Four elements of quality. Defining the capabilities of products and processes in wood processing and furniture manufacture. Individual authors and their opinions on management and quality assurance (Crosby, Juran, Taguchi, Ishikawa, etc.) Position of quality in an organisation. The definition of total quality control, quality assurance, quality management and total quality management; Quality management in wood processing and furniture manufacture; Process control – input, process, output; Quality management in wood processing and furniture manufacture; Control process – input; Position of quality in individual management systems of production and business; Information system for quality assurance.
Development of quality management and quality assurance. Stages and steps in the development of quality management system and quality assurance; Comparison of traditional and modern firm organisation in wood processing and furniture manufacture.
Methods and techniques of quality assurance; Quality circle, relation between production and process; Specific features of methods and techniques in quality management and quality assurance in plants for wood processing and furniture manufacture.
International standard systems; New trends in the development of quality assurance and quality management; European standardisation procedure, certification, and compliance of standards; System of quality management and quality assurance; System of standards, requirements, control, supervision, and system certification.

Type of course:
Quality management and assurance (elective course, 3th, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define terms of quality control, quality assurance, quality management, total quality management and business excellence.	exercises, tests, exam	D1
Explain the basic techniques of quality management (Deming PDCA circle-quality and brainstorming).	exercises, tests, exam	A1
Describe and explain the traditional tools for quality management (diagram of cause and effect, Pareto diagram, flow chart, examination sheet, histogram, scatter diagram, control charts).	exercises, tests, exam	D1
Describe and explain the new managerial tools for quality management (diagram affinity diagram interdependence, stratification, matrix diagram, a form of arrows, the software maps the decision-making process, a systematic diagram).	exercises, tests, exam	D1
Describe and explain quality management methods (QFD and FMEA).	exercises, tests, exam	D1
Explain the term integrated management systems.	exercises, tests, exam	D1
Explain the concept of quality costs and specify the kind of quality costs.	exercises, tests, exam	D1
Provide quality control positions in the production system (input, process and final quality control).	exercises, tests, exam	D1
Define processes and their interconnections in the given example (given example enterprise for production of furniture) and define the necessary documentation for the defined processes.	exercises, tests, exam	D1
Determine the critical processes in the given example.	exercises, tests, exam	D5
Choose the appropriate quality control method on the given example - apply quality control tools.	exercises, tests, exam	D5
Select the appropriate control chart for the given example; determine if the cause of the variation is common or special.	exercises, tests, exam	D5
Determine process capability indices Cp and Cpk, and assess the process spread and centering process.	exercises, tests, exam	D1
To evaluate suppliers in a given case.	exercises, tests, exam	D3

General competences
Students are trained to solve the issues of quality management and quality assurance by gaining general and specific knowledge in the field of management and quality assurance adjusted to specific production problems in wood processing and furniture manufacture.

Type of instruction
Lectures
In the course of lectures, students gain knowledge about quality management and quality assurance in wood industry.
Exercises
As part of auditory exercises and computer exercises, students receive an upgrade the knowledge about quality management and quality assurance gained during the lectures.

Working methods:
Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers, compiling knowledge tests, and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the tests and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	30	1,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Test 1 (T1)	40%	60-70%	Sufficient (2)	1	21,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Test 2 (T2)	40%	60-70%	Sufficient (2)	1	21,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		60-70%	Sufficient (2)			
TOTAL	**100 %**	**(Ex20 + T1x40 + T2x40)/100**		47	73	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
TOTAL	**100 %**	**(FEx80+Ex20)/100**				

* Students who during the semester do not pass the subject by a written test shall attend the exam, that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students was checked and recorded. Student may justifiably be absent with a maximum of 15 % of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. For each exercise, students receive individual templates - tasks. The deadline for the exercise is two weeks and if the exercise is not timely submitted and the positive evaluation is not obtained, the student gets an additional task. The accuracy, tidiness and regularity of exercise are evaluated (time-honoured exercises).	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Test 1	Students who have a positive assessment of the first half of exercises and who have not abstained from teaching more than 15% can access the first test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	8th week	Students who pass the first test can access the second test.
Test 2	Students who have a positive assessment of all exercises and who have not abstained from teaching more than 15% can access the second test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	15th week	Students who pass 1st and 2nd test are exempted from the exam.
Written exam	Students who have a positive assessment of all exercises can attend the exam. The exam consists of three computational and theoretical tasks. To pass, students must acquire a minimum of 60% of the points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **(WAx40+OAx40+Ex20)/100**		-

Obligatory literature

1. Figurić, M. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Lazibat, T.: Upravljanje kvalitetom, Znanstvena knjiga, Zagreb, 2009.
3. Greger, K. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja (zbirka zadataka), Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.

Recommended literature

1. Skoko, H.: Upravljanje kvalitetom, Sinergija d.o.o., Zagreb, 2000.
2. Gryna, F., Juran, J.: Planiranje i analiza kvalitete, Mate, Zagreb, 2002.
3. Šiško Kuliš, M., Grubišić D.: Upravljanje kvalitetom, Sveučilište u Splitu, Ekonomski fakultet, 2010.
4. Štajdohar-Pađen, O., Plivati s ISO-om i ostati živ, Zagreb: Grafički zavod Hrvatske. Zagreb: Kigen, 2009.

Designing wood industry plants

WD-2355

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 15
Exercises 30
Field work 2 days

Lecturer
Associate Professor Ivica Župčić, PhD

Associate teachers for exercises
Associate Professor Goran Mihulja, PhD
Assistant Professor Josip Miklečić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Introduction to designing plants in wood industry. Technology and technological systems. Production and technological processes in wood processing. Basic principles in approach when building or reconstructing a plant. Planning investment projects. Types of projects in business systems. Content and operative plans of projects. Building and reconstruction of manufacturing plants. Production program – basics of the technological process. Analysis of the production program. Structure of products and range. Needs and supply of raw materials. Calculating materials and needs for materials. Reserves of materials, intermediate and finished goods. Analysis of resources and suppliers. Designing technological processes. Methods of designing technological processes. Determining and choosing technology. Criteria (technological, capacity, flexibility, reserves and losses of material, productivity, degree of automation, precision and quality of processing). Organizing space and arrangement of workspace. Defining needs of employees. Inner transport and storage. Production and energy facilities. Macro and micro locations of basic and auxiliary plants. Energy needs and sources. Energy buildings and installations. External transport and roads. High and low buildings. Project documents. Project task. Notional – technologic solution and project – study of development. Investment program, main and executive project, survey of completed works.

Type of course:
Designing wood industry plants (elective course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to explain basic concepts of production (material preparation, inner transport, the manufacturing of parts, surface treatment, assembly etc.) and technological (qualitative changes of the input material in the end product) processes in wood and wood panel processing and the manufacture of furniture	final examination	C3
to distinguish and categorise basic project types (pre-project, preliminary design, investment programme, executive project, the survey of completed works etc.) in the business system	exercises, correction, exercise evaluation, final examination	C3
to explain and use basic principles in the approach when building and reconstructing (adapting the technological process to science and technology development) wood industry plants in relation to the proper use of new equipment, production volume increase and environmental protection	exercises, correction, exercise evaluation, field report, final examination	C3
to select machinery, equipment and tools based on the criteria of increased productivity, tool cost reduction, increased machine life cycle (the choice of a suitable processing schedule, proper machinery and tool maintenance) improved product quality, rejects reduction etc.	exercises, correction, exercise evaluation, field report, final examination	C3
to analyse and evaluate factors influencing product durability and reliability (the quality of built-in materials, construction, processing, human environment impact)	final examination	C3
to analyse the production programme, production resources and suppliers for a more rational use of machinery and tools, increased production and reduced manufacture costs	exercises, correction, exercise evaluation, field report, final examination	C3
to recommend a suitable technological procedure and wood processing technology based on needs determined by means of an analyses while taking into account the safety of employees, increased machine efficacy and wood and wood panel utilization	exercises, correction, exercise evaluation, field report, final examination	C3
to assess and recommend the optimum manner of using existing technology to increase productivity, utilisation and product quality while taking into account market demands (eg. new product introduction)	exercises, correction, exercise evaluation, field report, final examination	C3
to manage the preparation of conceptual & technological solutions for the production (guided by the criteria of production technology, flexibility and productivity) the and product development study	final examination	C3
to design the work space and working areas in the work industry plant in order to ensure ergonomics (adequate machinery height), safety at work (noise, protection against dust, smoke, vapour and alike, working area illumination, vibrations etc.) and the proper arrangement of machinery	exercises, correction, exercise evaluation, field report, final examination	C3
to gather, group and process information about the assigned topic and present it	exercises, correction, exercise evaluation, field report, final examination	C3
to apply the knowledge acquired during the studies from other courses (final wood processing technology, conveyor technology in wood industry, technological processes of the surface treatment of wood etc.) to designing wood industry plants	exercises, correction, exercise evaluation, field report, final examination	C3

General competences
Acquiring knowledge about basic designing elements. To apply the knowledge acquired during the studies to design wood industry plants.

Type of instruction
Lectures
Exercises
Making exercises based on given parameters. For a draft product, preparing the technological solution and optimal machine arrangement in accordance with the capacity increase.

Working methods:
Teacher's obligations:
To hold original classes – lectures, exercises and field work. To develop exercises and draw up tests and grade them. To conduct oral examinations and hold consultations. To draw up the teaching material.
Students' obligations:
Regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission of exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			15	-	0,5
Exercising (E)	30%	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	30	39	2,3
		Neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, correct, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete, submitted on time	Very good (4)			
		Neat, correct, complete, submitted on time	Excellent (5)			
Oral examination (OE)	35%	60-70%	Sufficient (2)	-	36	1,2
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(OEx70 + Ex30)/100**		45	75	4

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student's class attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	in accordance with the syllabus	-
Exercises and making exercises	Student's attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade is the arithmetic mean. The requirements for taking the examination (oral part) are positively graded exercises which are included in the overall grade.	in accordance with the syllabus	-
Oral examination (OE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students' theoretical knowledge and their understanding of designing methods and procedures as well as of a given technological process will be examined. The final grade will be calculated by the formula **(OEx70 + Ex30)/100**	examination period	-

Obligatory literature

1. Petrič, Z.: Načela projektovanja v lesni industriji, LES 1-2, Ljubljana, 1972.
2. Tkalec, S.: Organizacija i projektiranje tehnološkog procesa u finalnoj drvnoindustrijskoj proizvodnji, "Drvna industrija" 1-2, Zagreb, 1974, str. 25-32.
3. Bogner, A., 1982.: Poboljšana linija za površinsku obradu ploča lakovima i oblaganje folijama. Drvna industrija 33, 7/8, 175-176.

Recommended literature

1. Rochstroch, W.: Betriebsgestaltung in der Holzindustrie, Leipzig, 1981, str. 189-255.
2. Mosch, H.P.: Betriebseinrichtung, Entwurfslehre fuer Projektirung und Rekonstruktion I. VEB Verlag Technik, Berlin, 1984, str. 251-365.
3. Rase, H.F., Barow, M.H.: Project Enginering of Process Plant, New York, 1957.
4. Tkalec, S., Bogner, A. 1983.: Tehnologija unutrašnjeg transporta u DIP "OGULIN" Preliminary design p. 22. Faculty of Forestry ZIDI.
5. Tkalec, S., Bogner, A. 1983.: Pomoćne radionice u DIP "OGULIN" Preliminary design p. 5. Faculty of Forestry ZIDI.

Industry environmental protection

WP-2356

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Prof. Anka Ozana Čavlović, PhD
Prof. Ružica Beljo Lučić PhD
Prof. Vlatka Jirouš Rajković, PhD
Prof. Vladimir Jambreković PhD
Assoc. Prof. Marin Hasan, PhD

Associate teacher for exercises
Prof. Anka Ozana Čavlović, PhD
Prof. Ružica Beljo Lučić, PhD
Prof. Vlatka Jirouš-Rajković, PhD
Prof. Vladimir Jambreković, PhD
Assoc. Prof. Marin Hasan, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Emission of solid aerosols and gases from energetic installations, boiler rooms and transport equations in wood industry. Biomass and fossil fuel combustion. Emission of CO, CH_4, SO_x, NO_2, NO_x, NMVOC, CO_2. Greenhouse gases. Aerosol. Airborne particles as absorbers of heavy metals (lead, cadmium, manganese), acidic components (chloride, nitrate, sulphate), and polycyclic aromatic hydrocarbons. Waste water from veneer, pulp and paper production. Impact climate index of a company. Choice of a clean transport. Catalytic cleaning of gases from static and dynamic sources. Nitrate removal by ionic change. Mechanical separators. Introduction of international standards – Environmental Management System ISO 14 000. Legislation on air and water protection. Emissions at working places: wood and metallic dust, noise, vibration, VOC, formaldehyde, wood preservation components. Regulatory Act on maximum permissible concentrations (MPC) of hazardous substances in the working atmospheres and biological limit values (BLV). International standards of occupational health OHSAS. Legislation on of occupational health and workers protection. Air cleaner system control, separators, absorbers, anti - vibration equipment. Management of industrial environment.

Type of course:
Industry environmental protection (elective course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
recommend cleaner energy and raw materials, methods, techniques and technologies of wood processing and wood products design according to the 4R principles of cleaner production (reduce, replace, reuse and recycle);	Evaluation a short report	C7, E3
suggest activities in wood processing companies for implement regulations and norms related to the protection of industrial environment;	Evaluation a short report	C7, E3
propose and implement legislation on the safety at wood production working places and suggest precautions and protective equipment at the workplace, and opportunities to reduce exposure;	Evaluation a short report	C7, E3
determine the worker's exposure to wood dust by using a photometric method and evaluate and interpret the obtained measurement results;	Evaluation laboratory exercises	C7
measure, analyze and evaluate the noise level at the workplace in woodworking, apply the appropriate noise reduction methods, investigate the worker's noise exposure, and apply the optimal methods of protecting the worker from excessive noise;	Evaluation laboratory exercises	C7
interpret the impact of wood processing on the carbon cycle and the issue of greenhouse gases;	Evaluation of debate	C7
calculate the quantities of pollutants (CO, CO2, NOx, SOx, PM10) from the discharge of wood waste, the amount of carbon dioxide from combustion of fossil fuels used for transport in the production and the amount of accumulated carbon in the wood product;	Evaluation of calculation exercises	C7
to propose and describe the optimal protection technology for a number of protective products for wood products, to anticipate and describe possible human and environmental hazards for the selected protective agent and to propose possible recovery and recycling processes of treated wood products;	Evaluation a short report	B3, C7, E3
to interpret the problem of wastewater in the production of wood fibers and paper	Evaluation laboratory exercises	C1, C7
evaluate the emission of free formaldehyde wood materials;	Evaluation laboratory exercises	C1, C7
distinguish hazardous substances in the wood varnish process and the basic method of purifying air and water in paint shops;	Evaluation a short report	C2, C7, E3
design measures to reduce volatile organic compounds in the surface treatment of wood and wood materials and make solvent management plans;	Evaluation a short report	C2, C7, E3
to recommend an integrated environmental management system, quality system and safety at work;	Evaluation a short report	C7, D1, E3

General competences

Students acquire skills required in wood industry environmental management. They are introduced to contamination sources of a working atmosphere, monitoring of emissions, standards and legislation, as well as to ecology engineering and administrative methodology of environmental protection.

Type of instruction

Lectures

Performing lectures by using the active learning method (reflection, shorter lectures, reading, research, dissemination, evaluation).

Exercises

Students have a number of smaller tasks to explore current topics and oral presentations. They actively participate in active learning teaching (critical review, case analysis, action plan and debate).

Working methods:

Teachers' obligations:

Educate in an active way using as many practical examples as possible. Designing exercises and tasks and correction of exercises and discussion with students. Maintenance of written and oral exams. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	10%	-	-	15	-	0,5
Exercises (short report) (E)	20%	The report does not have the default format and has a contribution to the already well-known knowledge	Sufficient (2)	30	36	2,2
		The report has given form and in addition to contributions already known knowledge has a smaller original contribution.	Good (3)			
		The report has the default format but has a medium original contribution.	Very good (4)			
		The report has the default form and high original contribution.	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	3	36	1,3
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Lx10+Ex20 + FEx70)/100**		48	72	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The presence of students on the class is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours. The student activity is recorded by the task and presentations in the student group.	semester (45 hours of direct lecturer)	-
Short tasks	Concerning the topic of lectures, students receive short research tasks which need to present in the course. Reports are evaluated.	according to the agreement	It is possible to bring the task next week and present it later.
Written exam	The written exam consists of 22 theoretical and computational questions of 28 points. It is necessary to have more than 16.8 points (60%) for a positive rating.	Exam terms	
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Verification of theoretical knowledge (from scripts), understanding of environmental protection. The final grade is obtained according to the formula: **(Lx10+Ex20 + FEx70)/100**	Exam terms	

Obligatory literature

1. Čavlović, A.O.: Interna skripta iz kolegija „Zaštita industrijskog okoliša“, Šumarski fakultet Zagreb, 2017.
2. E-kolegij u sučelju Merlin https://moodle.srce.hr/2018-2019/course/view.php?id=37709

Recommended literature

1. McCreary, J.H.: ISO 14 000: A Framework for Co-ordinating Existing Environmental Management Responsibilities, Dewars&Doyle, UK, 1995.
2. Filipan, I.: Goriva i maziva za cestovni promet. Škola za cestovni promet, Zagreb, 1994.
3. Payton, K.B.: Fuel field manual: Sources and sollutions to performance problems. Nelco/Exxon Energy Chemicals, L.P., Ne York, McGraw Hill, 1998.
4. Heinsohn, R.J., Sources and Control af Air Pollution, Prentice Hall, 1999.
5. Grisogono, P.: Industrijske peći i primjena goriva. Sveučilište u Splitu, 1994.
6. N. de Nevers, Air Pollution Control Engineering, McGraw-Hill, N.Y., 1995.
7. Šverko, B., Jerenić, Ž.: Ergonomski aspekti novih tehnologija, Hrvatsko ergonomsko društvo, Zagreb, 1991.

Field work III – Wood technology processes

WP-2357

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 3th semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:
Field work III – Wood technology processes (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Formulate the technological process (technological map and description of operations) in the industrial production of construction timber products (windows, doors, floor coverings, laminated carriers).	Field work report evaluation	C2, C3,C4
Appoint and interpret technological parameters of production, measure technological parameters and evaluate the suitability of measurements (dimensionality and shape accuracy, surface smoothness, density, water content and hardness of wood, glue application, pressure temperature and duration of adhesive hardening, application of surface treatment and hardening dynamics in production floor elements of wood.	Field work report evaluation	B1, C4
Collect information about the production program, the materials used in surface treatment of wood, and compile a flow chart of the technological surface processing of wood.	Field work report evaluation	A2, C2
Analyze the technological process of surface treatment of wood and propose possible technical advancements.	Field work report evaluation	C6
Assess the justification of the applied surface treatment technology and choose an alternative option.	Field work report evaluation	B1, C4, C7
Identify and differentiate impregnation by full cell method from empty cell method. Identify factors that affect the quality of wood preservation (impregnation) and, if necessary, remove them to improve the quality of protection.	Field work report evaluation	B3
Find appropriate solutions that will contribute to the quality of the protection procedure. Manage, control and improve (develop) the wood product protection process independently.	Field work report evaluation	B3
Report on the management and quality assurance of the production process in primary processing and furniture production. Collect information on norms and standardization (state, international). Capture the ability of a technological process in the field and determine the critical points of the process.	Field work report evaluation	A1, D1, D5, E3

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of gathering data on the factors of the manufacturing process or business of the company. Based on calculations and analysis, the student suggests improvements for a more rational and optimal process. The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:
Teachers' obligations:
Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.
Students' obligations:
Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The students' skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		

Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
   Available at http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=39

Master thesis - Wood technology processes

WP-2457

ECTS 30

Grading

Course content:
Master thesis is an individual written work based on students' own research that is written in a scientific form and implies students' engagement in work that is equivalent to 30 ECTS module. Graduation is usually done during IV. semester on graduate study and ends with oral defense (presentation and answering the questions).

Type of course:
Master thesis - Wood technology processes (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
apply the current knowledge to define a scientific and professional problem in choosing the topic of work	Master thesis
create a schedule of work in accordance with the deadlines of making the graduate thesis in stages	Master thesis
independently devise a methodology of research work	Master thesis
apply the methodology of writing a professional and scientific work	Master thesis
present their work in written and oral form, using skills succinct interpretation of the results and conclusion of these guidelines to predict the future development of the topics of work	Master thesis, public defense of master thesis

General competences
Master thesis is an independent, comprehensive and highly independent task in which the student must demonstrate knowledge of the background of the profession and of the scientific research work, ie, in the definition of hypotheses and research goals, research planning, data collection and processing and writing of scientific work. Includes expansion and deepening of knowledge of the content of the curriculum, individual engagement around the problem topics, gaining experience in writing technical papers, the ability to apply scientific methods and instruments in processing problems and drafting work, the ability of independent service corresponding domestic and foreign literature and the use of knowledge, facts and attitudes published in the mentioned sources.

Type of instruction
Other
A student under the guidance of a mentor conducts research and writes a master thesis on a subject accepted by the master examination Commission. Master thesis is defended in front of the commission for evaluation and defense of graduate thesis which completes graduate study.

Working methods:
Teachers' obligations:
Hold consultations every week according to schedule. Provide the student with the necessary help and instructions when submitting themes and planning the graduate thesis. Conduct a student to set up tests, conduct analysis, and collect and analyze data. Introduce the student with the principles of ethical

approach in writing graduate thesis. Review the master thesis and give instructions for refinement before binding. Help the student prepare for public defense diploma work.

Students' obligations:

Report the topic of master thesis, conduct research and work in accordance with the Instructions for designing master thesis. Come to consultations and present progress in research and work. Observe and follow the instructions of the mentor. Observe the principles of ethical approach to writing master thesis. Prepare the presentation and defend the master thesis in front of the appointed commission.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Master thesis (MT)	70%	See description	Sufficient (2) Good (3) Very good (4) Excellent (5)		810	27
Public defense of master thesis (PD)	30%	See description	Sufficient (2) Good (3) Very good (4) Excellent (5)		90	3
TOTAL	**100%**				900	30

Evaluation elements	Description	Deadline
Master thesis (MT)	sufficient (2) - There are substantial deficiencies in the work, the basic concepts are superficial and no deeper knowledge of the subject good (3) - Only some of the relevant aspects of the topic are presented in this paper, the literature is processed correctly but only partially. The scientific and professional vocabulary is basic very good (4) - The work is well-structured with facts, relevant theories and up-to-date data are presented, the literature is correctly elaborated, but the approach lacks creativity. excellent (5) - The work is logically well structured factually correct and conceptually well-defined, the entities are related, the relevant and recent literature is used and the approach to the topic from different perspectives is visible.	
Public defense of master thesis (PD)	sufficient (2) - The presentation is a retelling of the read text, the answers to the questions are scarce. good (3) - The presentation is clear and informative, but without the ability to link theory to practice. Ability to answer only simple questions. very good (4) - The presentation is clear and substantive, the answers to the questions are just correct and do not indicate a deeper reflection on the topic. excellent (5) - The presentation is clear, highly informative, answers the questions right and creative.	

Obligatory literature

1. Pravilnik o izradi i obrani diplomskog rada na diplomskim sveučilišnim studijima Šumarskog fakulteta
2. Obrazac DS-1 Zamolba za odobrenje teme i mentora diplomskog rada
3. Upute o izgledu i sadržaju diplomskog rad
   Dostupno na http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=43

Graduate study
H. WOOD PRODUCTS DESIGN

In the conditions of development of wood processing and its finalization and in the expected significant development of this area, based on its own raw materials of the Republic of Croatia, the design of furniture and other finished wood products is already present, and especially in the coming years, will be an increasing support for this development.

There is currently no such university study in the Republic of Croatia that could fully meet the needs of contemporary design, design, manufacture and sale of furniture. (Design Faculty at the Faculty of Architecture educates designers of the general direction, and conceptualises the students to realize the appropriate design solutions in collaboration with constructors, technologists and other experts, but too little technical education prevents their independent work in the konstruction work and production planning and new concepts or redesigned products, as well as in interior design and furnishing skills).

The Study of Wood Product Design represents a unique form of graduate education that includes systematic and complete knowledge and understanding of the complexity of the design, construction and manufacture and sale of furniture and other wood products. Only in this study students are able to specialize their knowledge of wood and wood (composite) materials as inspirational raw materials in product design, study methodological approaches in design, construction and CNC technologies for final product production and to bring about the relationships and communication of man, furniture and dedicated space as well as the conscious use of furniture in relation to human health and the environment.

The aim of the study is to enable students to independently and creatively solve the problem of design of furniture and other final products, regardless of the fact that they operate in larger or smaller plants or shops, expressed in the areas of design, construction, modern technology for the production and processing, testing and quality assurance of final products, the use of modern IT technology in designing and designing, and also furnishing facilities and furniture trade and other end products.

The question of the expediency of the proposed study considering the labor market in the public and private sectors will be invaluable not only for graduating students who intend to find work in the profession, but to all areas of public and private economic sectors involved in the design, production and distribution of furniture and interiors . Today's need for universal knowledge and people who know and can engage in the problem of rapid and productive team and interdisciplinary problem solving is partly a response to this kind of projection of the study. Students have been trained to have a solution based on fundamental analysis and problem solving, realized in a prototype or product that can find its place in the market Meaningful and meticulously designed programs each case directing the student to the use of existing scientific modern knowledge, which studies associated with departments for development, construction, technology or other departments and establishments manufacturing company which product should streamline the decision or innovate. They also introduce students into new systematic researches that are enabled in modernly equipped laboratories and research institutes at

the faculty, CAD and other IT equipment, whose results and findings are used in further collaboration with the economy.

Many smaller universities in the world, such as High Point in the United States (North Carolina, www.highpoint.edu), especially the Fachakademie GAP (Fachschule für Schreiner und Holzbildhauer, www.fachschule-schreiner.de), Angewandte Kunst Schneeberg (www.fh-zwickau .de / aksor), MOFA universities in Germany (Fachschule des Möbelhandels, Köln, www.moefa.de) and the College of Fine Arts (Seoul, Korea) related design studies, technology and economy of furniture and other finished wood products as well as interior design, with the possibility of specialization in a particular area. Particular emphasis should be put on their relationship with manufacturing companies, as well as other economic and public sectors that are regularly realized through student competitions and project assignments.

List of compulsory and optional courses

I YEAR

Code	Course unit	L*	PW	FW	ECTS
	1st semester				
WD-1158	CONSTRUCTION OF WOODEN PRODUCTS III	2	2		5
WD-1159	TECHNOLOGICAL PRODUCTION MANAGEMENT	2	2		5
WD-1160	PANEL MATERIALS	2	1		4
WD-1161	METHODOLOGY OF INDUSTRIAL DESIGN OF FURNITURE	1	2		4
	OPTIONAL COMPULSORY COURSE	2	1		4
	OPTIONAL COURSE**	2	1		4
WD- 1166	FIELD WORK			6	4
	Total:	11	9		30
	Optional compulsory courses				
WD-1162	MACROSCOPIC PROPERTIES AND TEXTURE OF WOOD	2	1		
WD-1163	FURNITURE AND INTERIOR DECORATION	2	1		
WD-1164	METHODS IN WOOD STRUCTURE RESEARCH	2	1		
WD-1165	NONWOODEN MATERIALS	2	1		
	2st semester				
WD-1266	INVESTIGATION OF PHYSICAL AND MECHANICAL PROPERTIES OF WOOD	2	2		5
WD-1267	WOOD COMPOSITE MATERIALS	2	2		5
WD-1268	QUALITY ASSURANCE OF FINISHED PRODUCTS	1	2		4
WD-1269	INFORMATION SYSTEMS ON WOOD PRODUCTS MARKET	2	1		4
	OPTIONAL COMPULSORY COURSE	2	1		4
	OPTIONAL COURSE**	2	1		4
WD-1273	FIELD WORK			6	4
	Total:	12	8		30
	Optional compulsory courses				
WD-1270	CONSTRUCTION OF WOODEN PRODUCTS IV	2	1		
WD-1271	SPECIAL PRODUCTS OF WOOD	2	1		
WD-1272	SELECTION OF TOOLS AND PARAMETERS OF WOODWORKING	2	1		
WD-1280	INTERNATIONAL MARKET OF WOOD PRODUCTS	2	1		

* L– lectures (classes/week); PW – practical work (classes/week); FW – field work (days/semester)
**That can be chosen from a list of courses at their own studies or from other studies.

2 YEAR

Code	Course unit	L*	PW	FW	ECTS
	3st semester				
WD-2373	FINISHING OF WOOD PRODUCTS	2	2		5
WD-2374	DESIGNING OF WOODEN PRODUCTS	2	2		5

WD-2375	FURNITURE AND HEALTH	2	1		4
WD-2376	APPLIED STATISTICS	2	1		4
	OPTIONAL COMPULSORY COURSE	2	1		4
	OPTIONAL COURSE**	2	1		4
WD-2381	FIELD WORK			6	4
	Total:	12	8		30
	Optional compulsory courses				
WD-2377	TESTING GLUED JOINS	2	1		
WD-2378	QUALITY MANAGEMENT AND INSURANCE	2	1		
WD-2379	PROJECT MANAGEMENT	2	1		
	4st semester				
WD-2481	DIPLOMA WORK				

* L– lectures (classes/week); PW – practical work (classes/week); FW – field work (days/semester)
**That can be chosen from a list of courses at their own studies or from other studies.

Pogramme requirements and learning outcomes

The graduate study programme in Wood Products Design develops the competencies necessary for managing interdisciplinary issues pertaining not only to designing and constructing products and presenting them, but also to decisions regarding choice of material, proper finishing technology and ensuring quality of the final product. The studies enable students to adopt methodologies of final wood products design, product development, quality improvement, product design and construction, furnishing facilities and presenting and selling products. In the first year of studies, students fully acquire knowledge of wood properties, panel materials and wood composite materials. By upgrading their knowledge in the field of wood product constructions students completely master complex computer programmes. Students acquire the methodology of industrial furniture design. They become qualified to conduct technological production management. In the field of quality assurance of final products, students acquire the knowledge necessary for developing a quality system compatible with international standards. By mastering information systems on the wood product market, students acquire the knowledge necessary for monitoring market trends. Through elective courses from the list submitted in the study programme and free elective courses, students have the opportunity to broaden their knowledge. Through fieldwork in project centres and wood processing plants they acquire the necessary practical experience. In the third semester of the second year, students improve their knowledge of wood product design through methods of designing and finishing wood products. Furniture and health is an interdisciplinary course which provides them with the necessary insights to be able to have a broader perception of the issues in design, manufacturing and furniture usage. Applied statistics allows them practical usage, and provides a basis for scientific research work. An elective course from the list submitted in the study programme and a free elective course enable them to broaden additionally their knowledge and insights into wood products design. Through fieldwork in project centres and wood processing plants they acquire the necessary practical experience. The forth semester is dedicated exclusively to research related to the master's thesis. Students acquire competencies for performing the most complex jobs in wood products design and for continuation of education in doctoral and specialist studies by individually writing the master's thesis. Defending the master's thesis is a requirement for the conclusion of studies. With the knowledge acquired during the study programme, a Master of Engineering in Wood Products Design is able to:

A) WITH GENERAL ENGINEERING COMPETENCE

—A1: Inform potential buyers of final product quality characteristics and of trends in wood products design,
—A2: Independently gather data, statistically process, present and analyse gathered data, discuss and make conclusions based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways,
— A3: Give presentations at fairs.

B) WITH FOCUSED ENGINEERING COMPETENCE
—B1: Apply current technical regulations in ensuring quality of wood, wooden materials and final products,
—B2: Resolve interdisciplinary problems which refer not only to product design or construction and their presentation, but also include the selection of all production materials, processing technology and assurance of final product quality,
—B3: Apply final wood product, wooden and non-wooden materials design methodology in developing and improving products, quality upgrade, product design and construction,
—B4: Develop and plan a complete construction system which consists of planning, designing, constructing, preparing technical documentation and applying technologies

for final product manufacturing
—B5: Evaluate board materials according to processing possibilities, technical and ecological characteristics, and choose optimal constructional solutions adequate for the properties and processability of each board material type,
—B6: Evaluate, select and apply composite materials regarding the patterns existing inside the wood composite construction system and decide on the selection of proper material,
—B7: Apply theoretical, practical and methodological basics of furniture design as a complex interdisciplinary process,
—B8: Develop the ability of independent analytic and creative design and acting,
—B9: Analyse and make conclusions on wood properties and their application in wood product design,
—B10: Apply knowledge of furniture quality and methods of its examination and develop and plan a complete system of final product quality assurance,
—B11: Perceive space, conduct measuring, display, plan, design and equip functional special units and apply methods of analysis and coordinating functional furniture groups in relation to the space,
—B12: Develop skills of complete space equipping.

C) WITH TECHNOLOGICAL ENGINEERING COMPETENCE
—C1: Construct wooden products for building purposes in accordance with the basic safety criteria and usage functionality,
—C3: Conduct furnishing of facilities,
—C4: Recommend the finishing process technology for products, evaluate quality of the finishing process and recommend methods for preventing mistakes in the finishing process,
—C5: Apply systematic work methods on planning with the aim of rational material application and constructional solutions,
—C6: Manage projects from the preliminary design to serial production with additional operating of CAD programmes for visualization and automatic construction,
—C7: Apply contemporary methods and techniques of healthy furniture design and ensure protection of man and environment through its production and usage,
—C8: Choose optimal constructional solution and its versions using discursive methods,
—C9: Apply 3D modelling using AutoCAD and 3D Studio MAX programme packages,
—C10: Programme during construction process in order to improve design productivity, and thus the entire production system,
—C11: Choose tools and set the parameters for the operation of mechanical treatment in final wood processing.

D) WITH ORGANISATIONAL ENGINEERING COMPETENCE
—D1: Perform responsible tasks in company management in the area of production management, technical production preparation, termination and management of materials,
—D2: Manage and ensure quality adapted to specific production problems in wood product design,
—D3: Manage and conduct international trade in wood and wood products,
—D4: Perform responsible tasks in company management in the area of project management.

E) WITH OTHER ENGINEERING COMPETENCE
—E1: Perform tasks of scientific and professional associate in scientific research institutions

in the field of wood and wood technology,
—E2: Conduct courses in vocational secondary schools and other similar schools,
—E3: Perform activities and tasks in publicist writing and the media related to the wood profession,
—E4: Upgrade their professional and scientific competencies through different forms of education and postgraduate studies.

The correlation between the learning outcomes of the subject and the learning outcomes of the program

Code from course	General engineering competence			Focused engineering competence												Technological engineering competence										Organizational engineering competence				Other engineering competence			
	A 1	A2	A3	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	E1	E2	E3	E4
DD-1158		+			+		+					+	+		+	+	+		+			+	+										
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Construction of wood products III

WD-1158

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2

Lecturer
Professor Ivica Grbac,. Ph.D.
Associate Professor Ivica Župčić, Ph.D.

Associate teachers for exercises
Associate Professor Ivica Župčić, Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to the construction of wood objects for civil engineering. Construction of outer doors of solid wood. Construction of inner doors. Construction of window frames and balcony doors. Interior equipment (ceiling lining, floor lining, staircases and stairs, separating walls, built-in cupboards). Interior equipment for yachts and ships. Construction of the equipment for children's playgrounds. Exterior equipment. Building construction. Construction of funeral equipment. Construction of special wood-made products (additional interior equipment, toys, fancy articles and packaging materials).

Type of course:

compulsory, 1. semester, 1. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to describe and explain the construction types of objects for civil engineering (doors, windows, and interior equipment) based on their modelling features and use;	drawing exercises, correction, exercise evaluation, field report, final examination	C1
to recommend and chose the type of wood and non-wood material for making objects for civil engineering with regard to their physical and mechanical properties;	drawing exercises, correction, exercise evaluation, field report, final examination	C4
to analyse physical and mechanical properties of wood as the basis for modelling objects for civil engineering;	final examination	B9
to design, draw and describe windows and balcony doors based on the principle of functionality, safety and durability of use;	drawing exercises, correction, exercise evaluation, field report, final examination	C1
to design, draw and describe outer and inner doors (entrance, room, cellar door with a suitable door frame) based on the principle of functionality and safety of use;	drawing exercises, correction, exercise evaluation, field report, final examination	C1
to design, draw and describe the interior equipment of a facility (separating walls, floor, wall and ceiling lining, staircases and stairs, built-in cupboards) based on the principle of functionality and safety of use;	drawing exercises, correction, exercise evaluation, final examination	C1
to calculate the dimensions of steps (height & width) and staircases (walking line inclination and length) for straight, double-flight, multiple-flight and curved staircases;	drawing exercises, correction, exercise evaluation, final examination	C7
to manage and supervise the installation of windows, doors and interior equipment ;	final examination	C2
to recommend a cost-effective application of materials and the optimal construction solution with regard to material consumption and quality;	drawing exercises, correction, exercise evaluation	C4
to use CAD programmes as aid when designing and virtualising objects for civil engineering;	drawing exercises, correction, exercise evaluation	C8
to draw up the technical documentation and choose the suitable technology for product manufacturing;	drawing exercises, correction, exercise evaluation	B4
to sketch and describe funeral equipment (coffin, sarcophagus and semi-sarcophagus)	drawing exercises, correction, exercise evaluation	B2
to recognise the modelling and construction solutions of the equipment for children's playgrounds with regard to the safety of user according to the applicable regulations (HRN EN standards);	final examination	B10

to recognise and describe the technological process of window and balcony door production;	final examination	B4
to sketch and analyse the construction of special wood-made products (additional interior equipment);	exercises in a computer classroom, correction, exercise evaluation, final examination	B12
to recognise and describe factors examined in doors and windows;	final examination	B2
to develop products such as windows, doors and interior equipment (product planning, modelling, designing, manufacture and presentation);	drawing exercises, correction, exercise evaluation	C1
to gather, group and process information about the assigned topic and present it	exercises	A2

FIELD WORK

Organised visits to furniture of wood products for civil engineering, interior and funeral equipment. To become familiar with the technological process of manufacturing.

Organised visits to international fairs of furniture and accompanying industry.

General competences

acquiring knowledge of designing and the types of wood products for civil engineering, of the development, needs and manners of testing product quality as the basic criteria for product safety and functionality when being used; to develop skills required for the development and planning of the complete designing system: planning, modelling, designing, preparing technical documentation and the technology applied when constructing the end product.

Type of instruction

Lectures

Exercises

Using design tools in AutoCAD software for individual assignments in order to apply what they have leant in classes. Making technically equipped drawing exercises for digital and freehand sketching.

Working methods:

Teacher's obligations:

to hold original classes – lectures, exercises and field work. To develop exercises and draw up tests and grade them. To conduct oral examinations and hold consultations. To draw up the teaching material.

Students' obligations:

regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission of exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures(L)	-			30	-	1
Exercises (E)	30%	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	30	45	2,5
		Neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, ccorrect, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete and submitted on time	Very good (4)			
		Neat, correct, complete, submitted on time	Excellent (5)			
Written examination (WE)	35%	60-70%	Sufficient (2)	-	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral examination (OE)	35%	60-70%	Sufficient (2)	-	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(WEx35 + OEx35 + Ex30)/100**		60	90	5

Oral examination (OE)	35%	60-70%	Sufficient (2)	-	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

TOTAL	**100%**	**(UIx70 + Vx30)/100**		45	75	4

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	in accordance with the syllabus	-
Exercising and making exercising	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade is the arithmetic mean. The requirements for taking the examination (written part) are positively graded exercises .	in accordance with the syllabus	-
Written examination (WE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students randomly choose an assignment with the product photograph or given parameters for drawing and designing. Orthogonal projections and characteristic sections are drawn freehandedly, and the component and technical description on forms prepared beforehand. The written examination is graded and included in the final grade .	examination period	-
Oral examination (OE)	A requirement for taking the oral examination is to acquire sufficient scores in the written part of the examination. Students' theoretical knowledge and understanding of constructional compositions are examined. The final grade will be calculated by the formula **(WEx35 + OEx35 + Ex30)/100**	examination period	

Obligatory literature

1. Turkulin, H., Jirouš-Rajković, V. i Grbac, I. (1997): Površinska postojanost drvnih građevnih konstrukcija (Surface Durability of the wood Building Constructions, Šumarski list, 121, Zagreb.
2. Turkulin, H., Ljuljka, B. (1988): Lamelirana građevna stolarija, Zagreb
3. Ivelić, Ž., Turkulin, H., Grbac, I., Bogner, A. (2001): Primjena računala u dizajnu i konstrukcijama drvnih proizvoda za građevinarstvo (Use of computers in design of wood building components), International conference: Wood in construction industry - tradition and future, University in Zagreb, Faculty of Forestry (Croatia), Zagreb
4. Grbac, I. i sur. (2001): Obrada i uporaba jelovine (The use and processing of fir), monografija "Obična jela u Hrvatskoj", Academy of Forestry Science, Zagreb

Recommended literature

1. Šimetin (1983): Građevinska fizika, Liber, Zagreb;
2. Mayer-Bohe (1983): Fussböden, Stuttgart, Njemačka;
3. Reitmayer, U. (1967): Holzfenster, Julius Hoffmann Verlag, Stuttgart, Njemačka;
4. Reitmayer, U. (1942): Holztüren und Holztore, Julius Hoffmann Verlag, Stuttgart, Njemačka;
5. Bonardi, G. (1993): Le Scale Elicoidali, Aspetti Tecnologici e Strutturali – tesi di laurea,
6. Politecnico di Milano, Facolta di Architettura, Milano, Italija;
7. Reitmayer, U. (1974): Holztreppen, Julius Hoffmann Verlag, Stuttgart, Njemačka.

Technological production management

WD-1159

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 1

Lecturer
Professor Denis Jelačić, Ph.D.

Associate teacher for exercises
Professor Denis Jelačić, Ph.D.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Goals and tasks of production management in wood processing and furniture manufacturing. Technological, operations management and work distribution. Production management as a part of management subsystem. Production order as a main holder of production management information. Planning, launching, execution and control of production orders. Technological production management.Establishing of product components. Types of components. Establishing the material standards. Establishing the time standards, production time, and production order time. Establishing the flow coefficient. Making of schedule plans.Establishing the production order launch priorities. Material management. Methods for establishing optimal stock sizes.Method for establishing capacity requirements. Control of production execution. Work distribution and production order evaluation.Multiplication, completion and launch of production documentation. Analysis of operation plan execution.Production evaluation, production order evaluation and analysis. Production management documentation. Workfolw of production management documentation as a part of information subsystem.Project of management-information system in wood processing and furniture manufacturing. Basics for making projects of management-information systems. Systematical, analytical and synthetical approach to making such projects.

Type of course:

Technological production management (elective course, 1st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To establish the position and activities of production management within management system;	Exercises evaluation, partial exams, final exam	D1
To create production order as a main holder of production management information;	Exercises evaluation, partial exams, final exam	D1
To establish material standards and requirements for production;	Exercises evaluation, partial exams, final exam	D1
To establish time standards and requirements for production;	Exercises evaluation, partial exams, final exam	D1
To establish capacity requirements for production;	Exercises evaluation, partial exams, final exam	D1
To prepare and make complete technological documentation as a part of management-information system in company;	Exercises evaluation, partial exams, final exam	D1
To make a project of management-information system in company	Exercises evaluation, partial exams, final exam	D4

General competences

Student gets knowledge necessary to work in the industrial branche on work posts with responsitilies in enterprise management in the field of production management. It is especially important on work posts of technological production management, in a field of scheduling, material management and similar.

Type of instruction

Lectures
Lectures on theoretical basis prepare students for work on work posts with responsitilies in enterprise management in wood processing and furniture manufacturing in the field of technological production management with practical examples and with computer technology aid, which make exercises and the whole subject easier to acquire.

Exercises
Exercises on individual tasks with a purpose to implement theoretical basics learned on the lectures in a work in computer practicum using computer softwares. Making of technicaly prepared complete projects with the complete technological documentation and the project of management-information system for production of individual task product.

Working methods:

Teachers' obligations:
To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Studenats' obligations:
To attend the lectures and exercises regularely and to activelly participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	40%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	28	30	3
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex40 + PE1x30+PE2x30)/100**		60	60	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation

Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (30 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester. The project is 40 points and together with partial exams points it makes 100 points (100%).	At the end of semester	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 1 is 30 points and it covers the subject lectured until the time of partial exam.	7^{th} week	
Partial exam 2	Partial exam 2 can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 2 is 30 points and it covers the subject between partial exam 1 and time of partial exam 2. Students who collect enough points in two partial exams and in exercise project pass the subject and get the final grade.	13^{th} week	
Oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Grladinović, T. 1999: Upravljanje proizvodnim sustavima u preradi drva i proizvodnji namještaja, Šumarski fakultet, Zagreb.
2. Jelačić, D. 1995: Upravljanje proizvodnim sustavima u preradi drva i proizvodnji namještaja (Zbirka zadataka), Šumarski fakultet, Zagreb.

Recommended literature

1. Figurić i sur, 1992: Proizvodni sustavi u drvnoj industriji I, Šumarski fakultet, Zagreb.
2. Figurić i sur, 1992: Proizvodni sustavi u drvnoj industriji II, Šumarski fakultet, Zagreb.
3. Figurić i sur, 1993: Proizvodni sustavi u drvnoj industriji III, Šumarski fakultet, Zagreb.
4. Figurić i sur, 1994: Proizvodni sustavi u drvnoj industriji IV, Šumarski fakultet, Zagreb.
5. Figurić i sur, 1995: Proizvodni sustavi u drvnoj industriji V, Šumarski fakultet, Zagreb.

Panel Materials

WD-1160

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work

Lecturer
Professor Vladimir Jambreković, PhD
Assistant Professor. Nikola Španić, PhD

Associate teacher for exercises
Assistant Professor Nikola Španić, PhD

Grading

Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:

Elaboration of regulations associated with use of panel materials. Panel materials quality demands considering the construction and furniture design demands. Specific demands for panel materials in interior design. Wooden panels as construction materials for buildings. The influence of wooden raw material type on panel properties. The influence of chemical components on panel properties. The economic aspect of panels' applicability. The ecological aspects of panels' applicability for use in interior. The influencing factors on physical properties of panel materials. The influence of used raw material on panel's mechanical properties. The influencing factors on stability of panels in interior use. Panel durability factors in construction. Dependability of technical properties and formaldehyde emission. Specifics of combustion of unprotected panel materials. The influence of fire retardant on technical properties of panels. The influence of panel structure on heat and sound conductivity. Machinability of panels considering the type of raw material and structure. Aesthetic, ecological and technical aspects of panel overlaying with natural and synthetic materials. Comparable properties of panel materials. The direction of panels' properties development. The limitations of toxic chemical components share in panel structure.

Type of course:

Panel materials (obligatory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to interpret the rules for the application of panel materials	laboratory and practical classes, seminar paper, final exam	B5
to explain the requirements for the quality of panel materials with regard to construction requirements and furniture design requirements	laboratory and practical classes, seminar paper, final exam	B5
to identify specific requirements for panel materials in interior design	laboratory and practical classes, seminar paper, final exam	B5
to recommend wooden boards as constructive materials in buildings design	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the impact of wooden raw material on panel properties	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the impact of chemical components on panel properties	laboratory and practical classes, seminar paper, final exam	B5
to determine the applicability of the panels from the economic aspect	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the applicability of the panels for indoor use from the ecological aspect	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the important factors influencing the physical properties of panels	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the mechanical properties from the aspects of used raw material	laboratory and practical classes, seminar paper, final exam	B5
to analyse influential factors on panel stability in indoor use	laboratory and practical classes, seminar paper, final exam	B5
to determine the stability factors of panels in construction	laboratory and practical classes, seminar paper, final exam	B5
to explain the dependability of technical properties and formaldehyde emission	laboratory and practical classes, seminar paper, final exam	B5
to describe the specifics of burning of unprotected panel materials	laboratory and practical classes, seminar paper, final exam	B5
to examine and analyse the influence of fire retardants on technical properties of panels	laboratory and practical classes, seminar paper, final exam	B5
to explain the influence of panels structure on heat and sound conductivity	laboratory and practical classes, seminar paper, final exam	B5
to evaluate the machinability of panels with regard to wooden raw material type and structure	laboratory and practical classes, seminar paper, final exam	B5
to evaluate aesthetical, ecological and technical aspects of panel overlying with natural and synthetic materials	laboratory and practical classes, seminar paper, final exam	B5
to compare panel materials properties	laboratory and practical classes, seminar paper, final exam	B5
to recommend the guidelines of panel materials development	laboratory and practical classes, seminar paper, final exam	B5
to recommend limiting the share of toxic chemical components in the panel structure	laboratory and practical classes, seminar paper, final exam	B5

General competences

Acquiring of knowledge about physical, mechanical, aesthetic and ecological characteristics of panel materials together with possibilities of machining, in order to choose the optimal constructional solution suitable for particular material and design solution.

Type of instruction

Lectures

Exercises

As part of the exercise, the physico-mechanical, chemical, technical, acoustic and thermal properties of various types of wooden panel materials are examined in laboratory. All tests are of practical character and are carried out on samples of industrially produced particleboards, fibreboards, blockboards and plywood. On exercises the influence of the panels' structure (e.g. orientation of veneer plyes in plywood, or particles orientation in OSB panels), wood species and overlaying material on panel properties are also detremined, as well as are the properties of fragmented, fibrilated or stratified wood based mouldings. Exercises are an upgrade to the knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises report and seminar papers within the given time frame. To attend the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	15	1
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible and on time	Excellent (5)			
Seminar paper (SP)	10%	Partially disordered, incomprehensible and illogically conceived text, with major corrections and on time	Sufficient (2)	-	30	1
		Orderly, legible and logically conceived text, with major corrections and on time	Good (3)			
		Orderly, legible and logically conceived text, with minor corrections and on time	Very good (4)			

		Orderly, legible and logically conceived text, without corrections and on time	Excellent (5)			
Exam (EX)	70%	50-61%	Sufficient (2)	-	30	1
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	**100%**	**(Ex20 + SPx10 + EXx70)/100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (45 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. All exercises are of practical character and are carried out in laboratory. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Seminar paper	In their seminar paper the student process the results obtained on exercises. More precisely, the aim of the seminar paper is to compare the properties of examined boards as depending on their type. In addition to the practical part carried out as part of regular teaching, while writing their seminar papers the students also use the data recorded during field work. Theoretical part is performed through the study of relevant literature that they define in coordination with the course lecturer. The project task is submitted at the end of the semester, in the form of a written report.	15. week	Students who submit and their seminar paper is evaluated positively can access the exam
Written exam	Only the students which have submitted their exercises reports and whose seminar paper is evaluated positively, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula **(Ex20 + SPx10 + EXx70)/100**		

Obligatory literature

1. Jambreković, V.: Drvne ploče i emisija formaldehida, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 2004.
2. Bruči, V., Jambreković, V.: Ploče iverice i vlaknatice, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 1996.
3. Bruči, V., Janović, Z., Jambreković, V., Brezović, M.: Određivanje formaldehida iz drvnih pločastih materijala perforatorskom metodom, Sveučilišni laboratorijski priručnik, Šumarski fakultet, Zagreb, 1994.
Šumarska enciklopedija: Ploče iz usitnjenog drva, Jugoslavenski leksikografski zavod, Zagreb, 692-727, 1983.

Recommended literature

1. Maloney, T. M.: Modern particleboard & dry-process fiberboard manufacturing, Forest Products Society Madison, Wisconsin, 1993.
2. Wood Handbook: Wood as an Engineering Material, Forest Products Society, 1999.

3. Bruči, V., Penzar, F., Jambreković, V., Brezović, M.: Rezultati ispitivanja svojstava drvnih ploča, Zbornik radova "Uključivanje znanosti u gospodarski sustav preradbe drva u Hrvatskoj, 59-62, Novi Vinodolski, 1994. Jambreković, V., Brezović, M.: Kakvoća ploča na bazi drva, Zbornik radova "Uporaba drva", 39-50, Zagreb, 1996.
4. Bruči, V., Salah-Omer, E., Jambreković, V.: Certification and quality Attestation of woodbased panels. 1st International Conference "A Perspective of Wodworking-Industrial System in Bosnia and Herzegovina", Proceedings 183-193, Bihać, 1998.
5. Bruči, V., Jambreković, V., Brezović, M., Medved, S.: Improving properties and ensuring the quality of Wood Based Panels, International Conference Furniture Construction and Quality – a step forward to consumer protection, 59-65, Zagreb, 1999.

Methodology of industrial design of furniture

WD-1161

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 15
Exercises 30
Field work 2 days

Lecturer
Ivica Grbac, PhD, professor
Danijela Domljan, PhD, assistant professor

Associate teacher for exercises
Danijela Domljan, PhD, assistant professor

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The purpose, goals and reasons for implementation of methodology of furniture industrial design in wood industry. Tasks and effects of methodology. Introduction to the process of furniture design. Methods and systematic procedures of a design process. Methods for the control of planning and deadlines. Management of a product design process. Management phases. Conception phase. Spotting of problems and revealing of needs. Environmental analysis. Product concept. Project participants. Research into documentation and analogue solutions. Project task. Establishment of criteria, goals and needs – instructions for design. Drafting of several solutions. Feasibility study. Optimization of the solution. Performance solution. Communication of the solution. Evaluation of the result. Detailed study of design, construction and technological solution. Testing of the market about a new product. Construction, testing and giving final touch to a new product prototype. Preparation of the product for trial and large-scale production. Decision-making methods. Evaluation methods. Product concept and interdisciplinary. Basic characteristics of the joint development-production-business-social areas. Methodological procedure of interdisciplinary concept with respect to designing

Type of course:

Compulsory course, 1. semester, 1. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the purpose, goals and reasons of application of design methods (primary and secondary research, survey, interview, observation, photography, video recording, anthropometric research, literature research, marketing research, cultural analysis, focus group etc.), within the methodology of industrial furniture in wood industry.	exercises (project assignment), final exam	A2 B2, B7, B8 E2
Identify the effects of design methods in product research and development on a given example.	exercises (project assignment)	A1, A2 B2, B7
Evaluate the theoretical, practical and methodological goals and design methods of furniture as part of a complex interdisciplinary design process on a given example.	exercises (project assignment), final exam	A1, A2 B2, B7, B8, B9 E1, E2
Manage the product design process at all stages of the Product Development phase of product development process management (concept phase and realization; Creating and searching for concept, preliminary research and problem definition, project feasibility assessment, concretization of conceptual solutions, checking and expanding the concept, product development and concept development, sample design, value analysis and verification, realization, prototype production, trial series, solution evaluation, product launch and tracking).	exercises (project assignment), final exam	A1, A2, A3 B2, B7, B8 C6 E1, E2
Differentiate and apply product development methods at all stages of development. Explain each phase and the reason for its application throughout the design process.	final exam	B2, B7, B8
Apply the Design Concept phase (product concept) to product design and explain the importance of this phase in the process of design and development of furniture and wood products.	exercises (project assignment), final exam	B7, B8
Develop a project on improving life through the design of contemporary furniture and use phases of the product development process	exercises (project assignment), final exam	A1, A2 B2, B7, B8, B9, B10 C6 E1, E2
Establish criteria, goals and requirements for a new product under the Design Concept concept (concept of product).	exercises (project assignment), final exam	A2 B2, B7, B8

		C6 E1, E2
Design and present with design drawings ideas for seating furniture	exercises (project assignment)	A2 B2, B7, B8
Analyze product feasibility by applying feasibility criteria and optimize the solution (target user group, operating technology, materials used, standardization of elements, cost of production, etc.)	exercises (project assignment)	A1, A2 B2, B7, B8 C6
Define a product design solution with project documentation (presentation design drawing, technical product design overview in orthogonal projection with main dimension scale, M 1: 1 product design detail, technical and material list, technology map, cost analysis at all stages of production.)	exercises (project assignment)	A1, A2 B1, B2, B7, B8
Manage the product design process and, in the implementation phase of the solution, elaborate, examine and develop a prototype of a new product.	exercises (project assignment), final exam	B1, B2, B7, B8, B10
Make a detailed elaboration of design, constructional and technological solution of the product and prepare the product for a test (zero series) and serial production	exercises (project assignment)	B1, B2, B7, B8, B10 C6, C8
Develop a marketing campaign of the new product	exercises (project assignment)	A2, A3 B7, B8

General competences

Mastering and understanding of theoretical, practical and methodological principles of furniture design as a complex interdisciplinary process. Development of skills for independent analytical and creative design and work.

Tipe of instruction

Lectures

Exercises

The exercises involve making main project task and other tasks. During the semester, students write their exercises / tasks in team and individual work, while monitoring the continuous progress of the student and the acquisition of thematic knowledge and skills in accordance with the evaluation criteria. The exercises are performed by analyzing and elaborating each phase of the problem with the given task. The preparation of individual stages of the task is carried out by consultation and in agreement with the teacher, where questions and ambiguities are basically elaborated and conceptualized at home and explained in the exercises. According to the given dynamics during the exercise, it is obligatory to present and submit each phase of the exercise / task. Part of teaching is carried out in cooperation with companies and other economic and public entities involved in the implementation and realization of the task.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures, exercises and field teaching. Creating teaching materials. Preparing and designing exercises for their review and evaluation. Organization and management of project and field teaching. Maintain consultation and exam and evaluate tasks during exercise and exam.

Studenats' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. During the semester, it is mandatory to hand over seminar work as well as every stage of the elaboration to the insight and correction within the given deadline. Student has no right to sign and exit to the exam prior to the submitted and positively evaluated exam. Oral exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0			15	0	0,5
Exercises (E)	90%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	30	60	3
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			
		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Oral exam (OE)	10%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E×90 + OE×10) / 100**		45	75	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	semester (15 hours of direct lecturer)	
Excercises	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. The right to sign is acquired by the number of attendance classes and exercises. Exercises (project assignment) are submitted according to the given deadlines and are evaluated.	According the sylabus	
Oral exame	Requirements for the oral part of the exams are devoted and positively evaluated exercises, ie the project assignment and all other tasks. The oral exam consists of verbal defense (presentation) of the project task solution and the understanding of all phases of designing the conceptual and execution solution in the project assignment as well as the understanding and adoption of knowledge in lectures and exercises. The final grade is obtained according to the formula: (E × 90 + OE × 10) / 100	Exam terms	

Obligatory literature

1. Lapaine, B. (1993): Metodologija dizajna - skripta, Interfakultetski studij dizajna, Zagreb
2. Quarante, D. (1991): Osnove industrijskog dizajna, Arhitektonski fakultet Sveučilišta u Zagrebu –
3. Interfakultetski studij dizajna, Zagreb, odabrana poglavlja
4. Baxter, M. (2002): Product design, A practical guide to systematic methods of new product development, Nelson Thornes Ltd., Cheltenham, UK
5. Marchus, G.H. (2002): What is design today, H.N. Abrams Inc. , New York

Recommended literature

1. Laurel, B. (2003): Design research, methods and perspectives, Massachusetts Institute of Technology, The MIT Press, Chambridge, Massachusetts, London, England.
2. Kolter, P. (1972): Marketing management, Analysis, Planing and Control, Prentice Hool
3. Keller, G. (1995): Dizajn, Vjesnik , Agencija za marketing, Zagreb, odabrana poglavlja
4. Grbac, I (2005): Krevet i zdravlje, Sveučilišni udžbenik, Zagreb, odabrana poglavlja, u tisku
5. Grbac, I (2004): Ojastučeni namještaj, Sveučilišni udžbenik, Zagreb, odabrana poglavlja

MACROSCOPIC PROPERTIES AND TEXTURE OF WOOD

WD-1162

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1

Lecturer
Professor Tomislav Sinković, Ph.D.

Associate teacher for exercises
Assistant Professor Tomislav Sedlar, Ph.D.
Branimir Jambreković mag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Knowledge about impotrants of macroscopical properties of wood. Complite approach to determination of macroscopic properties of wood. Types and forms of texture. Ring width, percentage of latewood and early wood and finesse of annual rings. Texture of wood. Texture of basic wood sections. Texture of segments tree, root, root swelling, bole and branches. Wood sections and its influence on texture of wood. Factors important for texture of wood. Ttexture of wood from defects and abnormalities of wood. Texture of wood natural defects, reaction wood, compression and tension wood, cross grain, variations in log form and shakes. Macroscopically properties and texture of commercial coniferous wood species. Macroscopically properties and texture of commercial ring porous wood species.

Type of course:

Macroscopic properties and texture of wood (elective course, 1th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination of influence of macroscopic properties of wood on processing and application of wood in wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Determination of the influence of wood texture on wood processing and application of wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Evaluation of the impact of macroscopic properties of wood and texture of wood for certain types of wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Determination of type of woodworking for the purpose of achieving the maximum effect of macroscopic properties of wood and wood texture for certain types of wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Definition of macroscopic properties of wood and texture of wood for certain types of wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Practical determination of macroscopic properties of wood and texture of wood for certain wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2

General competences

Type of instruction
The student gains knowledge about macroscopical properties, texture and wood sections important for project processing and finishing products of wood. Macroscopically properties and texture of tree segments. Macroscopically properties and texture of commercial wood species.

Lectures
Lecture on theoretical basis prepares students to acquire basic knowledge about the macroscopic characteristics and textures of commercial wood species, which facilitate the making of exercises and complete mastery of the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Field work

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:
To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	30	2
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	15	30	1,5
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	14	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex70 + PE1x30)/100**		46	74	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%				
		81-90%	Good (3)			

	91-100%	Very good (4)
		Excellent (5)
TOTAL	**100%**	**(Fex100)/100**

*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (45 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Govorčin,S.; Sinković,T.: Tekstura drva, interna skripta, Zagreb, 2004, (CD)
2. Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
3. Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. Ugrenović,A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1.Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3. Lincoln, W., A. Walker, et al. 1989. The Encyclopedia of Wood. Facts on File Books. Quarto Publishing plc, London.
4.Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Furniture and equipment of space

WD-1163

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1 day

Lecturer
Ivica Grbac, PhD, professor
Danijela Domljan, PhD, assistant professor

Associate teacher for exercises
Danijela Domljan, PhD, assistant professor

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to space design. Typology and tasks of the space. Aesthetic and functional components of space. Perception of space. Characteristics of dwelling and equipment of a dwelling space. Etiological review through interior design. Characteristics of contemporary dwelling. Disposition, modes of designing and construction, materials and functional characteristics. Introduction to theory of space planning. Organization and design of space. Criteria of planning and of interior and exterior space design. Dwelling culture. Design principles and elements of dwelling space. Functional entities of contemporary dwelling unit. Analysis of dwelling units and their function. Human being as organizational module of a dwelling space. Design principles of space and furniture. Aesthetic, functional, social and psychological factors. Culture. Kitsch. Technical-technological, ecological and ethnological parameters. Originality and tradition. Trends in designing dwelling space and furniture. Modern components in quality validation of practical and technical objects of industrial design. Functional and design analysis of contemporary furniture and objects for use. Colours and materials in space. Psychology of colours. The role of colours and materials in Feng shui space design. Characteristics of the use and equipment for public work space. Relation between furniture and dedicated space. Analysis of functional groups of furniture vs. specific public space unit. Urban equipment.

Type of course:

Compulsory course, 1. semester, 1. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish types, typology and tasks of housing and public space	exercises (project assignment), final exam	A2 B2, B7, B8, B11
Analyze and compare the aesthetic and functional components of space in some historical style periods (from antiquity to 21 centuries)	exercises (project assignment)	A1, A2, A3 B2, B7, B11, B12
Identify and apply components, principles and elements of space design (color, texture, light, materials, orientation)	exercises (project assignment), final exam	A1, A2, A3 B2, B7, B11, B12 C2, C6
Distinguish the etiological contents, the culture of residence and the historical styles of interior and exterior design	exercises (project assignment), final exam	A1, A2, A3 B2, B7, B11, B12 C2, C6
Evaluate and implement features of Croatian heritage in designing the space content and interior furnishing with appropriate furniture.	final exam	A1, A2, A3 B2, B7, B11, B12
Apply the theory and criteria of spatial planning and architectural design in space furnishing	exercises (project assignment)	B11, B12 C2
Apply human measures as a module of space organization	exercises (project assignment)	B2, B7, B8, B11, B12 C2, C6
Evaluate and apply the principles of contemporary design of space and furniture (aesthetic, functional, social, psychological and social, technical-technological, ecological and ethnological) in relation to the needs and habits of the user	exercises (project assignment), final exam	A2 B2, B7, B8, B11, B12 C2, C6 E1, E2
Identify and interpret culture kitsch, trends, authenticity and tradition in the design of furniture and space.	exercises (project assignment), final exam	B2, B7, B8, B11, B12
Analyze and create public space interiors with the application of modern principles of design furniture and equipment space.	exercises (project assignment), final exam	A2 B2, B7, B8, B11, B12 C2, C6 E1, E2
Define, differentiate and valorize the characteristics of living and furnishing housing.	exercises (project assignment), final exam	A1, A2, A3 B2, B7, B8, B11, B12 C2
Design, organize and analyze functional units of modern housing units in relation to the needs of users (working, bedroom, living room, entrance, kitchen, dining room, living room, bedroom and children's room, office, bathroom etc).	exercises (project assignment)	A1, A2, A3 B2, B7, B8, B11, B12 C2
Recommend and design a functional furniture group in relation to the specified spatial unit for residential or public use and user needs.	exercises (project assignment)	A1, A2, A3 B2, B7, B8, B11, B12 C2
Analyze individual spatial units and their functions in the public space (common space, private (space), work space, socializing, communication, rest, etc.)	exercises (project assignment)	A1, A2, A3 B2, B7, B8, B11, B12 C2
Suggest and design new solutions for urban equipment for exterior furnishing (bench, waste bin, lighting fixture, bulletin board, bike rack etc.)	exercises (project assignment)	A1, A2, A3 B2, B7, B8, B11, B12 C2
Apply design shetching or computer design in presentation of the design solution of furniture and equipment	exercises (project assignment)	B2, B7, B8, B11, B12 C8

Present a solution of well-equipped space and shaped furniture to a group of people (potential clients, teachers, colleagues etc.)	exercises (project assignment), final exam	A1, A2, A3 B2, B7, B8, B11, B12 C2, C8 E2

General competences

Knowing how to view the space, measure, imagine, plan, design and equip functional space units as well as to master analytical methods and harmonize functional groups of furniture with space. Development of skills for comprehensive equipping of the interior with furniture and other equipment in the interior

Tipe of instruction

Lectures

Exercises

Exercises involve the preparation of project tasks by default. The student is obliged to attend the lectures and actively attend the exercises in which the analysis and elaboration of the problem set in the task is done and the appropriate solutions are available. The elaboration of individual stages of the task is carried out in consultation with the manager, where questions and ambiguities are basically elaborated and conceptualized at home and explained in the exercises. Part of teaching is performed in public space, depending on the task (space). Sending exercises (task stages) is by default within the course of the semester. Making solutions and presentations is individual. Presentation of the work is done at home, except in case the student does not have the appropriate conditions, presentation works at the faculty in agreement with the professor.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures, exercises and field teaching. Creating teaching materials. Prepare and design exercises (tasks) by reviewing and evaluating them. Organization and management of project and field teaching. Maintain consultation and exam and evaluate tasks during exercise and exam..

Studenats' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. During the semester, the seminar work is obligatory, as well as every phase of the project task to be inspected and corrected within the given time frame. Student has no right to sign and exit to the exam before submitting the project task papers. Written exam. A positive assessment of a written exam is a prerequisite for an oral exam. Oral (final) exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teach	Number of average students workload outside the direct teaching	ECTS

				inghours		
Lectures (L)	0			30	0	1
Exercises (E)	75%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	15	57	2,4
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			
		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Written exam (OE)	20%	Poor application and understanding of theoretical knowledge and practical skills in a given task, more than 50% of errors	Sufficient (2)	0	12	0,4
		Good application and understanding of theoretical knowledge and practical skills in a given assignment, less than 30% of errors	Good (3)			
		Very good application and understanding of theoretical knowledge and practical skills in a given assignment, less than 10% of errors	Very good (4)			
		Excellent application and understanding of theoretical knowledge and practical skills in the default task without any mistakes	Excellent (5)			
Oral exam (OE)	5%	60-70%	Sufficient (2)	0	6	0,2
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
TOTAL	**100%**	**(E×75 + WE×20 + OE×5) / 100**		45	45	75

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	semester (15 hours of direct lecturer)	
Partial exam	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. During the semester, the student prepares exercises / tasks in team and individual work, monitoring continuous student progress and adopting thematic knowledge and skills, in accordance with the evaluation criteria. The right to sign is obtained by the number of attendance classes and exercises as well as assignments within the given time limit. It is obligatory to submit each phase of the project task to insight. Submission of the project task is by deadline, by the end of the semester. A written exam student does not have the right to go out of handed and positively evaluated exercises.	According the sylabus	
Written exam	Requirements for entering the written part of the exams are submitted and positively evaluated exercises ie project assignment and all other tasks. The written exam consists of a task which examines the application and understanding of theoretical knowledge and practical skills. A positive assessment of the written part of the exam is a condition for going to the oral exam.	Exam terms	
Oral exam	The oral exam consists of the oral defense (presentation) of the project task solution and the understanding of each phase in the project task as well as the understanding and adoption of the knowledge in the lectures and exercises. The final grade is obtained according to the formula: **(E×75 + WE×20 + OE×5) / 100**	Exam terms	

Obligatory literature

1, Neufert, E. (2000): Elementi arhitektonskog projektiranja, Golden marketing, Zagreb
2. Grey, J., Ardley, S. i sur. (2001): Dizajn stanovanja; Znanje, Zagreb, 2001.
3. Lawrence, M. (1997): Dekoriranje i uređenje doma; Duševi&Kršovnik, Rijeka
4. *** (1999): Living spaces, Ecological Building and Design, Öko test, Könemann, English Edition,
5. (Edit.: Schmitz-Gunther T.), Mladinska knjiga tiskarna d.d., Ljubljana.

Recommended literature

1. Noblet de, J. (1999): Dizajn, pokret i šestar, Golden marketing, Zagreb
2. Cerver, F. A. (2000): Modernes wohndesign; Könemann, Köln
3. Grbac, I (2005): Krevet i zdravlje, Sveučilišni udžbenik - rukopis, Zagreb, selected chapters
4. Neidhart, V. (1997): Čovjek u prostoru, Školska knjiga, Zagreb
5. Panero, J. i Zelnik, M. (1987): Antropološke mere i interijer, Zbirka preporuka za standarde u projektiranju, IRO "Građevinska knjiga", Beograd
5. Asensio, P. (2002): Furniture design/Möbel Design/ Design de meubles/Meubles de diseño, Neues Publishing Group, NewYork US, Dusseldorf Germany, London Uk, Barcelona Spain.

Methods in wood structure research

WD-1164

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work xy

Lecturer
Prof.dr.sc. Jelena Trajković
Izv.prof.dr sc. Bogoslav Šefc

Associate teacher for exercises
Prof.dr.sc. Jelena Trajković
Izv. prof. dr. sc. Bogoslav Šefc
Dr.sc. Iva Ištok

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Getting acquainted with different techniques of microscopy and preparation for morphological, qualitative and quantitative analysis of wood, wood cells and wood materials. Optical light microscopy, polarization microscopy, interferential, phase-contrast and ultraviolet microscopy
Measuring Instruments and Methods in Optical Microscopy. Microtomy and wood maceration: preparation, staining and imbedding of microscopic slides. Photomicrography. Electron microscopy, ultramicrotomy, methods of sample replication. Methods of imbedding of wood samples for microscopy. Application of X-ray technique in wood anatomy. Nondestructive methods of measurement in wood anatomy. Special techniques for the preparation of partially degradated wood, techniques for preparing archeological wood for examination.

Type of course:

Methods in wood structure research (elective course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain and apply different microscopy techniques for identification of wood, wood cells and wooden materal	Practical exercises, seminars and final exams	A2
Make adequate wood slides for microscopy	Practical exercises, seminars and final exams	E1, E2
Using the computer program for image analysis, measure and analyze the morphological parameters of cells and wood tissue on which technical properties of wood depend.	Practical exercises, seminars and final exams	A2, B9
Explain the principles of dendrochronological analysis, measure the series of growth rings width on wood samples	Practical exercises, seminars and final exams	A2, E1, E2
Select the method for preservation and conservation of archeological woods	Practical exercises, seminars and final exams	B9
Recommend the use of non-destructive methods in the research of wood structure	Practical exercises, seminars and final exams	A2, E1, E2

General competences

Application of various microscopy and preparation techniques for morphological, qualitative and quantitative analysis of wood, wood tissue and wood materials.

Tipe of instruction

Lectures

Exercises

As part of laboratory exercises, wood preparations are made, and the morphologic parameters of cells and tissue of healthy and partially degraded and archeological wood are measured and analyzed. Demonstrations of available non-structural methods of wood structure analysis.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers. Providing oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside	ECTS

					the direct teaching	
Lectures (L) and Exercises (E)	-	-	-	45		1,5
Seminar preparation (S1)	20%	Written seminar70% Presentation 30%	2, 3, 4, 5 2, 3, 4, 5,	2	14	0,5
Seminar preparation (S2)	20%	Written seminar70% Presentation 30%	2, 3, 4, 5 2, 3, 4, 5	2	14	0,5
Exam (E)	60%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	1	42	1,5
TOTAL	**100%**	**(S1x20 + S2x20 + Ex60)/100**		50	70	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (L) and Exercises (E)	On lectures the attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	Semester (45 hours of direct lecturer)	-
Seminar preparation and presentation (S1)	The student groups (most often of 2 students) in the first we of classes receive the topics of the seminar work they must write and present in the agreed terms. Written seminar must be submitted in the same term. It is evaluated: written work (layout, information, literature, language, design, content, terminology, linking to course content, conclusion), presentation (language, use of tools, logic structure and conclusion, duration)	In accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student prepares an independent seminar work
Seminar preparation and presentation (S2)	The student groups (most often of 2 students) in later weeks of classes recieve the topics of the seminar work they must write and present in the agreed terms. Written seminar must be submitted in the same term. It is evaluated: written work (layout, information, literature, language, design, content, terminology, linking to course content, conclusion), presentation (language, use of tools, logic structure and conclusion, duration)	In accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student prepares an independent seminar work
Final exam (E)	Final exam is in terms of exams. On the exam student is asked for three questions that represent different part of subject content. The final grade	Exam terms	-

	of the subject is obtained according to the formula: (S1x20+S2x20+Ex60)/100

Obligatory literature

1.Abramowitz Mortimer, 2003: Microscope basics and beyond. Revised edition. For Olympus America http://microscopy.
fsu.edu/primer/pdfs/basicsandbeyond.pdf.
2. Geoffrey Daniel, 2016: Microscope Techniques for Understanding Wood Cell Structure and Biodegradation, u knjizi: Secondary Xylem Biology; Origins, Functions, and Applications, Chapter: 15, Publisher: Academic Press, Editors: Yoon Soo Kim, Ryo Funada, Adya P. Singh, pp.310-345
3. Caroline R. Cartwright, The principles, procedures and pitfalls in identifying archaeological and historical wood samples
4. Lloyd Donaldson, 2008: Microfibril Angle: Measurement, Variation And Relationships – A Review, IAWA Journal, Volume 29, Issue 4, pages 345 – 386
5. Jozsef Bodig, The Process of NDE Research for Wood and Wood Composites
6. Brian K. Brashaw, Voichita Bucur, Ferenc Divos, Raquel Gonçalves, 2009: Nondestructive Testing and Evaluation of Wood: A Worldwide Research Update, Forest Products Journal 59(3):7-14

Recommended literature

1. Tiago Ferreira, Wayne Rasband, 2012.: ImageJ Users Guide, 185 str.
https://imagej.nih.gov/ij/docs/guide/user-guide.pdf

Non-wood Materials

WD-1165

ECTS 4
English language -
E-learning -

Teaching hours 45
Lectures 30
Exercises 15
Field work

Lecturer
Associate Professor Jaroslav Kljak, Ph.D.

Associate teacher for exercises
Associate Professor Jaroslav Kljak, Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Non-wood materials in manufacture furniture and in civil engineering, metals and alloys, glass and enamel, species and uses, ceramics products, porous and nonporous ceramic, materials for grinding, textile, leather, natural organic materials, oils, waxes, resins, colours and painting materials, pigments, polymer materials, natural polymers, synthetic polymers, types and properties of polymer materials, production and processing of synthetic polymers, use polymer materials as adhesives and glues

Type of course:

Non-wood materials (elective course, 1. semester, 1. year, graduate study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Compare the physical and mechanical properties of selected materials.	knowledge test, final exam	B3
Compare an individual manufacturing processes for the processing of synthetic polymeric materials (extrusion, injection molding, blow molding, rotational molding).	knowledge test, final exam	B3
Suggest and select a particular type of material based on knowledge of its structure, properties and typical areas of use.	knowledge test, final exam	B3

General competences
Knowledge for seen to be gained by the programme of "Non-wood materials" enables students of wood technology studies to connect it with that gained in programmes of main expert subjects.

Tipe of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:
Teaching activities - lectures, exercises. Creating knowledge tests and evaluation. Providing oral exams and consultations. Preparing teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade		Evaluation elements	Share in evaluation
Lectures(L)	-		-	30	0	1
Exercises (E)	-	-	-	15	30	1,5
Final Exam (FE)	*100 %*	*60-70%* *71-80%* *81-90%* *91-100%*	*dovoljan (2)* *dobar (3)* *vrlo dobar(4)* *odličan (5)*	*2*	*43*	*1,5*
TOTAL	**100%**			**47**	**73**	**4**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably miss no more than 15% hours of all lectures and exercises.	semester (45 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who attended lectures and exercises. The students in the written exam (multiple choice question), choose the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	After passing a written exam, students are asked questions from different parts of the lecture content.		

Obligatory literature

1. M. Biffl, Poznavanje materijala II, Šumarski fakultet, Zagreb, 1986.
2. Z. Janović, Polimerizacije i polimeri, HDKI – Kemija u industriji, Zagreb, 1997.

Recommended literature

1. V. Tadejević, V. Jakovlić, Poznavanje robe, Školska knjiga, Zagreb, 1971.
2. B. Ljuljka, Površinska obrada drva, Šumarski fakultet, Zagreb, 1990.
3. I. Filipović, S. Lipanović, Opća i anorganska kemija I/II, Školska knjiga, Zagreb, 1991.

Field work I. – Design of Wood Products

WD-1166

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 1st semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:

Field work I. – Design of Wood Products (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Evaluate wooden board materials according to HRN EN standards. Evaluate the qualitative difference between individual groups of board materials. Choose environmentally friendly board materials for indoor use. Recommend certain materials for a particular purpose.	Field work report evaluation
Compare the cyclic method of product development with the development method at the factory. Suggest a new solution of existing furniture according to the chosen method. Evaluate the quality and design of the developed assortment of furniture.	Field work report evaluation
Identify and describe the technological process of window and door production. Identify and distinguish products for construction. Differentiate and compare wall, ceiling and floor coverings.	Field work report evaluation
Analyze the existing range of products according to purpose. Suggest a solution for furnishing space with products at the factory. Develop new solution (redesign) of existing products from the factory showrooms	Field work report evaluation
Compare the advantages and disadvantages of individual manufacturing processes for non-wood materials. Analyze the economic criteria for selecting a particular type of material. Analyze the ecological aspects of production and use of a particular type of material.	Field work report evaluation
Plan the design of the most important textures that affect the aesthetic experience of wood products. Organize texture design that affects the experience of wood product form. Developing patterns with macroscopic properties and texture of wood important for a particular wood product.	Field work report evaluation

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of collecting data on the factors of the manufacturing process or business of the company. Student analyzes the range of products and used materials. He suggests improvements for a more rational and optimal production of furniture and wood products

The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:

Teachers' obligations:
Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.

Students' obligations:

Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and		

	withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/hr/studiji/studij-drvne-tehnologije/diplomski-studij-oblikovanje-proizvoda-od-drva/terenska-nastava/

Investigetion of physical and mechanical properties of wood

WD-1266

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 3

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambrekovićmag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Knowledge about physical and mechanical properties of wood. Preparation for investigation of physical and mechanical properties of wood. Methods for the selective sampling of wood and general requirements for physical and mechanical tests on small clear test pieces. Instruments and devices for determination of physical and mechanical properties of wood. Macroscopic properties of wood. Optical methods, tomography, ray *x*, *β*, γ. Physical properties of wood. Methods for determination of dimensions and mass. Methods for determination of volume (regular dimensions, immersion). Methods for determination of density (according to standards, floatation. immersion, ray *x*, *β*, γ). Methods for determination of moisture content (ove-drying, distillation, titration, electrical moisture meters, ray *x*, *β*, γ). Methods for determination of fiber saturation point (sorption, shrinkage, mechanical properties, electrical properties, and thermal conductivity). Methods for determination of thermal, electrical and acoustical properties of wood. Destructive and nondestructive methods for determination of mechanical properties of wood. Comparing and determination of macroscopic, physical and mechanical properties of domestic and foreign commercial wood species.
Interdiction of macroscopic, physical and mechanical properties of wood, and comparing technological properties of domestic and foreign commercial wood species.

Type of course:

Investigetion of physical and mechanical properties of wood (obligatory course, 2th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination of the necessary parameters of trees for the selection of modal trees for the exploration of physical and mechanical properties of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Selection and felling of trees for the exploration of physical and mechanical properties of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Preparation of samples for research of physical and mechanical properties of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Testing of physical and mechanical properties of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Statistical treatment and evaluation of the results of the research of physical and mechanical properties of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Collection of relevant data to display the results of research on physical and mechanical properties of wood for the purpose of displaying as scientific or professional work	Exercises evaluation, partial exams, final exam	A2,B1, B2

General competences

Type of instruction

The student gains knowledge about scientific approach on for investigation of physical and mechanical properties of wood. Preparation and leading for investigation of physical and mechanical properties of wood. Analysis of results physical and mechanical properties and its influence on different use of wood species.

Lectures

Lectures on theoretical bases are prepared by students to acquire knowledge about the research of macroscopic characteristics, physical and mechanical properties of commercial wood species, which facilitate the production of exercises and complete mastering of the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Field work

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:

To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	90	3
Exercises (E)	40%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	15	30	1
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex40 + PE1x30+PE2x30)/100**		46	150	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lectures)	-

Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Govorčin,S.; Sinković,T.: Tekstura drva, interna skripta, Zagreb, 2004, (CD)
2. Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
3. Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. Ugrenović,A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3.Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.
4. Walter, F.: Pruftechnikin der Holzindustrie, Leipzig, 1977, str. 1-318.

Wood Composite Materials

DD-1267

ECTS 5

English language -

E-learning -

Teaching hours 60
Lectures 30
Exercises 30
Field work

Lecturer
Associate Professor Jaroslav Kljak, Ph. D.

Associate teacher for exercises
Associate Professor Jaroslav Kljak, Ph. D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Types of wood composite materials; properties and application. Wood composite with laminate structure, properties and application, wood and non-wood materials for structural elements, synthetic fiber reinforcements, matrix materials, production processes, mechanical and physical properties. Wood composite with sandwich structure. Face materials – plywood panels, particleboards, fibreboards, OSB, metals, synthetic fiber composites - mechanical and physical properties. Core materials – balsa wood, honeycombs, foam and corrugated cores - mechanical and physical properties. Properties and mixture of synthetic resin for sandwich composites: epoxy resins, polyurethanes, phenolic, polyester and vinyl ester resins. Calculation and analysis of mechanical and physical properties. Joints between sandwich panels. Design and analysis of wood composite materials by finite element method. Wood composite with particle reinforced structure. Wood composites with inorganic binders. Production processes, properties and application.

Type of course:

Non-wood materials (elective course, 1. semester, 1. year, graduate study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Select materials and determine the technological parameters for pressing process of wood composite sandwich panels.	knowledge test, final exam	B6
Select materials and determine the technological parameters for pressing process of laminated wood composites.	knowledge test, final exam	B6
Apply European and international standards for determining the properties of wood composite panels.	knowledge test, final exam	B6

General competences

A course objective is getting knowledge about properties of wood composite materials, application, and about regulatory that exist inherent construction system of wood composite. Accepted knowledge enable to students to make a decision about selecting adequate material according to requirements for specific use. It also enable to students to design the properties of wood composite material, with different calculation methods, according to pre-setting load parameters.

Tipe of instruction

Lectures

Exercises

Working methods:

Teachers' obligations:

Teaching activities - lectures, exercises. Creating knowledge tests and evaluation. Providing oral exams and consultations. Preparing teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade		Evaluation elements	Maximum points or Share in evaluation
Predavanja	-		-	30	0	1
Vježbe	-	-	-	30	30	2
Final exam (FE)	*100 %*	*60-70% 71-80% 81-90% 91-100%*	*Sufficient (2)* *Good (3)* *Very good (4)* *Excellent (5)*	*2*	*58*	*2*
Total	**100%**				**88**	**5**

			62		

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably miss no more than 15% hours of all lectures and exercises.	semester (60 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who attended lectures and exercises. The students in the written exam (multiple choice question), choose the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	After passing a written exam, students are asked questions from different parts of the lecture content.		

Obligatory literature

1. Kljak, J., Brezović, M., Pervan, S., 2004.: Modification of plywood by composite materials. International scientific conference, Zagreb, 77-81.
2. Kljak, J., Brezović, M., Jambreković, V., 2003.: Analiza interakcije strukturnih materijala kompozoitnoga uslojenog drva metodom konačnih elemenata. Drvna ind. 54 (2) 75-76.
3. Brezović, M., Jambreković, V., Kljak, J. 2002.: Utjecaj karbonskih vlakana na neka relevantna svojstva furnirskih ploča. Drvna ind. 53 (1): 23-31.
4. ***, 1999.: "Wood Handbook". Forest Products Society.

Recommended literature

1. D. Zenkert, 1997.: "The Handbook of Sandwich Construction".Engineering Materials Advisory Services Ltd.
2. Ever J. Barbero, 1998.: "Introduction to Composite Material Design". Taylor & Francis.

Quality assurance of finished products

WD-1268

ECTS 4

English language R1

Teaching hours 45
Lectures 15
Exercises 30
Field work 2

Lecturer
Professor Ivica Grbac, Ph.D.
Associate Professor Ivica Župčić, Ph.D.

Associate teachers for exercises
Associate Professor Ivica Župčić, Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Basic facts about the quality assurance of products and services. Viewpoints of manufacturers, users and society. Innovation and quality: standards and international practice. Errors; technical, measuring and statistical parameters. Quality determinants. Durability and reliability. Quality planning. Evaluation of construction. Significance of materials and semi-finished products for product quality. Quality parameters. Quality tests of products, effect of production technology on product quality. Packaging, transportation and services. Testing methods for furniture and construction wood. Testing of wood, wood materials, textile, leather, glass, synthetic materials, hardware, etc. Quality parameters, functional dimensions, quality tests and use values (functionality) of: chairs, tables, furniture to hold the objects, bed frameworks, windows and doors.

Type of course:

Quality assurance of finished products - compulsory, 2. semester, 1. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to recognise, describe and distinguish the quality factors of end products (constructional, technological, economic, aesthetic, ergonomic etc.)	final examination	B1
to use and apply current technical regulations (HRN EN or ISO standards) in assuring the quality of end products	exercises, correction, exercise evaluation, final examination	B1
to apply an interdisciplinary approach (use of non-wood material, influence of furniture on human health) when assuring the quality of end products and furniture	exercises, correction, exercise evaluation, field report, final examination	B2
to test furniture by using applicable HRN EN standards (testing school furniture, office furniture, sitting and lying furniture)	exercises, correction, exercise evaluation, final examination	B1
to analyse and evaluate factors influencing product durability and reliability (the quality of built-in materials, construction, processing, human environment influence)	final examination	B2
to manage the quality control process in furniture manufacture depending on different levels and stages of the manufacturing process	final examination	B1
to assess the impact of materials and semi-products on the quality of the end product	exercises, correction, exercise evaluation, final examination	B1
to manage and ensure the quality in specific manufacturing conditions when modelling and constructing wood products	exercises, correction, exercise evaluation, field report, final examination	B1
to recognise and evaluate the level of applying HRN EN standards in manufacture	exercises, correction, exercise evaluation, field report, final examination	B1
to evaluate the flammability of upholstered furniture and to apply organic production	exercises, correction, exercise evaluation, final examination	B1
to gather, group and process information about the given topic and to present it	exercises, correction, exercise evaluation, field report, final examination	B1
to deal with the complex system of interaction between the user’s body and furniture	exercises, correction, exercise evaluation, final examination	B1

FIELD WORK

1. Organised visits to furniture and wooden joinery factories. To become familiar with the technological process of manufacturing.
2. Organised visits to international fairs of furniture and accompanying industry.

General competences

acquiring knowledge of furniture quality and quality testing methods;

developing skills required for the development and planning of the complete quality assurance system for end products.

Type of instruction

Lectures

Exercises

Furniture testing in an accredited furniture and furniture parts testing laboratory in accordance with HRN EN standards. Making exercises based on conducted laboratory testing.

Working methods:

Teacher's obligations:

to hold original classes – lectures, exercises and field work. To develop exercises and draw up tests and grade them. To conduct oral examinations and hold consultations. To draw up the teaching material.

Students' obligations:

regular class attendance and to actively take part at lectures and exercises, field work, preparation, submission and oral presentation of exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			15	-	0,5
Exercises (E)	30%	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)			

		Neat and partly correct, corrected twice, submitted on time	Good (3)	30	30	2,0
		Neat, correct, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete and submitted on time	Very good (4)			
		Neat, correct, complete, submitted on time	Excellent (5)			
Oral examination (OE)	35%	60-70%	Sufficient (2)	-	45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(OEx70 + Ex30)/100**		45	75	4

Detailed description of evaluation elements for lectures, exercises, partial or final examinations:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	in accordance with the syllabus	-
Exercising and making exercising	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade is the arithmetic mean. The requirements for taking the examination (oral part) are positively graded exercises and an oral presentation given of the assigned product tested in the Laboratory.	in accordance with the syllabus	-
Oral examination (OE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students' theoretical knowledge and understanding of methods and procedures for testing furniture and other wood products will be examined. The final grade will be calculated by the formula **(OEx70 + Ex30)/100**	examination period	-

Obligatory literature

1. Ljuljka, B. (1983): *Kvaliteta namještaja*, *Šumarska enciklopedija* II, LZ, Zagreb, p. 484-490.
2. Grbac, I. (1984): *Istraživanje trajnosti i elastičnosti različitih konstrukcija ležaja* – master thesis, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.
3. Grbac, I. (1988): *Istraživanje kvalitete ležaja i poboljšanje njegove konstrukcije* – doctoral disseratation, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.
4. Crosby, P. B. (1989): Kvaliteta je besplatna, Zagreb, p. 1-218.
5. Grbac, I. (2004): Ojastučeni namještaj, university textbook, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.
6. Grbac, I. (2006): Krevet i zdravlje university textbook, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.

Recommended literature

1. Masing, W. (1980): Handbuch der Qualitaetssicherung, München, p. 1-975.
2. Feigenbaum, A. V. (1983): Total Quality Control, New York, p. 1-471.

Information systems on wood products market

WD-1269

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work -

Lecturer
Prof. Darko Motik, Ph.D.

Associate teacher for exercises
Assist.prof. Andreja Pirc Barčić, Ph.D.
Prof. Darko Motik, Ph.D.

Grading

Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Market information system. Market Researchers. Market Research of Wood and Wood Products. Characteristics of market research. Overcoming obstacles in conducting market research of wood and wood products. Analyzing the needs and trends for wood and wood products in the macro-circle. Economic environment. Demographic environment. Technological environment. Political environment. Social and cultural environment. Information on the market for business spending and business behavior when purchasing wood and wood products. The market for consumer spending in relation to the final consumer market. Participants in the process of buying a business. Institutional markets for final wood products. Collecting information about industry and competition in wood processing and furniture manufacturing. Identifying competitor strategies. Assess the strength and weakness of competitors in the wood and wood products market. Evaluation of common competitor's reactions. Application of information obtained on wood and wood product market status.

Type of course:

Information systems on wood products market (compulsory, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To carry out a process of wood and wood product market research and to evaluate supply and demand data for wood products.	Exercises evaluation, partial exams, final exam	D3
To analyze the needs and trends for wood and wood products in the macro-circle	Exercises evaluation, partial exams, final exam	D3
To analyze information on business to business market and business behavior when purchasing wood and wood products.	Exercises evaluation, partial exams, final exam	D3
To compare a business to business and business to customer's markets related to consumption of wooden products.	Exercises evaluation, partial exams, final exam	D3
To select the most important participants in the business buying process regarding wood based product market and businesses.	Exercises evaluation, partial exams, final exam	D3
To assess the strengths and weaknesses of competitors in the wood and wood products market.	Exercises evaluation, partial exams, final exam	D3

General competences

Student gets knowledge necessary to work in the wood industry companies on work posts with responsibilities regarding information management on wood and wood products markets within company management activities
Student gets competencies for business documentation analyses, for creating a basic market reports, identify a competitor's strategy.

Lectures

Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise management in wood processing and furniture manufacturing in the field on information management systems.

Exercises

Exercises on individual assignments with the purpose of applying theoretical settings learned in lectures
Students, besides performing exercises, need to collect data, systematize data and present the results obtained in the form of project tasks for each exercise.

Working methods:

Teachers' obligations:
To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	50%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	13	45	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	25%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	25%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E50 + PE1x25+PE2x25)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	51-70% 71-80% 81-90%	Sufficient (2) Good (3)	2	30	1

		91-100%	Very good (4)
			Excellent (5)
TOTAL	**100%**	**(FE100)/100**	

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lecturer)	-
	Exercises are made individually. Within the exercise, 4 individual tasks are performed, which eventually merge into the whole and form a project assignment (the project task is presented in the last term of the course, before the 2nd semester) At the beginning of the first exercise, students are provided with instructions on how to perform the exercises and the appearance of the collar, liner and insertion sheet in which they will print in the form. The accuracy, regularity and regularity (time-honored exercises). Exercises carry 50 points.	According to a time schedule	
Partial exam I	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. The 1. Partial exam is 50 points and it covers the issues regarding until the time of partial exam.	6th. week	
Partial exam II	Second partial exam can be attended by students who did not miss more than 15% of lectures and exercises and have obtained more than 25 points in the Partial exam I. The II. Partial exam is 150 points.	14th. week	
Written exam	Students who did not receive a positive assessment from the exercise and the partial exams (less than 51% of the total score) or are not satisfied with a final grade will approach the written exams according to certain examination deadlines. The written exam consists of 2 assignments (depending on the complexity of the assignment, with each assignment max number of points)	Exam terms	
Oral exame	The requirement for the oral exam is 51 % on the written exam. The score obtained on the oral exam is the final grade in the 100% ratio. Note: The person who passed the exam via partial exams and obtained the right to a final grade, and is not satisfied with the final grade, can access the oral exam, but in that case may score a grade higher than the grade obtained by passing the exam through a partial exam . The grade given on oral exam is final and it makes 100% of the grade.	Exam terms	

Obligatory literature

1. Motik, D., Pirc, A.: Tržište namještaja i ostalih drvnih proizvoda do 2006-te godine, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 2007. (stručna knjiga)
2. Motik, D., Pirc, A.: Pokazatelji stanja na tržištu namještaja i ostalih drvnih proizvoda Republike Hrvatske do 2007. godine, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 2008. (stručna knjiga)

Recommended literature

1. Marušić, M., Vranešić, T. 2001: Istraživanje tržišta, Adeco, Zagreb.
2. Kotler, P. 2006: Upravljanje marketingom, MATE d.o.o., Zagreb.

Constructions of wooden products IV

WD-1270

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 2 days

Lecturer
professor Silvana Prekrat, PhD

Associate teacher for exercises
professor Silvana Prekrat, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Discursive construction methods – selection of optimal constructional composition by discursive and non-destructive methods. The role of CAD in the comprehensive production system – opportunities to rationalize the production with introduction of CAD system, 3D modelling with AutoCAD and 3D studio max. Classification of applications with working basics and applications for furniture construction, visualization of constructional calculations and simulations. Rendering – working with materials; the use of textures and colours; selection and preparation of textures for their loading into standard databases; Setting of the backgrounds for drawings; Animation – the role of animation in presentation of furniture, interior and exterior design; Programming – Basics and application in drawing and wood industry production process. Auto LISP, Visual LISP, Selection criteria for CAD programme; Connecting of CAD with CAM system – Preparation of construction documentation for CAM system. Conditions for continuance of production process. Control of performance. Organization and management of drawings – management of drawings with Design Centre; setting up of standards for drawings. Monitoring of drawings; use of environment with more simultaneously opened databases; Import and export of databases into other formats; working with grid drawings**.**

Type of course:

Constructions of wooden products IV – (Elective course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Apply and analyze discursive destructive and non-destructive construction methods when designing a design solution	exercise, project, seminar, exam	A2 B10 C4
Define and explain the application of non-destructive methods in the design of wood assemblies and products	exercise, project, seminar, exam	B10 C5
Define the role of CAD in the overall production system	exercise, project, seminar, exam	B7 C8
Check the possibilities of manufacturing rationalization by introducing CAD systems in the preparation, development and technological process of making furniture and wood products.	exercise, project, seminar, exam	B7,B10 C5, C8
Create a virtual 3D model of furniture, wood and interior products using the exact and parametric method of a computer program.	exercise, project, seminar, exam	B7, B10 C8, C9 E3
Analyze and classify computer programs for design, construction and visualization according to the given qualitative quantitative criteria.	exercise, project, seminar, exam	A2 B8 C4 E3
Define the features, advantages and disadvantages of virtual and physical 3D models in product development.	exercise, project, seminar, exam	C4, E3
Create a rendered 3D product model or interior using scenes.	exercise, project, seminar, exam	A3 B10 C4, C8, E2
Analyze the quality of photorealisticity of making a rendered 3D model created by different computer programs.	exercise, project, seminar, exam	A1 B8 C4, C8,

General competences

Selection of the optimal construction solution and its versions with the use of discursive methods. Mastering of 3D through modelling with AutoCAD and 3D studio max. application; Programming in the process of construction aimed at improving constructional productivity and, thus, the whole production system. Tipe of instruction

Lectures

Exercises
Exercises involve creating separate tasks / seminars and projects. During the semester the student prepares exercises in team and individual work. Through the semester, continuous student progress and the adoption of thematic knowledge and skills are monitored, in accordance with the evaluation criteria**Working methods:**

Teachers' obligations:
Maintaining original teaching - lectures, exercises and field teaching. Creating teaching materials. Preparing and designing exercises for their review and evaluation. Organization and management of project and field teaching. Maintain consultation and exam and evaluate tasks during exercise and exam.

Studenats' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. During the semester, it is mandatory to hand over seminar work as well as every stage of the elaboration to the insight and correction within the given deadline. Student has no right to sign and exit to the exam prior to the submitted and positively evaluated exercises/project. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0			30	0	1
Exercises (E)	90%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	15	60	2,5
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			
		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Written Exam (OE)	10%	60-70%	Sufficient (2)	1	14	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

TOTAL	**100%**	**(E×90 + WE×5) / 100**	45	75	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	According to silabus	
Excercises	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. The right to sign is acquired by the number of attendance classes and exercises. Exercises (project assignment) are submitted according to the given deadlines and are evaluated.	According the sylabus	
Written exame	Requirements for the oral part of the exams are devoted and positively evaluated exercises, ie the project assignment and all other tasks. The oral exam consists of verbal defense (presentation) of the project task solution and the understanding of all phases of designing the conceptual and execution solution in the project assignment as well as the understanding and adoption of knowledge in lectures and exercises. The final grade is obtained according to the formula: (E × 95 + WE × 5) / 100	Exam terms	

Obligatory literature

1. Tkalec, S. Prekrat, S. (2000): Konstrukcije proizvoda od drva – osnove drvnih konstrukcija, Sveučilišni udžbenik Šumarski fakultet i Znanje, Zagreb
2. Pandžić, S. I., Pejša, I., Matković, K., Benko, H., Čereković, A., Matijašević, M.: (2011.) Virtualna okruženja: Interaktivna 3D grafika i njene primjene, sveučilišni udžbenik, Element, Zagreb

Recommended literature

1. Ruechinger A. (2003.): Grundlagen des Moebel und Innenausbaus, DRW-Verlag
2. McFarlane, B. (2017.):Autodesk Inventor Exercises, Taylor & Francis
3. Simmons, H. Colin; Maguire, E.D; Phelps, N. (2012.): Manual of Engineering Drawing - Technical Product Specification and Documentation, Elsevier

Special products of wood

WD-1271

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1

Lecturer
Professor Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant professor Tomislav Sedlar, PhD.
Branimir Jambrekovićmag. ing. techn. lign.

Grading

Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Knowledge about pencils, history of pencils and wood species for pencils. Matches and wood species for its productions. Models and wood species for its productions. Heel and wood species for its productions. Barrels and wood species for its productions. Barrels for strongdrink and softdrink. Light barrels. Barrels manufactured from plywood. . Pacage and wood species for its productions. Parts of wooden pacages. Standards for wooden pacages. Wood densifying by commpresion (lignostone). Manufacturion of beech lignostone. Structure, density, variation of moisture content, swelling and shrinkage, straingth, impact bending strength. Birch lignostone. Use of lignostone. Wooden briquttes, wood species for its productions and productions. Houses made of wood, square timber, sawn timber, particleboard, plywood and sandwich composites. Musical instruments. Acoustical properties of wood. Compering of acoustical properties of wood species witch are used for musical instruments. Toys and wood species for its productions. Fancy wood articles. Clasification over use of fancy wood articles. Wood species for productions of fancy wood articles. Wood in shipbuilding. Forms of forest cultivated for shipbuilding. Wood species for shipbuilding. Ships and boats made of wood. Parts of ships and boats. Request of shipbuilding technique and construction. Properties of wood for shipbuilding. Select the wood species for shipbuilding. Carving and inlaid work. Wood species and its properties inportante for carving and inlaid work. Wood for sport equipments and props.

Type of course:

Special products of wood (obligatory course, 2th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determining the characteristics of special products of wood in use that affect the choice of wood species for the production of special products of wood	Exercises evaluation, partial exams, final exam	A2,B1, B2
Determination of the required parameters of trees and sawmill for making special wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Determining the most characteristic properties of wood material for the production of special wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Determination of timber properties relevant for the production of special wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Defining the basic technological characteristics for the production of special wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Valuation of technological characteristics for production of special wood products	Exercises evaluation, partial exams, final exam	A2,B1, B2
Collection of relevant data to display the basic technological characteristics for the production of special wood products for the purpose of displaying as scientific or professional work	Exercises evaluation, partial exams, final exam	A2,B1, B2

General competences

Type of instruction

The student gains knowledge about specific request for special products of wood. Selection of wood species for special products of wood. Specificity of wood properties inportante for special products of wood.

Lectures

Lectures on theoretical bases are prepared by students to acquire knowledge of the influence of macroscopic characteristics, physical and mechanical properties of commercial wood species on the production of special wood products. Types of special wood products. Insights that facilitate the production of exercises and complete mastering of the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Field work

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:
To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	45	2,5
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	15	15	1
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex70 + PE1x30)/100**		46	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			

		81-90%	Very good (4)
		91-100%	Excellent (5)
TOTAL	**100%**	**(Fex100)/100**	
*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**			

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (45 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Bađun, S.: Tehnološke karakteristike drva I, skripta, Zagreb, 1979,str.1-50.
2. Govorčin,S.; Sinković,T.: Specijalni proizvodi od drva, interna skripta, Zagreb, 2002, (CD)
3. Ugrenović,A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. Panshin, A.J. and C. deZeeuw. 1980. Textbook of Wood Technology, 4th Edition. McGraw-Hill Series in Forest Resources. McGraw-Hill Book Company, New York.
2. Forest Products Laboratory. 1999. Wood Handbook - Wood as an Engineering Material. Gen. Tech. Rep. FPL-GTR-113. U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI.
3. WOOD Magazine. 1993. Classic Woodworking Woods And How to Use Them. Better Homes and Gardens WOOD Magazine. Meredith Books, Des Moines, IA.
4. Jackson, A. and D. Day. 1991. Good Wood Handbook: The Woodworker's Guide to Identifying, Selecting and Using the Right Wood. HarperCollins Publishers Ltd, London.

Selection of tools and processing parameters

WD-1272

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1

Lecturer
Associate professor Goran Mihulja, Ph.D.

Associate teacher for exercises
Associate professor Ivica Župčić, Ph.D.

Grading
Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:
Roughness of wood surface. Inherent roughness of wood. Roughness from wood processing. Roughness of wood in respect to fiber direction and cross section. Measuring roughness on wood surface. Contact methods. Methods without contact. Parameters of roughness. Theory of wood cutting. Directions of cutting wood. Types of chips when cutting in the direction of the fibers, vertically to the fibers and when processing the transverse cross section of wood and quality of processing. Process ability of different kinds of wood. Quality of processed surface in general. Quality and precision of processed surface. Quality of surface processed in sawing. Quality of surface processed by planning and routing. Quality of surface processed by wood turning. Quality of surface processed by drilling and mortising. Quality of surface processed by sanding. Quality of surface for gluing. Quality of surface for surface wood finishing. Selection of tools and processing parameters for individual tasks: Cutting of boards. Cutting massive wood, along the fibers and across it. Cutting bent parts. Cutting foams and textiles. Production of base areas on a planner. Processing on thicknesses and four-sided planners. Processing on lathe machines. Processing on routers. Processing on drills and grinders. Sanding wood. Producing jigs and other appliances in the mechanical processing of wood.

Type of course:

Selection of tools and processing parameters (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the basic concepts of wood surface roughness	partial or final exam	C3
Analyze the appearance of mechanically treated wood surface (macro irregularity) and the result of surface roughness measurement (micro irregularity)	laboratory exercises, corrections, and exercises evaluation	C3
Evaluate and recommend the optimal method of mechanical surface treatment of the most important types of wood (sawing, planning, milling, sanding, ...)	partial or final exam	B2, C10
Recommend optimum processing finish of wood surface required for further treatment (impregnation, modification, bonding, surface treatment, engraving)	partial or final exam	C10
Identify the factors (process, tools, wood types, ...) that have the greatest impact on the surface roughness of a particular process	partial or final exam	C10
Compare and evaluate the use of technologically and economically most advantageous materials and / or tools to meet the needs surface roughness based on their technological and exploitation properties in use and / or processing	laboratory exercises, corrections, and exercises evaluation	C10
Evaluate the technological and economic factors of the selected processing tools	partial or final exam	C10
Evaluate the possibility of applying templates and auxiliary devices for mechanical wood processing to the technological and economic effects of production	partial or final exam	C10
Conduct a selection of woodworking tools based on catalog offer, processing materials and type of woodworking machine	laboratory exercises, corrections, and exercises evaluation	C10

General competences
Acquiring knowledge about selection of tools and processing parameters for mechanical woodworking processes.

Type of instruction

Lectures
Mainly auditoria with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.

Exercises
Exercises are an upgrade to knowledge adopted in lectures. It consists of laboratory demonstrations and measurements that are limited by the practical work of the students. The report consists description of the task and measurement procedure, as well as the results and conclusions.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	30%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	15	30	1,5
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	35%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	35%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(E x 30 + PE1 x 35+ PE2 x 35)/100**		47	73	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS points
Final exam (FE)	80 %	51-64%	Sufficient (2)	2	43	1,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			

TOTAL	**100%**	**(FE x 80 + E x 30)/100**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes.	semester (30 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) have to be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Ljuljka, B.: Tehnologija proizvodnje namještaja, Zagreb, 1980, str. 1-257.
2. Prokeš, S. Obrabeni dreva a novich hmot ze dreva.

Recommended literature

1. Bogner, A., Grbac, I., 1983.: Proces brušenja u proizvodnji pločastog namještaja. Drvna industrija 34, 3, 53-58.
2. Bogner, A., Grbac, I., 1984.: Neki problemi tehnologije namještaja iz masivne bukovine. Zbornik radova KOLOKVIJ O BUKVI 125-133, Velika.
3. Bogner, A., Grbac, I., 1983.: Optimizacija obrade pločastih furniranih sklopova. Bilten ZIDI 11, 7, 79-100.

Field work II. – Design of Wood Products

WD-1273

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 2nd semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:

Field work II. – Design of Wood Products (compulsory course, 2nd semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Identify and describe the quality system in the company. Analyze the factors of quality furniture from the factory showroom. Identify and evaluate the degree of use of EN standards in production.	Field work report evaluation
Choose materials for making lightweight boards. Determine the technological parameters of lightweight boards pressing and production line capacities. Specify the technical characteristics of the boards.	Field work report evaluation
Organize a selection of modal trees for the exploration of physical and mechanical properties of wood. Make a plan for making samples for the research of physical and mechanical properties of wood. Choose methods of research of physical and mechanical properties of wood.	Field work report evaluation

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of collecting data on the factors of the manufacturing process or business of the company. Student analyzes the range of products and used materials. He suggests improvements for a more rational and optimal production of furniture and wood products

The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:

Teachers' obligations:
Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To

introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.

Students' obligations:

Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/hr/studiji/studij-drvne-tehnologije/diplomski-studij-oblikovanje-proizvoda-od-drva/terenska-nastava/

International market of wood products

WD-1280

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work -

Lecturer
Assist.prof. Andreja Pirc Barčić, Ph.D.

Associate teacher for exercises
Assist.prof. Andreja Pirc Barčić, Ph.D.
Prof. Darko Motik, Ph.D.

Grading

Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Wood economy. The basic features of wood processing, furniture manufacture and paper manufacture and recycling. The basic facts about international market of wood products. The strategies of development and growth of wood economy on the international market. An aggregate demand and a multiplier model. International market research of furniture and other wood products. Different methods of collecting, systematizing and data processing of European and world wood products market.Measuring economic success of wood economy in international wood products market. The methods of calculating consumption, export, import and production on the international market of furniture and other wood products. Different techniques of presenting the processed data of international market research. The influence of macroeconomic policy of certain countries on the growth and development of wood economy. The criteria for evaluation the wood economy share in the complete economy. The share in industry and gross domestic product. Sales trends monitoring of certain wood products on the world market. The information about the employment record, employees 'structure, payments, the enterprise income and investments on the international market of wood and wood products.

Type of course:

Internationl market of wood products (optional, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyze the impact of the macroeconomic policies of individual countries on growth and development of the timber economy.	Exercises evaluation, partial exams, final exam	D3
To review the economic success of the wood industry in international wood products market with a view to achieving competitive advantages within the wood sector.	Exercises evaluation, partial exams, final exam	D3
To analyze production, export and import of furniture and other wood products on the international market.	Exercises evaluation, partial exams, final exam	D3
To calculate the consumption of furniture and other wood products on the international market using apparent consumption method	Exercises evaluation, partial exams, final exam	D3
To analyze information on employment trends, salaries, income and investments on the international furniture and wood products market.	Exercises evaluation, partial exams, final exam	D3
To analyze criteria for monitoring the share of the wood economy in the entire economy.	Exercises evaluation, partial exams, final exam	D3
To analyze the trade statistics regarding wood based European and world markets.	Exercises evaluation, partial exams, final exam	D3
To investigate possible activities to increase the share of wood products in the international market.	Exercises evaluation, partial exams, final exam	D3

General competences
Student gets knowledge necessary to work in the wood industry companies on work posts with responsibilities regarding international market research, analysis of the company's environment on international markets necessary in upper management of business activities.
Student gets competencies for business documentation analyses, for creating a basic market reports, identify a competitor's strategy.

Lectures
Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise management in wood processing and furniture manufacturing in the field on international market research.

Exercises
Exercises on individual assignments with the purpose of applying theoretical settings learned in lectures Students, besides performing exercises, need to collect data, systematize data and present the results obtained in the form of project tasks for each exercise.

Working methods:

Teachers' obligations:
To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	50%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	13	45	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	25%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	25%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E50 + PE1x25+PE2x25)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	51-70%	Sufficient (2)	2	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(FE100)/100**				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lecturer)	-
	Exercises are made individually. Within the exercise, 4 individual tasks are performed, which eventually merge into the whole and form a project assignment (the project task is presented in the last term of the course, before the 2nd semester) At the beginning of the first exercise, students are provided with instructions on how to perform the exercises and the appearance of the collar, liner and insertion sheet in which they will print in the form. The accuracy, regularity and regularity (time-honored exercises). Exercises carry 50 points.	According to a time schedule	
Partial exam I	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. The 1. Partial exam is 50 points and it covers the issues regarding until the time of partial exam.	8th. week	
Partial exam II	Second partial exam can be attended by students who did not miss more than 15% of lectures and exercises and have obtained more than 25 points in the Partial exam I. The II. Partial exam is 150 points.	13th. week	
Written exam	Students who did not receive a positive assessment from the exercise and the partial exams (less than 51% of the total score) or are not satisfied with a final grade will approach the written exams according to certain examination deadlines. The written exam consists of 2 assignments (depending on the complexity of the assignment, with each assignment max number of points)	Exam terms	
Oral exame	The requirement for the oral exam is 51 % on the written exam. The score obtained on the oral exam is the final grade in the 100% ratio. Note: The person who passed the exam via partial exams and obtained the right to a final grade, and is not satisfied with the final grade, can access the oral exam, but in that case may score a grade higher than the grade obtained by passing the exam through a partial exam. The grade given on oral exam is final and it makes 100% of the grade.	Exam terms	

Obligatory literature

1. Hansen, E., Ranwar, R., Vlosky, R. (2014): The Global Forest Sector. CRC Press.
2. Previšić, Ozretić Došen, Krupka: Osnove međunarodnog marketinga, Školska knjiga, Zagreb, 2012.

Recommended literature

1. Kotler, P., Wong, V., Saunders, J., Armstrong, G. (2006). Osnove marketinga. Mate, 4th ed.,

Finishing of wood products

WD-2373

ECTS 5

E-learning R2

Teaching hours 60
Lectures 30
Excercises 30
Field work 2

Lecturer
Professor Vlatka Jirouš-Rajković
Assistant professor Josip Miklečić

Associate teacher for exercises
Assistant professor Josip Miklečić
Professor Vlatka Jirouš-Rajković

Grading

Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91%

Course content:
The appearance of a product. The impression of colour. Te base of colorimetry. The instrumentation for the measurement of colour. The influence of light on the discolouration of the coated wood. Gloss and gloss measurement. Coatings for wood during history. Wood properties that affect durability of wood-coating system. Surface preparation for finishing. Types of coating. Composition of coatings. The binders. The solvents. The pigments. Other coatings ingredients. The properties of different coatings. Modern methods of applying finishes. Modern commercial finishing apparatus. The base of forming the film. Wetting and spreading. Adhesion of coating on wood. Interaction of wood and wood finish. Internal stresses. Imitation treatment of wood and wood products. Special technologies of wood finishing. Finishing for exterior wood: wood natural enemies, classification of wood coatings, properties of coatings, durability of coatings and maintenance. Removing coatings from wood surface and refinishing. Finishing troubles. Compliant coatings. Environmental legislation. Abatement. Testing of coating material before applying. Quality testing of coated wood surfaces.

Type of course:

Finishing of wood products (compulsory course, III semester, II Year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	
To explain the meaning of color and distinguish color measurement systems.	Laboratory work, partial exam, exam	A2, C3
To measure the color and gloss of coated wood and interpret the result.	Laboratory work, partial exam, exam	A2,C3
To recommend finishing systems for wood products in the interior and exterior.	Laboratory work, partial exam, exam	C3
To explain the surface phenomena on wood-coating interface and relate their mutual influence (wetting, spreading, surface tension, surface energy, adhesion, penetration).	Laboratory work, partial exam, exam	C3
To analyze the causes of internal stresses in wood coatings.	Laboratory work, partial exam, exam	C3
To analyze the factors affecting the performance of wood-coating system.	Laboratory work, partial exam, exam	C3
To assess the causes of wood staining failure and coating failures.	Laboratory work, partial exam, exam	C3
To distinguish the materials and processes for imitation of wood and wood products.	Laboratory work, partial exam, exam	C3
To plan wood finishing process in craftmanship and in industrial production.	Laboratory work, partial exam, exam t	C3, B2
To rank qulity of wood finishing based on laboratory testing of aesthetic properties, mechanical properties, resistance to chemical influences and heat, resistance to weathering.	Laboratory work, partial exam, exam	B1, B10,C3
Collect information about the professional topic, synthesize and present them.	seminar	A2, E3

General competences
Development of written and spoken communication skills and professional expression.
Identifying problems, participating in problem solving, and logical linking of facts.
Ability to interpret test results.
Teamwork.
Development of responsibility and ethics.

Forms of teaching

Lectures

Exercises

Laboratory exercises are supplement to lectures. Students make 10 exercises according to instructions given in MERLIN. Completed exercises (worksheets) are a condition for obtaining signatures. Exercises must be submitted in pre-defined terms and for this the students earn points.

Working methods:

Teachers' obligations: Teaching - lectures, exercises, homework, topics of seminar papers. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations: Regular attendance and active participation in lectures and exercises, preparation and submission of laboratory worksheets and seminar papers within the deadline. Resolving and delivering homework. Passing partial exams or examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	15 %	1,5 points for each task (worksheet) that was submitted on time	-	30	10	1,3
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points. To gain access to the second partial exam must achieve a minimum of 15 points.	-	1	24	0,8
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points.	-	1	24	0,8
Homeworks	5 %	1 point for each homework that was submitted on time	-	-	5	0,1
Seminar paper or project task	20 %	The maximum possible number of points scored is 20	-	-	25	1
TOTAL	**100%**	From all the elements of monitoring and checking the student can achieve a maximum height of assessment of 100 points, which makes 100 % of the grade. For the passing grade, the student must have a minimum of 60 points or 60 % of the grades. Scale rating is as follows:		62	88	5

		60 % - 70 %	Sufficient (2)			
		71 % - 80 %	Good (3)			
		81 % - 90 %	Very good (4)			
		91 % - 100 %	Excellent (5)			

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)*	100 %	60-70 %	Sufficient (2)	2	48	1,6
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
UKUPNO	**100%**					

***** A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. The exam consists of a written and oral part. Prior to exam seminar paper and exercise woorksheets must be submitted for review.

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is recorded. Students are allowed 20 % absence from lectures and 10 % from excersises. Exercises are attending in groups. Exercises tasks are submitted within a predefined time limit, and timely delivery of the correct work sheets is scored.	semester	-
Submission of worksheets from laboratory work (excercises)	Exercises are attended in groups. Students must submit worksheets in a predefined period of time and timely submitted worksheets are scored.	According to weekly class schedule	-
Partial exams	There are two partial exams. Each brings 30 points. At the first partial exam a student must achieve at least 50 % to gain access to second partial exam.	VIII week XV week	-
Homeworks	Each on-time delivered homerwork brings 1 point	According to weekly class schedule	-
Seminar paper/project task	Students choose the theme of the seminar work from the proposed themes in MERLIN. Seminars are scored according to the given criteria.	XIII; XIV week week	-

Written exam	A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. Prior to exam seminar paper and exercise woorksheets must be submitted for review.	Exam terms	-
Oral exame	Prerequisite for oral exam is minimum score of 60 in written exam	Exam terms	-

Obligatory literature

1. Ljuljka, B. 1990: Površinska obrada drva. Sveučilište u Zagrebu. Šumarski fakultet, Zagreb.
2. Ljuljka, B., Jirouš-Rajković, V., 2006: Osnove površinske obrade drva. Šumarski fakultet & Sand, Zagreb, 2006.

Recommended literature

1. Alić, O. 1997: Površinska obrada drveta, Mašinski fakultet Sarajevo.
2. Bulian, F. 2004: Verniciare il legno. CATAS, Udine.
3. Goldschmidt, A., Streitberger, H.-J. 2002: BASF-Handbuch Lackiertechnik. Vincentz Verlag, Hannover.
4. Rothkamm, M., Hansemann, M., Böttcher, P. 2003: LACK Handbuch Holz. DRW-Verlag.
5. Roux, M.-L. 2004: Environmentally Friendly Finishes for High Performance Wood for Indoor Uses. 4th
6. International Woodcoatings Congress: Developments for a Suistainable Future, The Hague 2004, Paper 1. The Paint Research Association, Teddington, UK.
7. Meijer, M. 2004: Wood Coating Interaction. 4th International Woodcoatings Congress: Developments for a
8. Suistainable Future, The Hague 2004, Paper 2, The Paint Research Association, Teddington, UK.

Designing of wooden products

WD-2374

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 2 days

Lecturer
professor Silvana Prekrat, PhD

Associate teacher for exercises
professor Silvana Prekrat, PhD

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction to products' design. – Design, projection, construction. Approach to projecting according to product's development stage; Project task – contents; Idea project for the model, sample. Main project for the prototype, industrial product; Review and selection of the production programme – classification, analysis of the product, assortment, manufacturing programme. – Launching of a new production programme. – Price classification. Selection criteria for the optimal construction solution and versions; determination of the types of basic and auxiliary materials: Determination of standardization degree and unification. Internal standardization of the parts and assemblies. Determination of constructional complexity. Production plan. Identification and classification. Assessment of annual production volume – requirements in materials by types, material use. Scoring criteria; System of constructional elements of wooden products – marking system for products structure, construction module in furniture industry. Visual presentation supported by ARCON and automatic construction of furniture supported by SELECTION.

Type of course:

Designing of wooden products - Compulsory course, 3th semester, 2nd year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Preparing the content of the project task based on the needs of the customer and the prescribed standards.	exercises (project assignment)	A2 B10 C4
Planning of designing, and constructing activities.	exercises (project assignment)	B4 C5
Design furniture and wood products according to functional, safety, mechanical, aesthetic, production and economic requirements	exercises (project assignment)	A2 B1, B2, B3, B4 C4, C6
Recommend an optimally constructive version with variants.	exercises (project assignment)	B2, B3 C4, C5, C6 E
Design a product in a 3D model using all the knowledge acquired from design, and other courses in which construction and calculation are studied.	exercises (project assignment)	B1, B2, B3, B4, B5, B6, B7 C4,C5,C6,C7, C8 D1
Evaluate different product variants in individual stages of product development using a multi-criteria approach	exercises (project assignment)	B1, B2, B3, B4, B5, B6, B7 C4,C5,C6,C7
Analyzing products, assortments, production programs.	exercises (project assignment)	B2, B8, B9 C4,
Presentation of an Argumented Own Solution (Written and Oral)	exercises (project assignment)	A1, A3

General competences

Acquire knowledge and skills in applying systematic design methods to design with the aim of rational application of materials and construction solutions.

Training of project management experts from conceptual solutions to serial production. Additionally, CAD software for visualization and automated design.

Tipe of instruction

Lectures

Exercises

The exercises involve making main project task and projects. During the semester, students write their exercises / projects in team and individual work, while monitoring the continuous progress of the student and the acquisition of thematic knowledge and skills in accordance with the evaluation criteria. The exercises are performed by analyzing and elaborating each phase of the problem with the given task. The preparation of individual stages of the task is carried out by consultation and in agreement with the teacher, where questions and ambiguities are basically elaborated and conceptualized at home and explained in the exercises. Part of the curriculum / product training process is carried out in co-operation with students at the Graduate Study of Wood technology precesses or companies and other economic and public entities involved in the implementation and realization of the task.

Working methods:

Teachers' obligations:
Maintaining original teaching - lectures, exercises and field teaching. Creating teaching materials. Preparing and designing exercises for their review and evaluation. Organization and management of project and field teaching. Maintain consultation and exam and evaluate tasks during exercise and exam.

Studenats' obligations:

Regular attendance and active participation in lectures, exercises and field teaching. During the semester, it is mandatory to hand over seminar work as well as every stage of the elaboration to the insight and correction within the given deadline. Student has no right to sign and exit to the exam prior to the submitted and positively evaluated exercises/project. Taking the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0			30	0	1
Exercises (E)	90%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	30	75	3
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			
		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Oral exam (OE)	10%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(E×90 + OE×10) / 100**		60	90	5

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	semester (15 hours of direct lecturer)	
Excercises	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. The right to sign is acquired by the number of attendance classes and exercises. Exercises (project assignment) are submitted according to the given deadlines and are evaluated.	According g the sylabus	
Oral exame	Requirements for the oral part of the exams are devoted and positively evaluated exercises, ie the project assignment and all other tasks. The oral exam consists of verbal defense (presentation) of the project task solution and the understanding of all phases of designing the conceptual and execution solution in the project assignment as well as the understanding and adoption of knowledge in lectures and exercises. The final grade is obtained according to the formula: (E × 90 + OE × 5) / 100	Exam terms	

Obligatory literature

1. Tkalec, S. Prekrat, S. (2000): Konstrukcije proizvoda od drva – osnove drvnih konstrukcija, Sveučilišni udžbenik Šumarski fakultet i Znanje, Zagreb
2. Tkalec S. (2000.): Identifikacija i klasifikacija strukture osnovnih proizvoda u finalnoj obradi drva, skripta

Recommended literature

1. Ruechinger A. (2003.): Grundlagen des Moebel und Innenausbaus, DRW-Verlag
2. Ehrlenspiel K. (2007): Integrierte Produktentwicklung, Hanser Verlag, 1-752
3. Smardzewski, J. (2015): Furniture design, Springer Verlag, 1-649
4. Oberšmit, E.: Primjena metodičkog konstruiranja u fazi koncipiranja proizvoda,
5. Strojarstvo 21, str. 61-65, 1979
6. Oberšmit, E.: (1989.): Nauka o konstruiranju, metodičko konstruiranje i konstruiranje pomoću računala, Sveučilišna naklada Liber, Zagreb, 1989

Furniture and Health

WD-2375

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work1 day

Lecturer
Professor Ivica Grbac Ph.D.
Assistant professor Danijela Domljan Ph.D.

Associate teacher for exercises
Assistant professor Danijela Domljan Ph.D.
Associate professor Zoran Vlaović Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Interactions between furniture and human health. Environmental effects on human health. Living healthy. Principles of a healthy furniture design. Unity principles of functional and aesthetically pleasing, cost-efficient and eco- certified product. Interdisciplinary as a generator of new findings. The importance of health parameters in furniture design. Ergonomics and anthropometry in the service of health. Body biomechanics. Spine. The importance of technical-technological parameters. Materials. Wood and wood-made materials, wooden-synthetic and synthetic materials. Sitting furniture in the function of human health. Office furniture. Healthy and relaxing work seating. Sitting dynamics. Ergonomic and anatomic aspects of the use of sitting furniture. Standards. Principles of a school furniture design. Standards. Children's' work furniture. Optimal school furniture. Principles of a school furniture design. Upholstered sitting furniture. Upholstered furniture for sitting, relaxation, rest and lying. Lying furniture in the service of human health. Sleeping culture. Standards for healthy bed design. Hygienic and eco-friendly materials. Relations between a sleeping system and a sleeper's body. Kid's bed. Vibroacoustic. Kitchen furniture in the service of human health. Design and functional characteristics of the healthy modern kitchen furniture. The importance of ergonomic and anatomic aspects. New materials and technologies in the function of kitchen environment design. Design of a healthy living space and furniture. Current trends in designing a healthy living space. Ecology. Feng shui.

Type of course:

Compulsory course, 3rd semester, 2ndyear

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to relate furniture ergonomics and human psychophysical health i.e. potential effects caused by (poorly constructed furniture, use of harmful materials or use of a quality, natural materials…) furniture to a human health and potential adverse or positive consequences.	presentation, seminar paper, exercise, final examination	A2 B7, B10 C6
to formulate the impacts of environment (such are: rhythm of life, environmental pollution, technological innovations…) on human health.	presentation, seminar paper, exercise, final examination	A1, A2 B7 C6
to identify the principles of healthy living (need for active modalities of interaction with furniture, necessity to use natural materials furniture, environmental awareness at recycling…).	presentation, seminar paper, exercise, final examination	A1, A2 B7 C6
to apply principles of furniture design for healthy, functional, cost effective and eco furniture.	presentation, seminar paper, exercises	A1, A2 B7, B8, B9, B10 C6
to collate interdisciplinary of new findings in modelling healthy furniture, on new technologies and materials, human needs for changes and improvement of a living quality.	final examination	A1, A2 B7, B8, B9, B10 C6
to propose health parameters at furniture modelling (anatomical-physiological compatibility of furniture with human needs, application of ergonomic and anthropometric regulations, taking into account the biomechanics of the body).	final examination	A2 B7, B8, B9, B10 C6
to apply ergonomics and anthropometry in furniture design.	presentation, seminar paper, exercises	A2 B7 C6
to valorise and apply available materials and exercise importance of the technical-technological parameters (utilization of materials in the service of human health, wood and wooden materials and the composite combinations, effects of harmful materials, environmental protection…).	presentation, seminar paper, exercises	A1 B5, B6, B7 C6
to design and construct sitting and lying furniture in the service of health.	presentation, seminar paper, exercises	A1, A2 B1, B2, B7, B8 C6, C7 D2
to use and know how to apply value standards for development and testing of furniture.	presentation, seminar paper, exercises	B1, B10
to apply a modelling principles of school furniture.	presentation, seminar paper, exercises	A1, A2 B7, B8 C6 D2
to design concept of upholstered furniture for sitting, resting and lying in the service of human health for household, professional and public use.	presentation, seminar paper, exercises	A1, A2 B2, B7 C6 D2

to interpret interaction of the bed system and body of a sleeping person (rules for using, thermal balance, microclimate of the bed system, comfortability…)	final examination	B7, B8, B10 C6
to propose modelling and functional features of a healthy modern furniture (with observing ergonomic principles, functional dimensions compliant with anthropometry, use of materials and technologies harmless for humans and environment…).	presentation, seminar paper, exercises, final examination	A1, A2 B2, B7, B8 C6 D2
to model a healthy living space and furniture (with observing ergonomic principles, functional dimensions compliant with anthropometry and the functionality of furniture, use of materials and technologies, harmless for humans and environment…).	presentation, seminar paper, exercises	A1 B2, B7, B11, B12 C2, C6 D2

General competences

Mastering and understanding the basic contemporary methods and techniques in designing healthy furniture and protecting humans and environmental health through the production and use.

Lectures

Exercises

Practical exercises imply the completion of written assignments from the midterm paper. After teaching faculty session (lecture), students exercise the tasks of analysing existing production portfolios at modern healthy furniture manufacturers according the covered lecturing topics, and by brainstorming method they grasp new conceptual structural modelling or technical-technological solutions.

Working methods:

Teachers' obligations:
to hold original classes – lectures, exercises and field work. To draw up teaching material. To prepare and devise exercises, to examine and grade them. To organise field work. To hold consultations and conduct examinations.

Students' obligations:
regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission of seminar papers and exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1

Exercises (E)	80 %	Partially applied teaching materials, well structured, substantially acceptable , not submitted on time	Sufficient (2)	15	60	2,5
		Partially applied teaching materials, well structured, substantially acceptable, submitted on time	Good (3)			
		Entirely applied teaching materials, excellently structured, complete and submitted on time	Very good (4)			
		Entirely applied teaching materials of excellently structured, substantially, complete and submitted on time	Excellent (5)			
Oral exam (OE)	20 %	60-70%	Sufficient (2)	0	15	0,50
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100 %**	**(E×80 + OE×20) / 100**		45	75	4

Detailed description of evaluation elements for lecturer, exercises, partial or final examinations:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Lectures (L)	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	according to syllabus	-
Exercises (E)	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Assignments are examined, and the seminar paper graded and presented to everyone.	according to syllabus	-
Oral exams (OE)	Students whose exercises have been given positive grades take the examination Students' comprehension and knowledge acquired at lectures and practical sessions will be examined The final grade will be calculated by the formula: **(E×80 + OE×20) / 100**	exam terms	-

Obligatory literature

1. Grbac, I. (2003): *Zdrav život – zdravo stanovanje*, *Prvi priručnik iz područja namještaja u funkciji zdravlja*, Spektar media, Zagreb
2. Grbac, I (2004): *Ojastučeni namještaj*, university textbook, Zagreb
3. Grbac, I (2005): *Kreveti zdravlje*, university textbook, Zagreb
4. Grbac, I. Marinšek, E. (1995): *Vodna postelja – zdravo spanje*, handbook-script, Ljubljana - Slovenia, February 95, 1-52.
5. *** (1999): Living spaces, Ecological Building and Design, Öko test ,Könemann, English Edition, (Edit.: Schmitz-Gunther T.), Mladinska knjiga tiskarna d.d., Ljubljana
6. Panero, J. iZelnik, M. (1987): *Antropološke mere iinterijer, Zbirka preporuka za standarde u projektiranju*, IRO "Građevinska knjiga", Belgrade

Recommended literature

1. Fuad-Luke, A. (2002): The Eco – Design Handbook, Thames & Hudson Ltd., London
2. Quarante, D. (1991): *Osnove industrijskog dizajna*, The Faculty of Architecture, University of Zagreb, Interdisciplinry Art &Design Studies, Zagreb
3. Meštrović, M. (1980): *Teorija dizajna i problem okoline*, Biblioteka Naprijed, Zagreb
4. Papanek, V. (1973): *Dizajn za stvarni svijet*, M. Marulić, Split
5. Marchus, G.H. (2002): What is design today?, H.N.Abrams Inc. , New York

Applied statistics

WD-2376

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Professor Anamarija Jazbec, Ph.D.

Associate teacher for exercises
Assistent professor Maja Moro, Ph.D.

Grading

Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Tests of Hypotheses. Testing for the Population Mean. Testing Proportion. Testing Variance. Difference between two Population Proportions. Difference between two Population Variances. Difference between two Population Means. T-test. Nonparametric Mann Whitney test. Analysis of Variance. Pearson's and Spearman rank Correlation. Linear Regression. Least Squares Methods. Estimation of Regression Coefficients. Coefficient of Determination. Model building. Methods of Model building. Univariate and Multivariate Models. Modelling Interactions. Chi square test. Fisher`s exact test. Cluster analysis.

Type of course:

Applied statistics (compulsory, 3. Semester, 2. Year graduate study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify, implement and perform a statistical test based on sample for testing population mean	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test based on sample for testing population proportion	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test based on sample for testing population variance.	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing difference between two population proportions (test of proportions)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing difference between two population variances (F test)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing difference between two population means (t test, Mann Whitney test)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing equality more than two population means (ANOVA)	Partial exams, written and oral exam	A2
Identify, implement and perform a statistical test for testing two dependent population means (t paired test)	Partial exams, written and oral exam	A2
Calculate population correlation and estimate coeficient of the correlation and preforme statistical test (Pearson's and Spearman rank correlations) with computer support..	Partial exams, written and oral exam	A2
Analyze and interpret the results of univariate and multivariate linear regression with the help of computer support.	Partial exams, written and oral exam	A2
Analyze the contingency table implement the chi2 test	Partial exams, written and oral exam	A2

General competences
Collect, statistically analysed, display collected data.
Discuss and make conclusions based on the already analysed data.
Writing a compliance report for a product.
Self-preforming statistical quality control

Tipe of instruction

Lectures

Exercises
Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Preforming original lessons - lectures, exercises. Preforming Partial, Written and Oral Exams and Consultations. Creating teaching materials. Correcting Exercises.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preapering, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-		-	30	15	1,5
Exercies	-	-	-	15	30	1,5
Partial exams	100%	65-74	Sufficient (2)	4	25	1
		75-84	Good (3)			
		85-94	Very good (4)			
		95-100	Excellent (5)			
Final exam	100%	60-70	Sufficient (2)	3		
		71-80	Good (3)			
		81-90	Very good (4)			
		91-100	Excellent (5)			
TOTAL	**100%**			**52**	**68**	**4**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of students on lectures and exercies is checked. The student may not attend a maximum of 4 hours of lecture classes and 4 hours of. Exercies.	semester (45 hours of direct lecturer)	-
Partial exams	During the course, students write two partial exams each with 5 tasks total 100 (2 * 50) points. The minimum number of points that can be obtained by the partial exam is 20. If they collect at least 65 points in two partial exams they can pass exam without the final exam.	During the semester	
Written exam	Exams can be accessed by students who have received a signature. The written part of the exam consists of 5 tasks totaling 100 points.	Exam terms	
Oral exame	Students who have passed the written part of the exam access the oral exam.	Exam terms	

Obligatory literature

1. Basic statistics e-course na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=36296
2. Jazbec A. 2009: Osnove statistike, 2 ed. Šumarski fakultet, Zagreb

Recommended literature

1. Bahovec V, Erjavec N ur. 2015: Statistika, Element, Zagreb
2. Jazbec A. 2009 : Osnove statistike, 2 ed. Šumarski fakultet, Zagreb
3. Montgomery D.C.2005: Statistical Quality Control, 5ed. Wiley, NewYork.
4. Duncan, A. J. 1974: Quality Control and Industrial Statistics, Irwin, Homewood, Illinois.

Research of adhesively bonded joints

WD-2377

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1

Lecturer
Associate professor Goran Mihulja, Ph.D.
Professor Hrvoje Turkulin, Ph.D.

Associate teacher for exercises
Assistant professor Josip Miklečić, Ph.D.

Grading
Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:

Types of bonded joints. Types of adhesives. Bonding techniques. Firmness of bond. Durability of bond. Effect of type of wood on the durability of bond. Effect of water content in wood on durability and firmness of bond. Inner stresses in bond. Resistance of bond to high (WATT test) or low temperatures. Atmospheric effects on durability of bond. Firmness of bonds that are permanently statically weighted (creep test). Exploration examination of glued products. Conditions of exposing the product. Conditions of realistic exploration. Accelerated conditions. Static and dynamic examination of glued products. Laboratory testing of joins on testers. Standards for testing glued joins (ISO, EN, HRN and ASTM). Testing firmness to shear. Pressure shear. Tension compression. Form of tests. Distribution of stress. Concentration of stress. Deformation tests. Testing firmness to tension compression. Form of testing and means of analysis. Testing resistance to bending. Form of testing and means of analysis. Testing glues with testers in the form of angled two-part holders. Testing resistance to peeling. Testing melting glues. Changes to temperature and climatic influences. Testing sponge glues. Flammability. Elasticity of the join. Strength of join. Resistance to swelling in solvents. Statistical expression of strength of glued joins. Normative firmness.

Type of course:

Research of adhesively bonded joints (elective course, 3. semester, 2. year

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish and categorize the basic groups of glued joints (width, thickness, length, ...);	partial or final exam	B2
Know and control the factors of forming the bonded joint (adhesive factors, substrates, environmental conditions, processing, ...);	partial or final exam	B2
Propose to use the specific construction of the glued joint in the wood products;	laboratory exercises, corrections, and exercises evaluation	B2
Formulate the importance of strength and durability of the joint on product quality;	partial or final exam	B2
Evaluate the quality of adhesive joint by standard ISO and EN test methods;	laboratory exercises, corrections, and exercises evaluation	B1
Analyse and evaluate the importance of factors affecting the strength and durability of adhesive joint;	exercises reports, corrections, and exercises evaluation	B2
Recommend methods for determining the strength of the bonded joints (methods for structural and non-structural joints);	partial or final exam	B2
Recommend methods for determining the durability of glued compounds (methods for structural and non-structural joints);	partial or final exam	B2

General competences
Acquiring knowledge on bonded joints in wood technology.
Acquire knowledge and skills on methods of test for bonded joints.

Type of instruction

Lectures
Mainly auditoria with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.

Exercises
Exercises are an upgrade to knowledge adopted in lectures. It consists of laboratory demonstrations and measurements that are limited by the practical work of the students. The report consists description of the task and measurement procedure, as well as the results and conclusions.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	30%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	15	30	1,5
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	35%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	35%	51-64%	Sufficient (2)	1	21,5	0,75
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(E x 30 + PE1 x 35+ PE2 x 35)/100**		47	73	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	80 %	51-64%	Sufficient (2)	2	43	1,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	**100%**	**(FE x 80 + E x 30)/100**				

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes.	semester (30 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) have to be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Ljuljka, B. 1978: Lijepljenje u tehnologiji finalnih proizvoda, Zagreb, 1 – 219.
2. Bandel, A. 1995: Gluing wood, CATAS, Udine.

Recommended literature

1. Bogner,A., Ljuljka.B., Grbac,I. 1984.: Optimizacija procesa lijepljenja ploča iz masivnog drva u proizvodnji namještaja BILTEN ZIDI 12,4,1-50.
2. Bogner, A., Ljuljka, B., Grbac, I. 1996.: Methods for Testing the Resistance of Wood Hotmelt
3. Adhesives to Temperature Changes and Weathering. Drvna industrija 47 (3), 108-113.
4. Bogner, A., Grbac, I., Mihulja, G. 1999.: Residual stresses in the glued structural members of wood. DRVNA INDUSTRIJA, 50 (4), 185-191.

Quality management and assurance

WD-2378

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 0

Lecturer
Assistant professor Krešimir Greger, PhD

Associate teacher for exercises
Assistant professor Kristina Klarić, PhD
Ivana Perić, PhD

Grading

Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Introduction. Basic concepts of quality management and assurance. Development of quality control. Standards and standardisation (domestic and international). Normative determination of quality in wood processing and furniture production. Quality and production process permeation. Four quality elements. Defining the capabilities of products and processes in wood processing and furniture production. Some authors and their consideration of quality management and quality assurance (Crosby, Juran, Taguchi, Ishikawa). Place of quality in organization. Defining Total Quality Control (TQC), Quality Assurance (QA), Quality Management (QM) and Total Quality Management (TQM). Quality management in wood processing and furniture manufacturing. Process control, input control, process and output control. Place of quality in production and business management systems. Information system of quality assurance. Quality cycle, quality control tasks at different levels and at different stages of the production process. Information system framework for quality management and quality assurance in wood processing and furniture manufacturing. Basic quality assurance stages. Development of quality management and assurance. Degrees and steps in developing system of quality management and quality assurance. Quality at the source (Q/S), Kaizen, QFD (QFD), Quality Teams (QT). Comparison of traditional and TQM organization of wood processing and furniture manufacturing companies. Quality assurance methods and techniques. Quality circles, the relationship between product quality and process. Specificity of methods and techniques for quality management and quality assurance in woodworking and furniture manufacturing plants. Division of methods and techniques. Non-statistical methods of quality control. Hundred percent quality control, zero quality control, direct control, self-control.
International standards systems ISO 9000 and ISO 10000. New development trends in quality assurance and quality management. European standardization process, certification and standards compliance. Quality management system and quality assurance system ISO 9000. System of standards, requirements, control, monitoring, system certification. Standard groups ISO 9001, 9002, 9003. Guidance groups ISO 10001, 10002, 10003. Derivatives from international standard systems (4 SIPs, 4 SWCs, 4 SEAs). Croatian standardization system. Specifications in wood processing and furniture production.

Type of course:
Quality management and assurance (optional, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define terms of quality control, quality assurance, quality management, total quality management and business excellence.	exercises, tests, exam	D2
Assess the place of the quality in some management and quality assurance systems.	exercises, tests, exam	D2
Manage the quality of the entire business process.	exercises, tests, exam	D2
Develop quality management and quality assurance for a wood processing and furniture manufacturing company.	exercises, tests, exam	D2
Distinguish national and international standards dealing with quality furniture.	exercises, tests, exam	D2
Assess the process capability in wood processing and furniture manufacturing.	exercises, tests, exam	D2
Identify the place of quality in organizations with less than 10, 50, 100, 300 and 500 employees.	exercises, tests, exam	D2
Organize, plan, assemble and build the entire system of quality management and quality assurance in the company of wood processing and furniture production.	exercises, tests, exam	D2
Compare the quality of products and quality of processes and choose the appropriate methods and techniques of quality management and quality assurance.	exercises, tests, exam	D2

General competences
Students are trained to solve the issues of quality management and quality assurance by gaining general and specific knowledge in the field of management and quality assurance adjusted to specific production problems in wood processing and furniture manufacture.

Type of instruction

Lectures
In the course of lectures, students gain knowledge about quality management and quality assurance in wood industry.

Exercises
As part of auditory exercises and computer exercises, students receive an upgrade the knowledge about quality management and quality assurance gained during the lectures.

Fieldwork
During fieldwork, students connect knowledge from the lessons and exercises with real production.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers, compiling knowledge tests, and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the tests and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	15	30	1,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Test 1 (T1)	40%	60-70%	Sufficient (2)	1	22,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Test 2 (T2)	40%	60-70%	Sufficient (2)	1	22,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		60--70%	Sufficient (2)			
TOTAL	**100 %**	**(Ex20 + T1x40 + T2x40)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 %	Sufficient (2)			1,5
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100	Excellent (5)			
TOTAL	**100 %**	**(FEx80+Ex20)/100**				

*** Students who during the semester do not pass the subject by a written test shall attend the exam, that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.**

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 15 % of direct teaching hours.	semester (90 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. For each exercise, students receive individual templates - tasks. The deadline for the exercise is two weeks and if the exercise is not timely submitted and the positive evaluation is not obtained, the student gets an additional task. The accuracy, tidiness and regularity of exercise are evaluated (time-honoured exercises).	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Test 1	Students who have a positive assessment of the first half of exercises and who have not abstained from teaching more than 15% can access the first test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	8^{th} week	Students who pass the first test can access the second test.
Test 2	Students who have a positive assessment of all exercises and who have not abstained from teaching more than 15% can access the second test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	15^{th} week	Students who pass 1^{st} and 2^{nd} test are exempted from the exam.
Written exam	Students who have a positive assessment of all exercises can attend the exam. The exam consists of three computational and theoretical tasks. To pass, students must acquire a minimum of 60% of the points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula: **(WAx40+OSX40+Ex20)/100**		-

Obligatory literature

1. Figurić, M. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Juran, J. M., Gryna, F.M. 1999: Planiranje i analiza kvalitete, Mate, Zagreb.
3. Greger, K. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja (zbirka zadataka), Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.

Recommended literature

1. Skoko, H.: Upravljanje kvalitetom, Sinergija d.o.o., Zagreb, 2000.
2. Lazibat, T.: Upravljanje kvalitetom, Znanstvena knjiga, Zagreb, 2009.
3. Šiško Kuliš, M., Grubišić D.: Upravljanje kvalitetom, Sveučilište u Splitu, Ekonomski fakultet, 2010.
4. Štajdohar-Pađen, O., Plivati s ISO-om i ostati živ, Zagreb : Grafički zavod Hrvatske. Zagreb: Kigen, 2009.

Project management

DD-2379

ECTS 4

English language R1

E-learning R1

Teaching hours 45
Lectures 30
Exercises 15
Field work 1

Lecturer
Prof. Denis Jelačić, PhD.

Associate teacher for exercises
Prof. Denis Jelačić, PhD.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Projects within production system. Establishing project activities, project management, mothods and techniques of project management. Gantt hart forward and backward, network diagrams, types of network diagrams and their implementation. Establishing resources necessary for project implementation in wood processing and furniture manufacturing.Plan and project. Approach to planning and enterpreneurial business planning, business plan, venture, project, investment project and investment study with implication to wood processing and furniture manufacturing.Enterpreneurial projects. Information on enterpreneur – investor. Analysis of purchase and sell market with examples from wood industrial branche. Technological-technical analysis of the business organization in wood processing and furniture manufacturing, location analysis. Financial preparation of a project, efficiency evaluation, purpose of enterpreneurial business plan, structure of enterpreneurial business plan, optimal enterpreneurial decision making. Important business and time components of a project and business plan. Company value. Restrictions in business of enterprises in wood processing and furniture manufacturing. Basics of economical calculations, interest calculation, simple and komplex interest calculation, loan repayment, economical evaluation of investment project. Return of investment period, profit, profit rate.

Type of course:

Project management (elective course, 3rd semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To establish position and project activities within the management system;	Exercises evaluation, partial exams, final exam	D1
To establish time components of a project by using Gantt charts and network diagrams;	Exercises evaluation, partial exams, final exam	D1
To establish the resources for quality project implementation;	Exercises evaluation, partial exams, final exam	D1
To establish the parameters of business plan for given project;	Exercises evaluation, partial exams, final exam	D4
To make technical-technological analysis, location analysis of the business plan;	Exercises evaluation, partial exams, final exam	D4
To make financial preparation of a project with important time milestones;	Exercises evaluation, partial exams, final exam	D4
To make a project of management system in a company	Exercises evaluation, partial exams, final exam	D4

General competences

Student gets knowledge necessary to work in the industrial branche on work posts with responsitilies in enterprise management in the field of project management.

Type of instruction
Lectures

Lectures on theoretical basis prepare students for work on work posts with responsitilies in enterprise management in wood processing and furniture manufacturing in the field of project management with practical examples and with computer technology aid, which make exercises and the whole subject easier to acquire.

Exercises

Exercises on individual tasks with a purpose to implement theoretical basics learned on the lectures in a work in computer practicum using computer softwares. Making of technicaly prepared complete projects with the complete business plan.

Working methods:

Teachers' obligations:
To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Studenats' obligations:
To attend the lectures and exercises regularely and to activelly participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	40%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	13	35	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	20	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	30%	61-70%	Sufficient (2)	1	20	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Ex40 + PE1x30+PE2x30)/100**		45	75	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	61-70%	Sufficient (2)	2	28	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	**100%**	**(Fex100)/100**				

*** students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.**

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (30 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester. The project is 40 points and together with partial exams points it makes 100 points (100%).	At the end of semester	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 1 is 30 points and it covers the subject lectured until the time of partial exam.	7^{th} week	
Partial exam 2	Partial exam 2 can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 2 is 30 points and it covers the subject between partial exam 1 and time of partial exam 2. Students who collect enough points in two partial exams and in exercise project pass the subject and get the final grade.	13^{th} week	
Oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Cingula, M., Hunjak, T., Ređep, M, 2004: Poslovno planiranje, RRIF, Zagreb.
2. Cingula, M., 2001: Kako izraditi poslovni plan i investicijski elaborat, RRIF, Zagreb.
3. *** 1999: Poslovni plan poduzetnika, Masmedia, Zagreb.
4. Demeter, D., Stepič, D. 1990: Project management, Otvoreno sveučilište, Zagreb.

Recommended literature

1. Osmanagić Bedenik, N. 2002: Operativno planiranje, Školska knjiga, Zagreb.
2. Bangs, D. H. Jr. 1998: Kako napraviti poslovni plan, Jakubin i sin, Zagreb.

Field work III. – Design of Wood Products

WD-1273

ECTS 4

Teaching hours 60

Grading

Course content:
Field work is a compulsory course of graduate study and implies a student's workload equivalent to the 4 ECTS. During the 3th semester of the Graduate Study, it is necessary to complete field work for a total duration of 8 days or 60 hours.

Type of course:

Field work III. – Design of Wood Products (compulsory course, 3th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
Evaluate materials for making "healthy" furniture. Assess the impact of furniture quality on user health. Analyze the conditions of application of furniture in interior.	Field work report evaluation
Critically evaluate the materials and technological process of surface wood processing and recommend alternative options. Discover the most common wood staining and coating and predict how to remove them	Field work report evaluation
Analyze quality control in the company and also suggest improvements. Analyze and evaluate the quality development of a company.	Field work report evaluation
Put together a plan of selecting parts of the tree to produce toys made of wood. Prepare the way of making parts of musical instruments. Choose physical, mechanical and technical properties for special wood products	Field work report evaluation

General competencies
Field work in production facilities completes theoretical knowledge of graduate studies with examples from practice. The student is focused on the analytical approach of collecting data on the factors of the manufacturing process or business of the company. Student analyzes the range of products and used materials. He suggests improvements for a more rational and optimal production of furniture and wood products

The student in the field work applies and completes the acquired knowledge about norms and regulations.

Working methods:

Teachers' obligations:

Organize the field work, to design tasks and provide a person from practice that will enable students to introduce the company, the production process and be available for consultation during the visit. To introduce students to the rules of behavior in the production plant in terms of safety and security at work. Provide the student the necessary help and instruction in dealing with field work assignments. Review and evaluate field work reports.

Students' obligations:

Active participation in field work. Respect the rules of behavior in the production plant with the purpose of safety and security at work. Write a report from the field work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Total:				60	60	4

Based on the assessment of students' work in the field work, which provide course teachers according to a report from the field work that prepares a student, head study combines grades of courses teachers and enters them in ISVU.

Evaluation elements	Description	Deadline	Compensation
The work performance of a student during field work	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during field teaching	a) It demonstrates the extraordinary skill of applying the theory in practical work b) Recognizes the theoretical framework in practical work c) Does not link the theoretical framework with practical work		
The student skill of solving problems during field work	a) Very skilled in solving problems, innovative and creative b) It is possible to solve the default problem in a familiar way c) Does not show satisfactory problem solving skills		
Ability of a student to make decisions during field work	a) Decides independently, based on thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) It often makes wrong decisions without analysis of the situation		
Ability to collaborate in the team during field teaching	a) Works in line with others, contributes to group relationships and efficiency b) Relationships with others are in accordance with normal circumstances, but does not stand out c) Uncommunicative and withdrawn to the extent of negatively affecting the group		
Communication skills of a student during field work	a) Extremely clear, well-organized and convincing communication, written and spoken b) Satisfying skills of written and spoken communication c) Poor writing skills and speech communication		
Motivation and responsibility of a student during field work	a) High degree of motivation in work and collective and social responsibility b) Satisfactory motivation for work and accountability c) Poor motivated, uninterested and lack of sense of responsibility towards the job		

Obligatory literature

1. Sigurnosne upute za izvođenje studentske terenske nastave
Available at http://www.sumfak.unizg.hr/hr/studiji/studij-drvne-tehnologije/diplomski-studij-oblikovanje-proizvoda-od-drva/terenska-nastava/

Master thesis – Design of Wood Products

WD-2481

ECTS 30

Grading

Course content:
Master thesis is an individual written work based on students' own research that is written in a scientific form and implies students' engagement in work that is equivalent to 30 ECTS module. Graduation is usually done during IV. semester on graduate study and ends with oral defense (presentation and answering the questions).

Type of course:
Master thesis - Design of Wood Products (compulsory course, 4th semester, 2nd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods
apply the current knowledge to define a scientific and professional problem in choosing the topic of work	Master thesis
create a schedule of work in accordance with the deadlines of making the graduate thesis in stages	Master thesis
independently devise a methodology of research work	Master thesis
apply the methodology of writing a professional and scientific work	Master thesis
present their work in written and oral form, using skills succinct interpretation of the results and conclusion of these guidelines to predict the future development of the topics of work	Master thesis, public defense of master thesis

General competences
Master thesis is an independent, comprehensive and highly independent task in which the student must demonstrate knowledge of the background of the profession and of the scientific research work, in the definition of hypotheses and research goals, research planning, data collection and processing and writing of scientific work. Includes expansion and deepening of knowledge of the content of the curriculum, individual engagement around the problem topics, gaining experience in writing technical papers, the ability to apply scientific methods and instruments in processing problems and drafting work, the ability of independent service corresponding domestic and foreign literature and the use of knowledge, facts and attitudes published in the mentioned sources.

Type of instruction
Other
A student under the guidance of a mentor conducts research and writes a master thesis on a subject accepted by the master examination Commission. Master thesis is defended in front of the commission for evaluation and defense of graduate thesis which completes graduate study.

Working methods:

Teachers' obligations:
Hold consultations every week according to schedule. Provide the student with the necessary help and instructions when submitting themes and planning the graduate thesis. Conduct a student to set up tests, conduct analysis, and collect and analyze data. Introduce the student with the principles of ethical approach in writing graduate thesis. Review the master thesis and give instructions for refinement before binding. Help the student prepare for public defense diploma work.

Students' obligations:
Report the topic of master thesis, conduct research and work in accordance with the Instructions for designing master thesis. Come to consultations and present progress in research and work. Observe and follow the instructions of the mentor. Observe the principles of ethical approach to writing master thesis. Prepare the presentation and defend the master thesis in front of the appointed commission.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Master thesis (MT)	70%	See description	Sufficient (2)		810	27
			Good (3)			
			Very good (4)			
			Excellent (5)			
Public defense of master thesis (PD)	30%	See description	Sufficient (2)		90	3
			Good (3)			
			Very good (4)			
			Excellent (5)			
TOTAL	**100%**				900	30

Evaluation elements	Description	Deadline	Compensation
Master thesis (MT)	sufficient (2) - There are substantial deficiencies in the work, the basic concepts are superficial and no deeper knowledge of the subject good (3) - Only some of the relevant aspects of the topic are presented in this paper, the literature is processed correctly but only partially. The scientific and professional vocabulary is basic very good (4) - The work is well-structured with facts, relevant theories and up-to-date data are presented, the literature is correctly elaborated, but the approach lacks creativity. excellent (5) - The work is logically well structured factually correct and conceptually well-defined, the entities are related, the relevant and recent literature is used and the approach to the topic from different perspectives is visible.		-

Public defense of master thesis (PD)	sufficient (2) - The presentation is a retelling of the read text, the answers to the questions are scarce. good (3) - The presentation is clear and informative, but without the ability to link theory to practice. Ability to answer only simple questions. very good (4) - The presentation is clear and substantive, the answers to the questions are just correct and do not indicate a deeper reflection on the topic. excellent (5) - The presentation is clear, highly informative, answers the questions right and creative.		

Obligatory literature

1. Pravilnik o izradi i obrani diplomskog rada na diplomskim sveučilišnim studijima Šumarskog fakulteta
2. Obrazac DS-1 Zamolba za odobrenje teme i mentora diplomskog rada
3. Upute o izgledu i sadržaju diplomskog rad
4. Dostupno na http://www.sumfak.unizg.hr/StudijPojedinacno.aspx?mhID=2&mvID=43

http://www.sumfak.unizg.hr/site/assets/files/2133/ob_sf_ds_01_zamolba_za_odobrenje_teme_diplomskog_rada.pdf

http://www.sumfak.unizg.hr/site/assets/files/1151/uputa_za_popunjavanje.pdf

Undergraduate Professional Study of WOOD TECHNOLOGY

Faculty of Forestry of the University of Zagreb is the only institution of higher education in the Republic of Croatia that offers education for experts in the fields of forestry science and wood technology. Its beginnigs can be traced at the School for Agriculture and Forestry in Križevci (founded in 1860) and Forestry Academy that was founded in Zagreb in 1898 as the fourth institution of higher education within the framework of Zagreb University. Experts in wood technology have been educated since 1948. Until today, about 7000 graduate engineers of forestry and about 2500 graduate engineers of wood technology have graduated from the Faculty of Forestry in Zagreb.

Why start the studies

The present-day employment conditions in Croatian timber and wood industry, but most of all, a need for a comprehensive usage of primary wood products and a production of final wood products that could be competetive on both local and foreign markets calls for a reform and adaptation of the system of education. The Commission for the Studies Reform of the Faculty of Forestry has worked out curricula of **the undergraduate professional studies of wood technology** programme.

The professional studies of wood technology provide basic knowledge in a wide area of technical and natural sciences, as well as expert knowledge and skills demanded by the contemporary development of wood processing companies. Wood is a challenging, versatile and renewable natural material and presents a significant potential of Croatian economy. The use of new technologies increases production efficiency and makes wood profession profitable. Because of its base of raw material, Croatia has real possibilities of increasing production of wood products, all in order to boost the selling and export of final wood products and decrease import of final wood products.

Faculty of Forestry has 176 employees, 60 of whom work as academic staff and fellows. It houses 15 laboratories and 5 educational and experimental forest facilities stretching over 3500 ha. Employees of the Department of Wood Technology, based on their participation in scientific and research work on several scientific projects financed by the Ministry of Science, Education and Sports, as well as in scientific and expert projects contracted directy with the economic sector and government administration, dispose of all information and skills needed to carry out the proposed studies programme.

The proposed studies programme can only partly be compared with similar studies of wood technology in Europe. undergraduate professional studies of wood technology has been developed on the base of 60 years long tradition of education at the Faculty of Forestry, the University of Zagreb. Collaboration with foreign faculties has always proved rewarding (bilateral agreements), thus helping that an up-to-date and adapted studies programme be worked out, one of its major characteristics being a provision of training for expert works in wood processing industry.

Previous experience of the sponsors in implementation of equivalent and similar programmes

These studies originate from the existing professional studies, which has licence from 2005. and is performed in Virovitica. These studies origanate also from the existing studies at the Department of Wood Tecnology of the Faculty of Forestry which was founded in 1948, improved through several reforms (five wood technology educational periods), until the last reform in 2001.

Openess of the studies toward fluctuation of students

Students at the professional undergraduate studies of wood technology will be able to fluctuate horizontally within the scope of Biotechnical sciences, as well as among those European universities that have signed a collaboration agreement with the University of Zagreb or Faculty of Forestry.

GENERAL PART

Name of the studies: PROFESSIONAL STUDIES OF WOOD TECHNOLOGY

Studies' proponent: Faculty of Forestry of the University of Zagreb
Realization: Department of Wood Technology

Duration of the studies: 3 years (6 terms, 180 ECTS)

Terms of Enrolment:

- Applicants who meet the requirements of the Statute of the Faculty of Forestry of the University of Zagreb.
- All candidates who have completed four-year secondary education in the Republic of Croatia or enrolled in the Republic of Croatia, can enroll.
- If there are more candidates than the prescribed number of students, the candidate's classification is based on total success in high school, success in the last and the previous grade based on success in relevant subjects (math, english) and success on the exam. The advantage is that candidates with a greater number of total points.

Competencies: Basics of engineering (mathematics, physics, chemistry), basic knowledge about wood (anatomy, mechanical and physical properties, technological properties), wood usage, basics of technology processes in woodworking and furniture production, usage of computor in technological processes for production final wood products, organization and economics of wood technology processes.
Work training: Professional baccalaureus will be able to work in all companies involved in wood processing, associates in commercial transactions and distribution of wood products, certain works and tasks in wood processing entrepreneurship. Experts will be trained to perform supervision of the process of drying of wood and wood materials, they will have competence in conducting supervision of technological procedures in a sawmill, in the area of the production of veneer, solid wood panels and particle boards, as well as in the production of furniture, timber and other wood products.
They will be able to use computor for planning and controlling of production.

Academic title upon completion of the studies: **Professional baccalaureus of wood technology**

PROGRAMME DESCRIPTION

List of obligatory and optional courses

I YEAR

Code	Course unit	L*	PW	ECTS
	1 semester			
SS-101N	STRUCTURE PROPERTIES OF WOOD	2	2	4
SS-102N	PHISYCS PROPERTIES OF WOOD	2	2	4
SS-103N	MATHEMATICS	3	4	7,5
SS-104N	WOOD CHEMISTRY	4	3	6,5
SS-105N	WOODINDUSTRY ENGINEERING 1	3	4	8
	Total:	14	15	30
	2 semester			
SS-201N	MECHANICAL PROPERTIES OF WOOD	2	2	5
SS-202N	WOOD PATOLOGY	2	2	3
SS-203N	INFORMATICS	3	3	5,5
SS-204N	WOODINDUSTRY ENGINEERING 2	2	3	5
SS-205N	ELECTROTEHNICS	1	3	3,5
SS-206N	MEASURING TECHNIQUES	2	2	4
SS-207N	NON WOOD MATERIALS	2	2	4
	Total:	14	17	30

* L – lectures (classes/week); PW – practical work (classes/week)

II YEAR

Code	Course unit	L*	PW	ECTS
	3 semester			
SS-301N	SAWMILLING	3	4	6,5
SS-302N	HYDROTHERMIC PROCESSING OF WOOD	3	4	6,5
SS-303N	PANELS FROM DISINTEGRATED WOOD	3	3	6,5
SS-304N	VENEER AND PLYWOOD	3	3	6,5
SS-305N	CONSTRUCTIONS OF WOODEN PRODUCTS 1	1	3	4
	Total:	13	17	30
	4 semester			
SS-401N	PRODUCTION ORGANISATION 1	2	2	4
SS-402N	WOOD AS A BUILDING MATERIAL	3	3	6
SS-403N	EXPENSES AND ACCOUNTING	1	3	4
SS-404N	CONSTRUCTIONS OF WOODEN PRODUCTS 2	1	3	6
SS-116A	FURNITURE PRODUCTION 1	2	2	4
SS-406N	WOODWORKING TOOLS AND MACHINERY 1	2	3	6
	Total:	11	16	30

* L – lectures (classes/week); PW – practical work (classes/week)

III. YEAR

Code	Course unit	L*	PW	ECTS
	5 semester			
SS-501N	PRODUCTION MANAGEMENT	4	4	7,5
SS-502N	FURNITURE PRODUCTION 2	1	3	4
SS-503N	WOODWORKING TOOLS AND MACHINERY 2	2	3	5
SS-504N	PRODUCTION ORGANISATION 1	2	3	5,5
	OPTIONAL COURSE	1	3	4
	OPTIONAL COURSE	1	3	4
	Total:	9	20	30
	LIST OF OPTIONAL COURSES			
SS-121	TECHNOLOGICAL PROPERTIES OF WOOD	1	3	4
SS-122	METHODS AND MATERIALS FOR WOOD PROTECTION	1	3	4
SS-123	COMPUTER ADDED CONSTRUCTION	1	3	4
SS-124	TRANSPORT AND STORAGE	1	3	4
SS-125	WOOD INDUSTRY POWER SUPPLY	1	3	4
	6 semester			
	OPTIONAL COURSE	1	3	4
	OPTIONAL COURSE	1	3	4
SS-50473	PRACTICAL WORK IN INDUSTRY	-	18	18
SS-132	FINAL EXAM	-	4	4
	Total:	2	28	30
	LIST OF OPTIONAL COURSES			
SS-126	TECHNOLOGY OF PANELS MADE FROM DISINTEGRATED WOOD	1	3	4
SS-127	COMPOSITE PLYWOOD	1	3	4
SS-128	SPECIAL METHODS OF DRYING	1	3	4
SS-129	QUALITY ASSURANCE OF FINISHED PRODUCTS	1	3	4
SS-130	ENTREPRENEUR'S BUSINESS PLAN	1	3	4

* L – lectures (classes/week); PW – practical work (classes/week)

List of learning outcomes

A. With general engineering competencies

A1. To apply simpler mathematical functions, differential and integral calculus
A2. To apply skills in solving practical issues in the business, either by control measuring, calculations or testing verifications
A3. To use accurately and optimally electric energy as the basic operating energy in wood industry
A4. To apply technical knowledge for the purpose of mastering wood industry procedures and processes, means of work and means for material handling
A5. To recognise software solutions for computer graphics and apply computers in all disciplines, especially in the elaboration of construction designs

B. With focused engineering competencies

B1. To explain the anatomic and chemical structure of the xylem of wood-like plants, the influence of macroscopic properties and flaws on the technological characteristics of wood and wood behaviour during basic refinement and processing
B2. To identify the most important types of insects and fungi, recognise flaws on wood incurred due to the biological factors of wood degradation, explain principles and purposes of wood protection and apply procedures and means for wood protection
B3. To define non-wooden material properties in wood refinement, production of wood materials, furniture and other wood products
B4. To recognise particular veneer and wood panel types, explain their properties, select and use veneers and wood panels with optimum properties
B5. To explain specific features of wood usage and appropriateness of specific wood species for construction purposes, recognise basic designs of physical and constructional protection and ensuring functional appropriateness of wood elements for construction purposes

C. With technological engineering competencies

C1. To handle sawmilling raw material and products, apply practical skills in categorisation and measuring and explain wood cutting processes
C2. To select, apply, optimally use and maintain operating appliances and machinery for primary sawmilling wood refinement
C3. To apply basic skills of wood sawmilling technology, techniques of log and board sawing and to identify factors of successful sawmilling wood processes
C4. To monitor and control processes of massive wood, veneer and wood particle drying and other special drying processes
C5. To monitor technological procedures of fragmented wood panels, veneer and composite plywood production
C6. To apply knowledge on furniture types, constructions and constructing and on the dependence of constructions on the mode of manufacture, development skills and application of the complete construction system in the final product manufacturing,
C7. To monitor the technological processes of final wood processing, define and recognise material properties important for final processing and identify machinery and tools for final wood processing

D. With organisational engineering competencies

D1. To apply knowledge and coordination skills of resource use through management of processes that include planning, organisation, operation, guidance and control

D2. To conduct production planning and calculation, calculate basic indicators of successful business, compose basic financial reports, recognise types of expenses and compose specific wood industry calculations

D3. To use general and specific knowledge from the field of time study, work rationalization, quality control, procurement organisation, stock optimisation and logistic support.

The link of the learning outcomes of the courses with the learning outcomes of the program

Course code	General engineering competencies					Fucused engineering competencies					Technological engineering competencies							Organisational engineering competencies		
	A 1	A 2	A 3	A 4	A 5	B 1	B 2	B 3	B 4	B 5	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3
SS-101N						+														
SS-102N						+														
SS-103N	+	+			+															
SS-104N		+				+		+												
SS-105N		+		+																
SS-201N						+														
SS-202N							+		+					+	+					
SS-203N					+															
SS-204N			+	+																
SS-205N	+	+	+					+		+	+									
SS-206N		+						+												
SS-207N								+												
SS-301N											+	+	+							
SS-302N														+						
SS-303N									+						+					
SS-304N									+					+	+					
SS-305N					+										+	+				
SS-401N																		+		+
SS-402N										+							+			
SS-403N																			+	
SS-404N					+											+				
SS-116A																	+			
SS-406N												+								
SS-501N																		+		+
SS-502N								+									+			
SS-503N												+								
SS-504N																				+
SS-121						+														
SS-122								+	+					+	+					
SS-123					+															
SS-124		+	+	+																
SS-125			+	+																
SS-126															+					
SS-127															+					
SS-128															+					
SS-129																+				
SS-130																+				
SS-50473	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
SS-132																				

Wood structure properties

SS 101 N

ECTS 4

English language R1
E-learning R2

Teaching hours 60
Lecturers 30
Exercises 30

Lecturers
Prof.dr.sc. Jelena Trajković
Izv.prof.dr sc. Bogoslav Šefc

Associate teacher for exercises
Prof.dr.sc. Jelena Trajković
Izv. prof. dr. sc. Bogoslav Šefc
Dr.sc. Iva Ištok

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The aims of wood anatomy. Role of wood in tree. The origin of wood in plant kingdom. Role of wood in tree. Commercial utilisation. Macroscopic wood characteristics. RouCoarse structure of wood, growth rings, referent sections, sapwood and hardwood, colour, luster, odor and taste, fibers and texture, density and hardness, anatomical structure of woodWood formation in tree, cambium. Structure of vascular plants: basic parts of a vascular plant, primary and secondary growth. Tissues. Cambium formation. Cambium: cell organization, dimensions, divisions, development, postcambial growth of cells. Ontogenesis of wood tissue.Secondary phloem and wytidoma. Periderm, structure, origin, elongation and duration. Bark, interior, outer, ritidoma, cork.Wood cells. Dimensions, shape, parts, division, origin of cell wall. Composition and distribution of cell wall components in wood cells. Submicroscopic structure and organisation of cell wall, microfibril organization, layers and sublayers of wood cell, microfibril angle, lamels. Sculptures of the cell wall: pits (jednostavne, bodrder, origin, modifications, fluid reduction mechanism), perforations of vessel members, spiral thickenings and dentations, warty structures and warty pits.Wood elements (cells). Morphology of cell wood, their dimensions and function. Histology of conifer wood. Layout and shape of cells and tissue in conifer wood, useful characteristics for identification of conifer wood, comparative anatomy of comercial conifer wood.Histology of hardwood. Layout and shape of cells and tissue in conifer wood, useful characteristics for identification of conifer wood, comparative anatomy of native comercial hardwood.Wood identification. Dyhotomous and polytomous keys for microscopic and macroscopic identification of comercial wood species, . limiting possibilities of key aplication, examples. Examples of wood identification (study case)Variations in wood structure. Influence of wood structure on technical properties of wood and its use. Irregularities of wood structure: Irregularities of wood structure. Reaction wood, compression failures, brittle heart, spiral grain, knots, false and incontinuous rings.

Type of course:

Wood structure properties (mandatory subject, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differntiate wood from tree, main botanical species	Exercises in practicum, colloquium and exam	B1
Explain the postion and role of wood cells and wood tissue in living tree and define the role of wood structure in selected technical wood properties	Exercises in practicum, colloquium and exam	B1
Differentiate native comercial wood species on the base of their macroscopic characteristics using wood identification keys	Exercises in practicum, colloquium and exam	B1

General competences
Students can define and describe macrocopic and microscopic and submicroscopic wood structure
Students the role of wood structure in selected technical wood properties
By application of keys for wood identification, differentiate native comercial wood species on the base of their macroscopic characteristics

Lectures

Exercises

Six practical exercises of the microscopic and macroscopic recognition of wood are performed as part of laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers obligations:

Maintaining original lessons - lectures, exercises. Providing colloquia, oral exams and consultations. Creating teaching and testing materials.

Students obligations:

Regular attendance and active participation in lectures and exercises. A justified absence of up to 20% of lectures and 10% of exercises is allowed (Article 30 of the Ordinance on Undergraduate and Graduate Studies at the Faculty of Forestry of the University of Zagreb). Taking colloquia and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Predavanja	-	-	-	30	30	2
Exercises (E)	5%	Mostly inaccurate, with major corrections Mostly accurate, with corrections Exact, with minor corrections Accurate and error-free	Sufficient (2) Good (3) Very good (4) Excellent (5)	30		1
Macroscopic Wood Identification Colloquium (C)	15%	Constant help of the examiner Partial help of the examiner minor help of the examiner without any help of the examiner	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	13	0,5
Exam (E_x)	80%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	13	0,5
TOTAL	100%	(Ex5 + Cx15 + E_xx80)/100		64	56	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and recorded.	Semester	-
Exercises (E)	Exercises are attended by groups. There are 6 practical exercises of microscopic and macroscopic recognition of wood. The accuracy, tidiness and regularity of performance are evaluated.	Semester (15 hours of exercises)	Exceptionally, in the case of a justified reason
Macroscopic Wood Identification Colloquia (C)	It consists of determination of 8 types of coniferous and dicotyledonous woods with the aid of magnifiers. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Colloquia can be taken three times in one academic year
Exam (P)	The exam can be attended by students whose exercises and colloquia were evaluated positively. The written exam is evaluated and participates in the final grade of the subject. The final grade of the course is obtained according to the formula $Ex5 + Cx15 + E_x x80)/100$	Exam terms	-

Obligatory literature

1. http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74pod predmet Strukturna svojstva drva, pod PREDAVANJA nalaze se poveznice: Predavanja iz predmeta strukturna svojstva drva (skripta, autori: Jelena Trajković i Bogoslav Šefc, pdf dokument oko 3 MB) i Atlas slika uz predavanja (Ilustracije uz predavanja, sabrali: Jelena Trajković i Bogoslav Šefc, pdf dokument oko 39 MB)
2. Z. Špoljarić 1978: Anatomija drva, Šumarski fakultet, Zagreb
3. Anatomija drva e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=37196

Recommended literature

1. Panshin, A. J.; Zeew, C. de, 1980: Textbook of wood technology, McGraw-Hill, Inc. 722 str.
2. Šumarska enciklopedija, HLZ Miroslav Krleža, Zagreb
3. Osnove nauke o drvu, Šumarski fakultet Sveučilišta u Zagrebu, 1985. (Drvo, Anatomija drva

Phisical properties of wood

SS 102 N

ECTS 8

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 00

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambrekovićmag. ing. techn. lign.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:
Familiarity with commercial tree species. Parts and shape of the tree. Factors, types and modifications of the tree. Elemental composition of wood and their impact on the properties of wood. Timber timber as a factor of wood properties. Properties of the cross-section of wood. White and marrow. Classification. The market. The theories of the process of being. The zone of early and late wood and the participation of the zone of late wood. Fine wood. The color and the glow of wood. The smell of wood. The texture of wood. The density of wood matter. Wood density. Wood density determination procedures. Wood density factors. Density distribution in wood and wood. Tying the water to the tree. Free and tied water in wood. Methods of determining the water content of the wood. State of the water content of wood. Distribution of water content in wood and timber products. A Gradient of water content in wood. Adsorption and desorption. Hythroscopic equilibrium. Fiber saturation point. The largest content of water in wood. It's a strain and a wake. Anisotropy of the tightening and the bugaing.
Dilation. Specific wood heat. Heat conduction in wood. The heating power of the wood. Electrical conductivity of wood. Dielectric and piezoelectric properties of wood. The speed and resistance of the sound in the wood. Drection and resonance sound of wood. The arrangement of physical properties in the wood. Diversity of physical properties between trees of the same type of wood. Comparing physical properties of wood for domestic and foreign commercial wood types.

Type of course:

Phisical properties of wood (obligatory course, 2th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify parameters relevant to identifying Commercial types of wood, parts of the tree and modification of the tree	Exercises evaluation, partial exams, final exam	B1
Define wood timber as a factor of wood properties. Wood Section Properties	Exercises evaluation, partial exams, final exam	B1
Defining and determining the physical properties of wood	Exercises evaluation, partial exams, final exam	B1
Defining and determining the most significant factors influencing the physical properties of wood	Exercises evaluation, partial exams, final exam	B1
Defining the arrangement of physical properties in the radial direction	Exercises evaluation, partial exams, final exam	B1

General competences

The objective of the case is to acquire basic knowledge about commercial wood species. Parts and forms of a tree. Macroscopic and physical properties of wood. Schedules of macroscopic and physical properties of wood within trees and trees. Basic knowledge required as a pre-knowledge for the basic wood-technology processes of wood processing.

Lectures

Lectures on theoretical bases are prepared by students to acquire basic knowledge about macroscopic characteristics and physical properties of commercial wood species, which facilitate the production of exercises and complete mastering of the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:

To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	120	5
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	30	30	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Ex70 + PE1x30)/100		61	180	8

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	100%	(Fex100)/100				
* students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. 1.Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
2. 2.Horvat,I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
3. 3.Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. 4.Ugrenović,A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. 1.Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. 2.Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3. 3.Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. 4.Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Mathematics for Engineers

SS 103 N

ECTS 7,5

English language

E-learning R1

Teaching hours 105
Lectures 45
Exercises 60

Lecturer
Assist. Prof. Maja Moro

Associate teacher for exercises
Assist. Prof. Maja Moro

Grading
Sufficient (2) 50 %
Good (3) 65 %
Very good (4) 78 %
Excellent (5) 90 %

Course content:

Course content is tailored to wood technology students. There is a need to preserve the complete material (functions, differential and integral account), but access to all the most important terms is maximized. The focus is on mastering the skills of mathematical models, the development of abstract thinking and analytical thinking, the precision of expression, the perception of the essence.

Type of course:

Mathematics for Engineers (obligatory, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define and implement the tasks terms of mathematical logic, sets and sets of numbers	partial exams, oral exam	A1, A2, A5
Define, analyze and relate the concepts and properties of real functions of a real variable, as well as terms related to a sequences (limit of a sequence, limit of a function)	partial exams, oral exam	A1, A2, A5
Define and apply the concepts tasks derivatives, indefinite and definite integrals	partial exams, oral exam	A1, A2, A5
Define and apply in the tasks from basic elementary algebra (matrices)	partial exams, oral exam	A1, A2, A5
Define and apply to measurement tasks of central tendency of the data	partial exams, oral exam	A1, A2, A5

Define and apply to variability measurement tasks of the data	partial exams, oral exam	A1, A2, A5

General competences

Demonstrate competences in theoretical principles, calculation methods and visualization of data of different measurements
Understand mathematical methods and laws applied in wood technology
Apply mathematics knowledge in identifying, formulating, and solving engineer tasks
Conduct conclusions and interpret results based on performed computer processing
Planning for continuing academic development in the field of wood technology, and for the development of interest in lifelong learning and further professional education

Type of instruction

Lectures (45 hours)
Exercises (60 hours)
Student's work independetly (120 hours)

Working methods:

Teacher's responsibilities:

Prepare teaching and exam materials
Regularly and conscientiously perform teaching and other forms of teaching work
Evaluate students' work on partial exams and final exams
Encourage students for autonomously work
Develop students' interest in mathematical content
Be available for student on teaching hours and non-teaching time

Student's responsibilities:

Attendance at lectures (minimum 80% hours = 36h) and exercises (minimum 80% hours = 48h)
Writing homeworks
Active participation in teaching
Solving three mandatory colloquia during the semester
Accessing to oral exam after passing the colloquia (minimum 50% points in each)

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (**P**)	20%			45		1,500
Exercises (**V**)	25%			60		1,875
1st Partial exam (**K_1**)	5%	(50 – 64)% (65 – 77)% (78 – 89)% (90–100)%	sufficient (2) good (3) very good (4) excellent (5)		10	0,375
2nd Partial exam (**K_2**)	20%				50	1,500
3rd Partial exam (**K_3**)	20%				40	1,500
Oral exam (**UI**)	10%				20	0,750
TOTAL	100%	$0,2P+0,25V+0,05K_1+0,2K_2+0,2K_3+0,1UI$		105	120	7,500

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (**P**)	20%			45		1,500
Exercises (**V**)	25%			60		1,875
***1st Partial exam (**K_1**)	5%	(50 – 64)% (65 – 77)% (78 – 89)% (90–100)%	sufficient (2) good (3) very good (4) excellent (5)		10	0,375
Written exam (**PI**)	40%				90	3,000
Oral exam (**UI**)	10%				20	0,750
TOTAL	100%	$0,2P+0,25V+0,05K_1+0,4PI+0,1UI$		105	120	7,500
* students who do not pass all of three colloquium during the semester will approach the exam period (subject to the K_1)						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures (P)	Attendance at lectures (minimum 80% of 45 hours=36h)		
Exercises (V)	Attendance at exercises (minimum 80% of 60 hours=48h)		
1st Partial exam (K_1)	Minimum 50% for access to 2nd Partial exam or to exam period		Multiple during semester
2nd Partial exam (K_2)	Minimum 50% for access to 3rd Partial exam		Multiple during semester
3rd Partial exam (K_3)	Minimum 50% for access to Oral exam		Multiple during the academic year
Written exam (PI)	Condition for access $0,8P+0,8V+0,5K_1$	exam period	
Oral exam (UI)	Condition for access $0,8P+0,8V+0,5K_1+0,5\ K_2+0,5\ K_3$ or $0,8P+0,8V+0,5K_1+0,5PI$		

Obligatory literature

1. Mathematics for Faculty of Technology
2. Mathematical Analysis 1

Recommended literature

1. Mathematics (function analysis)
2. Mathematics for economists
3. Literature from the Internet

Wood Chemistry

SS 104 N

ECTS 6,5

English language R1

E-learning R1

Teaching hours 105
Lectures 60
Exercises 45

Lecturer
Associate Professor Alan Antonović, PhD.
Assistant Professor Nikola Španić, PhD.

Associate teacher for exercises
Associate Professor Alan Antonović, PhD.
Assistant Professor Nikola Španić, PhD.

Grading
Sufficient (2) 51-63%
Good (3) 64-76%
Very good (4) 77-89%
Excellent (5) 90-100%

Course content:

Chemical understanding, international system of units in chemistry. Matter, chemical elements and chemical compounds, chemical bond, intermolecular bonding. Liquids, solutions, solution and mixture composition calculation, dispers systems. Chemical reactions and relationship between reactans and products of chemical equilibrium, energetic changes in chemical reactions. Solution acidity and alkalinity, pH, electrochemical reactions and cells. Radioactive materials, air, water, soil, environment pollution. Metalloids and their compounds, metals, inorganic pigments. Organic compounds characteristics, hydrocarbons. Ion-exchange resins, detergents, alkylhalogenids, nitrogen-compounds. Alcohols, phenols, polyols, ethers, aldehydes and ketons, carboxylic acids and their derivatives. Lipids, soaps, terpens, heterocyclic compounds. Aminoacids, peptides, proteins, enzymes, dye, dyestuff and organic pigments. Wood chemical composition, elemental and complex carbohydrates. Cellulose and hemicellulose, lignin, accessory materials (extractives). Wood as raw material for chemical processing.

Type of course:

Wood chemistry (obligatory subject, 1. semester + 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Use the knowledge acquired in different areas of wood technology, and to solve technological and qualitative tasks and problems in the wood industry.	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	A2
Explain the chemical composition and properties of wood and apply the same during the basic working and processing of wood	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	B1
Analyze and isolate all chemical components, whether analytically or instrumentally, related to determining different properties or for further working and processing of wood.	Chemistry laboratory exercises, partial exams, test of knowledge, final exam	B3

General competences

Knowledge and differentiation of individual components of elemental and group chemical composition of wood,
Identification and interpretation (characterization) of different wood chemical components during the use of different types of instruments and methods in wood chemistry,
Application of the wood chemical composition knowledge and their chemical properties to other wood properties as well as its technological characteristics,
Proposing scientific research work in the sense of improving the existing or developing new products of chemical processing of wood,
Designing and proposing topics for the application of scientific research projects in the field of wood chemical processing to domestic funds and European Union funds.

Lectures

Auditory lectures are carried out according to weekly curriculum

Exercises

As a part of the exercise, 30 (2 semesters x 15 exercises) practical laboratory exercises in the chemical laboratory are conducted, which are related to the subject content and the knowledge upgrade adopted during the lecture.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures and exercises. Designing and reviewing exercises and topics for final papers. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials,

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making exercises, conducting exams and preparing and presenting final work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	60	15	0,5
Excercises (E)	-	-	-	45	30	1,5
Final exam (FE)	100%	51-63% (102-126 points)	sufficient (2)	5	40	4,5
		64-76% (128-153 points)	good (3)			
		77-89% (154-179 points)	very good (4)			
		90-100% (180-200 points)	excellent (5)			
Total Final mark (FM)	**100%**	FM = FEx100/100		110	85	6,5

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from the direct teaching as much as stipulated in the Rulebook on Studying.	1. semester 60 hours of direct lecturer and exercises 2. semester 45 hours of direct lecturer and exercises	-
Exercises (E)	As a part of the exercise, during 2 semesters 30 (2x15 exercises) practical laboratory exercises in the chemical laboratory are conducted, which are related to the subject content and the knowledge upgrade adopted during the lectures. Students with task assignments and instructions for making all 30 exercises, as well as the appearance of the fascicles, liners and inserts, receive during the the first exercise in the form of Work Log. Exercise 1. The basics of laboratory chemistry work in the Work log is also a material for the qualification partial exam which is a prerequisite for the presence of other laboratory exercises in the chemical laboratory. The qualification partial exam consists of 8 questions and you need to answer exactly or more 5 answers for passage.	Continuously during the term of the semester according to the agreed term.	-

Written exam (WE)	The final exam consists of three units, namely (1) tasks, (2) structural formulas and (3) theories and they must be taken in that order. The tasks consists of three questions (2 exact answers are required for the passage and does not enter the total sum of points) and the structural formula and theory of 10 questions where each question is worth for a maximum of 10 points (51% points required for the passage). The minimum number of points obtained is 102 and a maximum of 200..	Written exam terms	-
Oral exam (UI)	The oral exam is only in case the students want a higher final grade than the written exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score.	Exam terms	-

Obligatory literature

1. M. Hus, KEMIJA Priručnik za studente Šumarskog fakulteta, Šumarski fakultet, Zagreb, 1997.
2. Filipović, S. Lipanović, Opća i anorganska kemija I/II, Školska knjiga, Zagreb, 1991.
3. M. Sikirica, Stehiometrija, Školska knjiga, Zagreb, 1993.
4. H.S. Pine i drugi. Organska kemija, Školska knjiga, Zagreb, 1991.
5. V. Sertić, Kemija drva, Šumarski fakultet, Zagreb, 1997.
6. I. Opačić, Kemijska prerada drva, Šumarski fakultet, Zagreb, 1967.

Recommended literature

1. V. Rapić, Nomenklatura organskih spojeva, Školska knjiga, Zagreb, 1991.
2. E. Sjöström, Wood chemistry, Fundamentals and Applications,Academic Press, New York, 1981.
3. D. Fengel, G. Wegener, WOOD, Chemistry, Ultrastructure, Reactions, Walter de Gruyter, Berlin-New York, 1989.

Wood industry mechanical engineering 1

SS 105N

ECTS points 8

English language R1

E-learning R1

Teaching hours 105
Lectures 45
Exercises 60

Lecturer
Prof. dr. sc. Stjepan Risović

Associate teacher for exercises
Doc. dr. sc. Branimir Šafran
Marko Rastija, mag. ing. mech.

Grading
Sufficient (2) 50 - 67%
Good (3) 68 - 78%
Very good (4) 79 - 89%
Excellent (5) 90% - 100%

Course content:

Legal metrology. Frequent measuring units in WI mechanical engineering. Signs and abbreviations for some measurements WI mechanical engineering. Production (industrial) metrology in WI mechanical engineering. Standards and norms in WI mechanical engineering. Introduction to mechanics. The basics of solid body statics. Definition of force and moment. Determining the resultant force. Conditions for equilibrium of forces as a result of the first axiom of mechanics. Friction phenomenology. Dry friction. Limiting friction. Coulomb's law. The basics of mechanics of materials. The difference between a rigid and deformable solid body. Definition of the term stress at a point that depends on the orientation of surface at which the point is located. Definition of deformation and stress-deformation relationship in real materials (Hooke's law). Definition of terms engineering and allowable stresses and factor of safety for each type of material derived from material testing. Formulae for stress and deformation in structures with axial, shear, torsion and bending loading. Analysis of internal forces and moments in rods. Construction of Q, M, N diagrams. Basics of stability calculation for columns (buckling calculation).
Classification and properties of metallic materials. Mechanical properties and their testing. Iron based materials (iron castings, structural and tool steels). Light and coloured metals and their alloys. Materials for building WI tools and products. Heat treatment of steel. Non-metallic materials in WI mechanical engineering. Composite materials.

Type of course:

Wood industry mechanical engineering 1 (compulsory course, 1. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determine the resultant force of group of forces acting on a body	partial exams, written exam, oral exam	A2
Calculate the moment of force around an axis	partial exams, written exam, oral exam	A2
Model the contact forces at the body contact points with the other body and environment	partial exams, written exam, oral exam	A2
Write conditions for equilibrium of forces acting on a body	partial exams, written exam, oral exam	A2
Calculate reactive forces to keep the body in balance	partial exams, written exam, oral exam	A2
Calculate force of friction	partial exams, written exam, oral exam	A2
Determine the forces of belt friction	partial exams, written exam, oral exam	A2
Determine axial forces and draw axial forces diagram for rods	partial exams, written exam, oral exam	A2
Determine sheer forces and bending moments and draw diagrams of shear forces and bending moments on a beam	partial exams, written exam, oral exam	A2
Calculate twisting moments of torsionally - loaded shaft and draw diagrams of twisting moments	partial exams, written exam, oral exam	A2
Determine stress and deformation of axially loaded rod	partial exams, written exam, oral exam	A2
Determine shear stress	partial exams, written exam, oral exam	A2
Calculate stress and deformation of a shaft subjected to torsion	partial exams, written exam, oral exam	A2
Determine bending stress	partial exams, written exam, oral exam	A2

Determine dimensions of cross section of structural elements based on material strength criteria	partial exams, written exam, oral exam	A4
Examine the stability of columns	partial exams, written exam, oral exam	A2
Define the material mechanical properties and ways of their testing	partial exams, written exam, oral exam	A2, A4
Identify and distinguish metallic and non-metallic materials used in the wood industry and tool production for wood industry	partial exams, written exam, oral exam	A4

General competences

Mastering the processes of the wood industry, working tools and means of materials handling.
Understanding of Newton's laws and their application for technical problems solving.
Ability to analyse technical problems in a simple and logical way.
Determining such dimensions of a construction and choosing right material that will withstand the load without breaking.

Lectures

Exercises

Working methods:

Teachers' obligations:

Delivering lectures, exercises. Organizing and setting partial exams, written exams, oral exams, holding consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Passing tests and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average student's workload hours outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	-	0
Exercises (E)	-	-	-	60	-	0
Partial exam 1 (PE1)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		20	1,5
Partial exam 2 (PE2)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		20	1,5
Partial exam 3 (PE3)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		20	1,5
Oral exam (OE)	49 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		75	3,5
TOTAL	100%	((PE1+PE2+PE3)x17+OEx49)/100		105	135	8

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average student's workload hours outside the direct teaching	ECTS points
Written exam* (WE)	50 %	50 - 67 % 68 - 78% 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	45	4,0
Oral exam* (OE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)	-	45	4,0
UKUPNO	100%	(WEx50+OEx50)/100				8
* students who do not pass tests during the semester will approach the exam, during examination period, that makes 100% of the grade (written exam - 50%, oral exam - 50%)						

Detailed description of evaluation elements for lectures, exercises, partial exams, written and oral exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked, and the attendance of the students is recorded. The student can miss maximum 20% of hours of direct teaching.	semester (105 hours of direct teaching)	-
Partial exams (PE1, PE2, PE3)	Students who regularly attend classes can take semester tests, making it easier pass the exam "stage by stage". The semester tests are evaluated and participate in the final grade.	PE1 – 6. week PE2 – 11. week PE3 – after the lectures	-
Written exam	Exams can be taken by students who have sufficient attendance at lectures. Students solve tasks containing computational problems. The written exam is evaluated and participates in the final grade of the subject.	examination period	-
Oral exam	Students who pass 3 semester tests or a written exam are asked questions from different parts of the curriculum content. The final grade of the course is obtained according to the formula ((PE1+PE2+PE3)x17+OEx49)/100 or (WEx50+OEx50)/100		

Obligatory literature

1. Kraut, B.: Strojarski priručnik, AXIOM, Zagreb, 1997.
2. Decker, K. M.: Elementi strojeva, TK Zagreb, 1980.
3. Kulišić, P.: Mehanika i toplina, Školska knjiga, zagreb, 1991, str 1-263.
4. Muftić: Mehanika I (statika), Tehnička knjiga, Zagreb 1989.
5. Alfirević I.: Nauka o čvrstoći, Tehnička knjiga, Zagreb 1989.

Recommended literature

1. Beer F., Johnston R.: Vector Mechanics for Engineers, Statics, McGraw-Hill, New York 1988.
2. Beer F., Johnston R.: Mechanics for Materials, McGraw-Hill, New York 1992.

Mechanical properties of wood

SS 201N

ECTS 5

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambrekovićmag. ing. techn. lign.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Mechanical properties of wood. Familiarity with measuring instruments and devices for determining the mechanical properties of wood. Wood strength on the train. Wood strength on pressure. Wood strength on bending. The strength of wood on the skirt. Wood strength on splitting. Wood strength to impact. Wood hardness. Resistance of wood against abrasion. Modulus of elasticity in mechanical properties of wood. Determination of wood resistance against abrasion in domestic and foreign commercial species of wood. Factors that affect the mechanical properties of wood. A schedule of mechanical properties in wood and wood. Comparison of mechanical properties of domestic and foreign commercial species of wood. Rheological properties of wood. Wood bugs. Classification. Wood defects due to weather hazards. Defects of wood caused by the irregularities of the tree shape and anatomic timber. Defects of wood caused by physical-mechanical influences, changes in colour and consistency of wood. The impact of wood defects on the mechanical properties of wood.

Type of course:

Mechanical properties of wood (obligatory course, 2th semester, 1rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Introduction to measuring devices for determining the mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Determination of mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Valuation of wood species based on mechanical properties of wood	Exercises evaluation, partial exams, final exam	B1
Defining the radial arrangement of mechanical properties of wood and their impact on further processing and use of wood	Exercises evaluation, partial exams, final exam	B1
Defining wood defects in trees	Exercises evaluation, partial exams, final exam	B1
Practical identification and valorization of errors Wood in the trees and the tree.	Exercises evaluation, partial exams, final exam	B1

General competences

The object of the object is the acquisition of basic knowledge about the mechanical properties of wood, the arrangement of mechanical properties of wood within the tree and trees, wood defects and the impact of faults on the mechanical properties of wood. Basic knowledge required as a pre-knowledge for the basic wood-technology processes of wood processing.

Lectures

Lecture on theoretical basis prepares students to acquire basic knowledge about mechanical properties of wood and wood faults, which facilitate workmanship and complete mastery of the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:
To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	60	3
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	30	15	1,5
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Ex70 + PE1x30)/100		61	90	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	100%	(Fex100)/100				
* students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Horvat, l.: Tehnologija drva l, skripta, Zagreb, 1976, str. 1-680.
2. Horvat,I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
3. Karahasanović, A.:Nauka o drvetu, Sarajevo 1988, str. 1-426.
4. Ugrenović,A.; Horvat,I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
3. Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.
5. Walter, F.: Pruftechnikin der Holzindustrie, Leipzig, 1977, str. 1-318.

Wood pathology

SS 202 N

ECTS points 3

English language R1

E-learning R1

Hours of classes 60
Lectures 30
Exercises 30
Field work 0

Lectures teacher
Associate Prof. Marin Hasan, PhD

Exercises teacher
Associate Prof. Marin Hasan, PhD

Grades
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Good and bad properties of wood as a raw material, natural resistance. Wood weathering (UV radiation and photooxidative processes – degradation of lignin, cellulose and hemicellulose, influence of wood in all three aggregate states, discoloration, hydrolysis, erosion of wood surface, swelling and shrinkage, cracking, influence of heat, thermal degradation of wood). Main biological causes of wood decay (lignicolous microorganisms, xylophagous insects and marine borers). Wood decay and succession: morphology, anatomy, physiology, ecology, divisions and most significant representatives. Lignicolous microorganisms: bacteria and fungi (moulds, blue stain, soft rot fungi, basidiomycetes – true decay fungi). Wood pests: primary, secondary, tertiary and quaternary insects (Coleoptera – wood boring insects and Isoptera – termites). Marine wood borers. The use of physical and structural characteristics of wood in the wood preservation (porosity, permeability, diffusion, sapwood, heartwood). The fundaments on the division and use of wood protection methods (preventive and repressive methods, surface and deep protection).

Type of the course:

Wood Pathology (obligatory Course, 2. Semester, 1. Year)

Learning Outcomes and Methods of Verification

Learning Outcomes (LO)	Methods of Verification	Correlation with LO of the Study Program
Distinguish the biological resistance of the natural durability of wood and define them.	exercises 1 and 2, 1st colloquium, final exam	C4
Analyse and describe the degree of degradation of wood by abiotic factors.	exercises 1 and 2, 1st colloquium, final exam	C5
Differentiate and explain faults in the structure and physical properties of wood resulting from the degradation of abiotic factors from faults caused by biodegradation of wood.	exercises 3 and 4, 2nd colloquium, final exam	C5
Differentiate and explain the faults in the structure and physical properties of wood resulting from the degradation of wood by certain groups (types, species) of wood decaying microorganisms.	exercises 3 and 4, 2nd colloquium, final exam	C5
Identify and distinguish insects from other arthropods.	exercise 4, 3rd colloquium, final exam	B4
Identify and distinguish between commercially the most important species of xylophagous insects based on morphological images of adult insects.	exercise 4, 3rd colloquium, final exam	C5
Differentiate and describe faults in the structure of wood caused by degradation of certain groups, genera and / or insect species.	exercise 4, 3rd colloquium, final exam	C5
Differentiate and describe faults in the structure of wood caused by the degradation of individual groups, genera and / or species of marine pests.	exercise 4, 3rd colloquium, final exam	C5
Analyse and describe the degree of degradation of wood caused by xylophagous organisms and assess the risk of using such wood in the manufacture of wooden products.	exercises 2 – 4, 3rd colloquium, final exam	D5
Independently write a report and present it in front of a group of people.	Seminar	D6

General Competencies

The skills in the identification of the most important wood pests and wood decay fungi and the recognition of all damages produced by mentioned organisms.
Knowledge on the basic principles in the wood protection.

Lectures

Lectures are held in the classroom or in the field work according to ERR guidelines, with explicit insistence on the more active participation of students in the learning process.

Exercises

Part of calculation exercises as well as some of the exercises on introduction to laboratory work are held in classroom and student practice room, and laboratory measurement exercises on prepared wooden specimens are held at the Laboratory for Anatomy and Wood Protection.

Mode of Teaching:

Teachers' obligations:
Maintaining the original teaching – lectures, exercises and field work. Developing exercises and topics of seminar papers, collecting literature for seminar papers, compiling knowledge tests and evaluating them. Reviews of written exercises and of seminar papers. Providing colloquia, oral exams, consultations and seminars. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises and seminars within the given time frame. Passing the colloquia, written and oral exams.

Methods of grading

Tracking elements	Grading share	Score scale / Grading	Grade	Number of Direct Teaching Hours	Number of working hours of an average student beside direct teaching	ECTS credits
Lectures (L)	–	–	–	27		1
Making Exercises (E)	20%	Correct exercises with less than 15 % of acceptable deficiencies	Sufficient (2)	27	5	1
		Correct exercises with less than 10 % of acceptable deficiencies	Good (3)			
		Correct exercises with less than 5 % of acceptable deficiencies	Very good (4)			
		Correct exercises with less than 1 % of acceptable deficiencies	Excellent (5)			
1st, 2nd and 3rd Colloquium in written form	40%	60-70%	Sufficient (2)	3	15	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

<table>
<tr><td rowspan="6">Final exam – oral exam (OE)

or

Seminar paper – SEM*</td><td rowspan="6">40%</td><td>60-70%</td><td>Sufficient (2)</td><td rowspan="4"></td><td rowspan="6">15</td><td rowspan="6">0.5</td></tr>
<tr><td>71-80%</td><td>Good (3)</td></tr>
<tr><td>81-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td>Seminar paper with less than 8 % of acceptable deficiencies</td><td>Very good (4)</td><td rowspan="2">3</td></tr>
<tr><td>Seminar paper with less than 1 % of acceptable deficiencies</td><td>Excellent (5)</td></tr>
<tr><td>TOTAL</td><td>100%</td><td colspan="2">(E×20 + (C1+C2+C3) ×40 + OE×40) / 100
or
(E×20 + (C1+C2+C3) ×40 + SEM×40) / 100</td><td>60</td><td>35</td><td>3</td></tr>
<tr><td colspan="7">* students who pass all three colloquia and choose to do seminar papers don’t need to complete the final exam; the defended seminar paper changes the final oral exam.</td></tr>
</table>

Tracking elements	**Maximum points ar grading share**	**Score scale / Grading**	**Grade**	**Number of Direct Teaching Hours**	**Number of working hours of an average student beside direct teaching**	**ECTS credits**
Final Exam* (FE) Written part (W) + Oral part (O)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	1
TOTAL	100%	(E×20 + FE×80) / 100				
* students who don't pass all three colloquia during the semester have to take final exam consisting of a written and oral part, and they make up to 80 % of the total grade, while the remaining 20 % make a grade of exercises						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Tracking elements	Description	Deadline	Recoupment
Lectures + Exercises (laboratory work)	The presence of students is checked and recorded during the lectures. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 direct teaching hours)	-
Making Exercises (E)	Exercises are attended by groups. As part of the exercise, 7 practical exercises are carried out, of which 2 are part of field work. At the beginning of the first exercise, students will receive templates with the look of the file, inserts and worksheets on which the students will handle and teach their exercises. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted within the probationary period (the student has the right to submit a maximum of two exercises within the probationary period, otherwise the right to sign the course is lost).	according to the agreed delivery dynamics	One probationary period for submitting the exercises for revision.
First Colloquium (C1)	The first colloquium contains the following material: Good and bad properties of wood, natural durability of wood and biological resistance, abiological degradation of wood. Each colloquium has 20 questions and each question equals one point. Partially correct answers (semi-points) or negative points does not exist. The minimum number of points for passage the colloquium is 12 (12 of 20 = 60%).	4th week	-
Second Colloquium (C2)	Second colloquium are available to students who have passed the first colloquium. Second colloquium contains the following materials: decaying fungi and bacteria. The minimum number of points for passage the colloquium is 12 (12 of 20 = 60%).	8th and 13th week	There is a possibility of correctional second colloquium at the time of the third colloquium.
Third Colloquium (C3)	Third Colloquium are available to students who have passed the first and second colloquium, as well as students who have passed only the first colloquium but at the same time, they are taking 2nd and 3rd colloquium together. The third colloquium contains the following: xylophagous insects and marine pests, wood protection. Each colloquium has 20 questions and each question equals one point. Partially correct answers (semi-points) as well as negative points does not exist. The minimum number of points for the passage each colloquium is 12 (12 points of 20 = 60%). All three colloquia are scored with a total of 60 points, with a total minimum of 36 of 60 points being needed for the pass (60%). Students who get enough points from all three colloquia only access the oral part of the exam, and if they successfully defend the seminar paper (the minimum grade is very good (4)), they get a final grade on the subject with no need of taking oral part of the exam. The final grade is the sum of Exercises (E), Colloquia (C1, C2 and	13th week and first examination period	There is a possibility of correctional third Colloquium on the first examination period at the time of the written exam.

	C3) and Oral Exam (OE) or Seminar (SEM): (E×20 + (C1+C2+C3) ×40 + OE×40) / 100 or (E×20 + (C1+C2+C3) ×40 + SEM×40) / 100		
Seminar paper	Seminar work are available to students who, until the moment of presentation of the conditions of making and theme of seminar papers, do not have a single absence from lectures and from exercises, and have passed the first colloquium. Seminar work is submitted for review by arrangement with the teachers throughout the semester. The final version is submitted to the 14th week and defending in the 14th or 15th week of the semester, provided that the student has passed all three colloquia. A written part of the seminar and oral presentation are evaluated (defence in front of the whole group of students). Overall rating of the seminar paper should not be less than very good (4) in order to replace the oral exam. The final grade is the sum of Exercises (E), Colloquia (C1, C2 and C3) and Seminar (SEM) (E×20 + (C1+C2+C3) ×40 + SEM×40) / 100	14th and 15th week	-
Final exam (FE) written part	The written exam consists of 60 questions, and each question carries one point. Partially correct answers (half-points) and negative points does not exist. The minimum number of points for the passage is 36 (36 of 60 = 60%). After completing the written part of the exam, students have a break (how much is needed for the teacher to review the written assignments) and afterwards (the same day) students that passed written part of exam approach the oral part of exam in groups of two to four students.	examination periods	-
Final exam (FE) oral part	The requirement for the oral part of the exam is enough points collected either in colloquia or on the written part of the exam. Practical knowledge of the recognition of biodegradation of wood on 4 samples is required, which is a condition for the further course of the oral part of the exam. After the successful recognition of all four samples, the student is asked two theoretical questions (questions from the least solved colloquium) or three theoretical questions covering entire material. The final grade is obtained according to the formula: (E×20 + FE×80) / 100	examination periods	-

Obligatory literature

1. Proceedings of the International scientific conferences: WOOD IN THE CONSTRUCTION INDUSTRY, (Despot, R. i Jambreković, V. Editors); (publication years: 2000 – 2004), Zagreb: Faculty of Forestry.
2. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom (selected chapters).

3. Bravery, A. F., Berry, R. W., Carey, J. K., Cooper, D. E.: RECOGNISING WOOD ROT AND INSECT DAMAGE IN BUILDINGS, BRE Bookshop, Second edition, 1992. Garston, Watford, United Kingdom (selected chapters).
4. *** HRN EN norms in the field of wood preservation and protection.

Recommended literature

1. Hasan, M., Despot, R.: ZAŠTITA DRVA I – Abiološki čimbenici, lignikolne bakterije i gljive, ksilofagni kukci i morski štetnici. Skripta za studente drvne tehnologije iz predmeta Zaštita drva I i Patologija drva. Sveučilište u Zagrebu, Šumarski fakultet, 2018. (at the web page: http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the course Zaštita drva I (Wood protection I), there is a link to download the script).
2. Špoljarić, Z: ZAŠTITA DRVA (Impregnacija), skripta za slušače DT odsjeka VII stupnja nastave Šumarski fakultet Zagreb, 1973.
3. Glavaš M.: GLJIVIČNE BOLESTI ŠUMSKOG DRVEĆA. Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, 1999. (selected chapters).
4. Vasić, K.: ZAŠTITA DRVETA 1: KSILOFAGNI INSEKTI, Naučna knjiga, Beograd, 1971 (selected chapters).
5. Petrović, M.: ZAŠTITA DRVETA 2: TRULEŽ I OBOJENOST DRVETA, Naučna knjiga Beograd, 1980. (selected chapters).

Informatics

SS 203 N

ECTS 5,5

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45
Field work 0

Lecturer
Professor Anamarija Jazbec, Ph.D.
Assistent professor. Matija Jug, Ph.D.
Assistent professor. Ernest Goršić, Ph.D.

Associate teacher for exercises
Assistent professor. Matija Jug, Ph.D.
Assistent professor. Ernest Goršić, Ph.D.

Grading
The average grade is the arithmetic mean of three parts of course curriculum.

Course content:

BASICS OF COMPUTER AND INFORMATIC TECHNOLOGIES: What is the computer and what its features are. Computer hardware: hardwarea and software. Analog and digital techniques. Examples of IT technology in practice (networks: Internet, CARnet, databases, multimedia, digital management).
IT DEVELOPMENT: Computer History. Generations of computers. Computer Categories. Integral information systems. HARDWAREA: Components of a computer. Input-output devices. Monitor, printer, plotter, scanner, audio equipment. CPU (Central Processing Unit). Types of computer connectors. Data storage. Magnetic, optical and flash memory.Notebooks. Examples. SOFTWAREA: Principles of Programming and Fundamentals of Program Structure. Algorithms. Lower and higher programming languages: types, differences, scopes, advantages and disadvantages of various languages. Operating systems. Examples. User Programs. Types. Examples: word processing programs, data processing programs, spreadsheets, programs for specific problems of particular profession or activity. Organizing files in the system. File Definition. Databases. COMPUTER NETWORKS: Definition. Types. Protocols. Network Services: WWW, e-mail, social networking, chat, social networks, video conferences. INTERNET AND CARNET: Information Services. Browsers. Searching bibliographic databases. CONSTRUCTING THE COMPUTER: In this part of the course, students are introduced to the following topics: how to use the user interface and AutoCAD in general, 2D (two-dimensional) objects view, draw, select and edit such objects, create layers, fill objects, use text to drawing, dimension, getting object data and printing on paper and converting to PDF formats.

Type of course:

Informatics (compulsory, 2. semester, 1. year udergraduate professional study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the computing and information technology Describe and explain the computer's hardware and softwarea Specify the basic operating system features Define and specify computer networks and network services. Distinguish and successfully use basic Internet services Using Windows operating system and Office self-creation and formatting of documents in Word, creation and formatting of databases by performing calculation and graphical data display in Excel	Exercises in Computer Classroom, Partial exams	A5
use AutoCAD computer software in 2D technique	Exercises in Computer Classroom, correction and evaluation exercises	A5
edit technical drawing settings, set the type of lines to use (layers or levels), type of text, dimension style, units and scale	Exercises in Computer Classroom, correction and evaluation exercises	A5
adjust the interface, adjust it with the cardtool to be used in the work	Exercises in Computer Classroom, correction and evaluation exercises	A5
make templates for drafting, create templates for several standard formats of paper ready for printing	Exercises in Computer Classroom, correction and evaluation exercises	A5
a computer to draw three basic views (NTB-plan, side elevation and plan view) given item	Exercises in Computer Classroom, correction and evaluation exercises, Colloquium, final exam	A5
drawn object correctly quoted, adjust the scale of the paper format to which it is printed	Exercises in Computer Classroom, correction and evaluation exercises, Colloquium, final exam	A5
isometric drawing	Exercises in Computer Classroom, Partial exams, Colloquium, final exam	A5
drawn object set into the prepared template for plot, plot and save to *PDF*, *DWG* and *dwt* format	Exercises in Computer Classroom, correction and evaluation exercises, Colloquium, final exam	A5

General competences

Explaine the basics of IT technology
Cite hardware and software computer parts.
Self-using Word office.
Self-searching the Internet and using online services.
Make self- sketches for later construction of computers.

To qualify for independent representation of an object on paper in three projections with an isometric view.
Print default object with all necessary information (listed all the important elements).

Lectures

Exercises
Exercises are an upgrade to knowledge adopted in lectures. Exercises are performed in a computer classroom.

Working methods:

Teachers' obligations:
Preforming original lessons - lectures, exercises. Preforming Partial, Written and Oral Exams and Consultations. Creating teaching materials. Correcting Exercises.

Studenats' obligations:
Regular attendance and active participation in lectures and exercises. Self-learning and solving exercises outside regular classes. Preapering, attending and passing two partial exams and, if necessary, final exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures	-		-	45	15	2
Exercies	-	-	-	45	15	2
Theorethical Partial exam	33%	50-60%	Sufficient (2)	1	15	0,5
		70-80%	Good (3)			
		90%	Very good (4)			
		100%	Excellent (5)			
Computer skills Partial exams	33%	2 of 5 correctly solved exercises	Sufficient (2)	1	15	0,5
		3 of 5 correctly solved exercises	Good (3)			
		4 of 5 correctly solved exercises	Very good (4)			
		5 of 5 correctly solved exercises	Excellent (5)			

AUTOCAD Partial exam Theoretical	17%	6 of 10 points	Sufficient	1	15	0,5
		7 and 8 of 10 points	Good (3)			
		9 of 10 points	Very good			
		10 of 10 points	Excellent			
Computer	17%	Subjective assessment of at least 60% accuracy of all draft elements	Sufficient (2)	1		
Total	100%	(K1+K2)×33+ (K3×34)/ 100		94	60	5,5
*During the course, students write 3 partial exams .The average score of all three parts makes the final grade						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of students on lectures and exercies is checked. The student may not attend a maximum of 4 hours of lecture classes and 4 hours of. Exercies.	semester (90 hours of direct lecturer)	-
3 Partial Exams	During the course, students write 3 partial exams. The first of the theoretical part and contains 10 questions. The second is computer skills that contains 5 exercises in excel. The third from AUTOCAD, which contains 10 questions from the theory and testing of computer skills through the evaluation of 7 elements. The average score of all three parts makes the final grade.	During the semester	
Final Exam	Testing just that part of course curriculum which was not passed by partial exams.	Exam terms	

Obligatory literature

1. Informatics is a e-course on the remote learning system Merlin :https://moodle.srce.hr/2018-2019/course/view.php?id=36295

Recommended literature

1. Jazbec A. Skripta iz Informatike, Zagreb, 2002.
2. Budin L. Informatika. Element, Zagreb,1997.
3. Čerić V, Varga H, Birolla H., ur. Poslovna informatika. Znak, Zagreb, 1998.
4. Trconić M, AutoCAD s primjerima tehničkih crteža, Vinkovci, 2007.
5. Finkelstein, Ellen: AutoCAD 2002 Biblija, Miš, Zagreb, 2005.
6. Opalić M, Kljajin M, Sebastijanović, S. Tehničko crtanje, Zagreb/Slavonski Brod 2002.

Wood industry mechanical engineering 2

SS 204 N

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45

Lecturer
Prof.dr.sc. Stjepan Risović

Associate teacher for exercises
Doc.dr sc. Branimir Šafran
Marko Rastija, mag. ing. mech.

Grading
Sufficient (2) 50 - 67 %
Good (3) 68 - 78 %
Very good (4) 79 - 89 %
Excellent (5) 90 - 100 %

Course content:

Characteristic machine elements in WI. Definition of machine, device, and machine element. Tolerances and joint tolerances. Tolerances of measure, shape and position.
Connecting elements; non separable (welded, soldered, glued joints, calculation of shrinkage joint) and separable joints (screw joints, joints with wedge, pin, bolt).
Power and motion transmition elements (axles and shafts, journals, bearings; belt, friction drive, gears, chain drive, cable drive).
Flow elements. Piping. Flow elements sealing in processes and machines in WI.
Heat prime movers and machines in WI. Basic terms of heat science. Equation of state for ideal gas. Internal energy. State change of ideal gas. Circular processes.
Internal combustion motors. Application in WI. Steam boilers. Working characteristics of steam boilers in WI. Saturated and superheated steam, moist air. Types and application in WI.
Steam boilers. Steam boilers parts. Posible application of steam boilers in WI.
Heat transfer. Heat conduction. Convection heat transfer. Heat radiation. Heat transfer through the wall.
Combustion. Fuels. Combustion process. Excess air ratio (lambda). Calorific value. Overview of energy problems in wood industry.
Hydraulic machines in WI. Basic laws of hydromechanics. Basic laws of hydrostatics and hydrodinamics. Bernoulli's equation.
Hydraulic devices. Classification of suction pumps. Definition and main exploitation characteristics. Performances of turbine pumps.

Main characteristics of radial and axial ventilators. Compressors. Characteristics and types of compressors in WI.

Type of course:

Wood industry mechanical engineering 2 (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identification of connecting elements, power and motion transmition elements	partial exam, written exam, oral exam	A3, A4
Calculate load magnitude at non separable and separable joints	partial exam, written exam, oral exam	A3, A4
Check main quantitys in work with rotation motion elements, peripheral and angular velocity, speed frequency, torque	partial exam, written exam, oral exam	A3, A4
Calculate power transfer elements by friction and engagement	partial exam, written exam, oral exam	A3, A4
Construct machine elements and define their application	partial exam, written exam, oral exam	A3, A4
Apply basic technical criteria for designing and dimensioning machine elements (factor of safety)	partial exam, written exam, oral exam	A3, A4
Analysis of piping, stop, safety and regulating organs from the point of pressure loss	partial exam, written exam, oral exam	A3, A4
Define mechanical properties and testing	partial exam, written exam, oral exam	A3, A4
Compare effects of heat and chemical-heat treatment of steel on dinamic load of machine elements	partial exam, written exam, oral exam	A3, A4
Analyze use of tool steels and new materials in production phases of mechanical processing	partial exam, written exam, oral exam	A3, A4
Calculate the amount of the change of state of idle gas and circular processes	partial exam, written exam, oral exam	A3, A4
Check and compare working features of turbopumps on Q - H, Q – η, Q – P diagrams	partial exam, written exam, oral exam	A3, A4
Differ types and characteristics of turbine plants in WI plants	partial exam, written exam, oral exam	A3, A4
Analyze the operation of the internal combustion engine from the standpoint of energy consumption considering the traveled distance	partial exam, written exam, oral exam	A3, A4
Calculate loses during heat transfer through the wall	partial exam, written exam, oral exam	A3, A4
Describe existing energy problems in WI and make plans for application of renewable energy sources (forest biomass)	partial exam, written exam, oral exam	A3, A4

General competences

Identification and distinction of certain machine and construction elements
Apply acquired theoretical knowledge in practice.
Apply the basic principles of constructing and dimensioning machine elements

Lectures

Exercises

Exercise part of the teaching program is carried out in a laboratory where on the basis of specific measurements the calculations of observed systems and principles are carried out. The second part of the exercises are calculation tasks where the theoretical knowledge adopted in the lectures is upgraded with aim of better understanding of the subject.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Providing partial exams, oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures and exercises. Laying the partial exams and exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	
Exercises (E)	-	-	-	45	0	
Partial exam 1 (PE1)	16 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		15	0,8
Partial exam 2 (PE2)	17 %	50 - 67 %	Sufficient (2)		20	0,85

		68 - 78 % 79 - 89 % 90 - 100 %	Good (3) Very good(4) Excellent (5)			
Partial exam 3 (PE3)	17 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		20	0,85
Oral exam (OE)	50%	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		25	2,5
TOTAL	100 %	(((PE1x16)+(PE2+PE3)x17 + OEx50)/100		75	80	5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Written exam*(WE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		50	2,5
Oral exam* (OE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)		30	2,5
TOTAL	100 %	(WEx50+OEx50)/100				
* students who do not pass the exam through the partial exams during the semester, will approach the final exam which makes 100% of the grade (written exam - 50%, oral exam 50%).						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercizes	The teaching attendance is checked and recorded. Students may be absent with a maximum share of 20 % of direct teaching.	semester (60 hours of direct lecturer)	-
Partial exam (PE1, PE2, PE3)	Students who regularly attend teachings can approach the writing of a partial exam, making them easier to pass the exam because the lessons are learned in the "stages". The partial exam is evaluated and participates in the final grade.	PE1 – 6. week PE2 – 11. week PE3 – after finished lectures	-
Written exam	Exams can be attended by students who have sufficient teaching attendance. Students solve tasks and answer asked questions. The written exam is evaluated and participates in the final grade.	Exam terms	-
Oral exam	Students who pass 3 partial exams or a written exam are areasked for questions from different parts of the teaching program content. The final grade is obtained according to the formula **(((PE1x16)+(PE2+PE3)x17 + OEx50)/100 or WEx50+OEx50/100**		

Obligatory literature

1. Kraut, B.: Strojarski priručnik, AXIOM, Zagreb, 1997.
2. Decker, K. M.: Elementi strojeva, TK Zagreb, 1980.
3. Elčić, Z.: Parne turbine, ABB Tvornica energetskih postrojenja d.o.o., Karlovac, 1995.

Recommended literature

1. Gulič, M., Brkić, Lj., Perunović, P.,: Parni kotlovi, Univerziter u Beogradu, 1991

Electrical Engineering (selected chapters)

SS 205 N

ECTS 3,5

English language Rx

E-learning Rx

Teaching hours 60
Lectures 15
Exercises 45

Lecturer
Doc.dr.sc. Kristijan Radmanović

Associate teacher for exercises
Doc.dr.sc. Kristijan Radmanović

Grading
Sufficient (2) 50%
Good (3) 65%
Very good (4) 80%
Excellent (5) 90%

Course content:

Electrical engineering and its division. Units of measurement. Electrical charges. Static electricity. Guides, insulators and semiconductors with quantum mechanics. Basic laws in the DC current circuit. Electrical current, power, potential and voltage. Electrical resistance, conductivity and Ohm's law. Voltage drop, electromotive force. Connecting resistance. Energy and power. Application of the Basic Electricity Act. Electrical capacity and capacitors. Chemical and Solar Power Sources: Chemical Effects of Electricity. Galvanic articles (primary). Batteries. Solar elements. Electromagnetism. Magnetism and magnetic field. Magnetic field of electric current. Magnetic hysteresis. Electromagnetic induction. Self-induction and mutual induction. Eddy currents. Power charges and power in the magnetic field. Basics of electric motor operation. Alternating current. Creation and presentation. Resistance, inductance and capacitance in alternating current circuit. Resonance. The closing circle. High-frequency generator. Power of alternating current. Measurement of power and alternating current energy. Structure of the calculation. Compensation of power factor. Three-phase alternating current system. Creation and presentation. Rotational magnetic field of three phase current. Basics of a three-phase asynchronous induction motor. Electric machines and transformers. Generally speaking about electric machines and their division. Induced EMS and direct current generator voltage regulation. Design, operation and launch of DC motors. Directional speed control of DC motors. DC machines with regard to excitation. Heating, Loss and Usage El. machines. Mechanical, thermal and el. protection. Transformers. Three-phase asynchronous induction motors. Single-phase asynchronous induction motors. Converters. Electric motor drive diagram. Types of electromotor drives. Electrical lighting. Photometric sizes. Electric light sources. Brightness. Laboratory and plant measurements.

Type of course:

Electrical Engineering (selected chapters) (compulsory collegium, 2st semester, 1st year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Appoint measuring units used in electrical engineering	colloquium, final exam, oral exam	A1
Appoint and describe the physical size that we describe the electric field.	colloquium, final exam, oral exam	A1
Analyze the serial and parallel condenser connections.	colloquium, final exam, oral exam	B3
Explain the capacity of the capacitor and the role of the dielectric at the capacitor.	colloquium, final exam, oral exam	B3
Describe direct current sources. Demonstrate Kirchoff's rules on an arbitrary example.	colloquium, final exam, oral exam	A3
Analyze complex current circuits of direct current. Explain the occurrence of magnetism and electromagnetic induction.	colloquium, final exam, oral exam	B5
Appoint and describe the physical size of the alternating current with appropriate current and effective values.	colloquium, final exam, oral exam	A3
Analyze the RLC titre circle and explain the role of each element in the circle.	colloquium, final exam, oral exam	B5
Distinguish the active, reactive and apparent power of alternating current.	colloquium, final exam, oral exam	A2
Explain the principle of electric motor and generator operation. Analyze the three-phase system.	colloquium, final exam, oral exam	B3
Define the photometric size	colloquium, final exam, oral exam	B3
Interpret electrical measurements in woodworking plants.	colloquium, final exam, oral exam	C1

General competences

Define the basic laws of electrical engineering, the associated physical size and the unit of measurement.
Select suitable electric machines in woodworking plants and know their characteristics
Create a drive diagram of individual electrical machines
Choose a suitable electric lighting for woodworking drives

Lectures

Exercises

Working methods:

Teachers' obligations:
Maintaining the original teaching - lectures, exercises. Compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures and exercises. Laying the exam, exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachingh ours	Number of average students workload outside the direct teaching	ECTS
Lectures	20%	-	-	15	0	0,5
Exercises	20%	-	-	45	0	1,5
Partial exam 1 (PE)	30%	50-64%	Sufficient (2)	-	20	0,75
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
Partial exam 2 (PE)	30%	50-64%	Sufficient (2)	-	20	0,75
		65-79%	Good (3)			
		80-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	100%	(Lx20+Ex20+PE1x30+PE2x30)/100		60	40	3,5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Written exam*(WE)	80 %	50 - 67 % 68 - 78 %	Sufficient (2) Good (3)	48	36	2,8

		79 - 89 % 90 - 100 %	Very good(4) Excellent (5)			
*Exercizes (E)	20 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good(4) Excellent (5)	12	9	0,7
TOTAL	100 %	(WEx80+Ex20)/100		60	40	3,5
*Students who do not pass through the semester during the semester will approach the exam time of 50% of the grade, and the remaining 50% make the grade from the oral part of the exam						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Partial exam 1	Students who regularly attend classes can access the first colloquium. The quiz consists of 5 assignments, each assignment being 20 points. Students have met the first partial exam if they achieve 50 points.	8. week	Exceptionally, in the case of a justified reason for the absence.
Partial exam 2	Students who attend classes regularly and who have collected at least 50 points in the first colloquium can approach another colloquium. The second colloquium consists of 5 assignments, each assignment being 20 points. The students met the second exam if they scored 50 points.	15. week	Exceptionally, in the case of a justified reason for the absence.
Written exam	Exams can be accessed by students who regularly attend classes and did not meet the first or second qualifications. The written exam consists of 5 assignments, each carrying 20 points. The students met the written exam if they achieved 50 points, after which they approached the oral exam. The written exam is evaluated and participates in the final grade of the subject	examination deadlines	
Oral exame	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the subject is the arithmetic mean of the written and oral part of the exam.	-	Exceptionally, in the case of a justified reason for the absence.

Obligatory literature

1. Kaiser, D.: Elektrotehnika osnovi, Tehnička knjiga, Zagreb, str. 1-310.
2. Primorac, M.: Skripta (zadaci, rješenja i pitanja)

Recommended literature

1. Mlakar France, Opća električna mjerenja, Tehnička knjiga Zagreb, Golden marketing, 2003.
2. Pitrovski, L. M., Električni strojevi, Tehnička knjiga Zagreb, Golden marketing, 1974.
3. Primorac, M., Racionalizacija iskorištavanja električne energije u drvnoindustrijskim pogonima

Measurement techniques

SS 206 N

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0 days

Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Associate Professor Igor Đukić

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:

Basics of measurement and measurement systems. Physical quantities and their values. Quantities, units and numbers. Types of measurement errors. Measurement uncertainty. Basic measurement instruments for measurement of electrical quantities. Measurement instruments for measurement of mechanical quantities. Measurement chain, standard part of measurement system with a computer. Static and dynamic characteristics measurement transducers and instruments. Measuring transducers for displacement, speed, acceleration, level, force, stress, torque, pressure, flow, temperature and humidity.
Measurements and their application in control and optimization in wood technology: - application of devices and measuring instruments on different processes and quantities in wood technology, and use of measurement data in control and optimization.

Type of course:

Measurement techniques (compulsory, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Calculate the accuracy of the analog and digital instrument.	partial exam, final exam	A2
Basic statistical analysis of measurement results.	partial exam, final exam	A2
Distinguish measurements errors due to their origin.	partial exam, final exam	A2
Describe the role of the individual components of the measurement chain.	partial exam, final exam	A2
Differentiate the basic transfer characteristics of measurement transducers and analyze them on the example of frequently used transducers in the wood industry.	partial exam, final exam	A2
Sketch the systems static characteristic and calculate system sensitivity.	partial exam, final exam	A2
Graphically calculate the static characteristic of connected units in the measurement system.	partial exam, final exam	A2
Differentiate the basic characteristics of dynamic signals (rms, mean value and peak value).	partial exam, final exam	A2

General competences

Basic processing of measurement results.
Acquiring knowledge for the selection of measurement systems of selected physical quantities in certain accuracy classes.

Lectures

Exercises

Numerical exercises related to the conversion of measuring units, processing of measurement results, determination of the instrument accuracy, static characteristics of the measuring system elements, basic characteristics of analogue to digital converter, dynamic characteristics of the signal. Measurements of selected mechanical quantities are performed as a basis for part of numerical exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing partial exam, oral exams and consultations. Creating teaching materials.

Studenats' obligations

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	28	2	1
Partial exam 1 (PE1)	50%	50-60%	Sufficient (2)	1	29	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-60%	Sufficient (2)	1	29	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	100%	(PE1x50 + PE2x50)/100		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60%	Sufficient (2)	2	58	2
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(FEx1)/100		2	58	2

*Students who do not pass through the semester during the semester will approach the exam time, that makes 100% of the grade.

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Partial exam 1 (PE1)	The partial exam can be accessed by all students.	9. week	
Partial exam 2 (PE2)	The second partial exam can be accessed by students who have passed the first partial exam. Students who get enough points from both partial exams get a final score.	14. week	
Written exam	The written exam consists of five numerical tasks. For the passage it is necessary to have at least 50% of the total number of points.	Exam terms	
Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked. The final grade is obtained according to the formula (FEx100)/100	Exam terms	

Obligatory literature

1. Kovačić Z., Bogdan S. 2004: Elementi automatizacije procesa 2, Fakultet elektrotehnike i računarstva Zagreb, interna skripta.
2. Božičević, J. 1992: Temelji automatike, II. knjiga – Mjerni pretvornici i mjerenje, [kolska knjiga, Zagreb

Recommended literature

1. Rajić, F. 1980: Osnove automatike I dio – Mjerenje neelektričnih veličina, Zagreb.
2. Rajić, F. 1980: Osnove automatike II dio – Automatsko reguliranje procesa, Zagreb.

Non-wood Materials

SS 207 N

ECTS 4

English language ---

E-learning ---

Teaching hours 60
Lectures 30
Exercises 30
Field work

Lecturer
Associate Professor Jaroslav Kljak, Ph. D.

Associate teacher for exercises
Associate Professor Jaroslav Kljak, Ph. D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Technical chemicals, inorganic and organic acids, base substances, salts, oxidation and reduction substances, solvents, chemical handling; metals, alloys galvanisation; glass and enamels, types and use; ceramic products, porous and nonporous ceramic, abrasive materials; natural organic materials, oils, waxes, resins; textile, lather, polymer materials, organic polymers, synthetic polymers, types of synthetic polymers, properties of synthetic polymers, manufacturing of synthetic polymers, polymeric materials for resins and adhesives.

Type of course:

Non-wood materials (compulsory course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Interpret structure of solid materials at the level of their microstructure (metals, ceramics and polymers).	knowledge test, final exam	B3
Compare the physical and mechanical properties of certain types of material	knowledge test, final exam	B3
Briefly describe the most common manufacturing processes for producing plastic parts.	knowledge test, final exam	B3

General competences

A course objective is getting knowledge about properties of nonwood materials that are used in wood industry.

Lectures

Exercises

Working methods:

Teachers' obligations:
Teaching activities - lectures, exercises. Creating knowledge tests and evaluation. Providing oral exams and consultations. Preparing teaching materials.

Studenats' obligations:
Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	60		4
TOTAL	100%	(FEx100)/100		60		4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably miss no more than 15% hours of all lectures and exercises.	semester (60 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who attended lectures and exercises. The students in the written exam (multiple choice question), choose the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	After passing a written exam, students are asked questions from different parts of the lecture content.		

Obligatory literature

1. M. Biffl, Poznavanje materijala II, Šumarski fakultet, Zagreb, 1986.
2. Z. Janović, Polimerizacije i polimeri, HDKI – Kemija u industriji, Zagreb, 1997.

Recommended literature

1. V. Tadejević, V. Jakovlić, Poznavanje robe, Školska knjiga, Zagreb, 1971.
2. Filipović, S. Lipanović, Opća i anorganska kemija I/II, Školska knjiga, Zagreb, 1991.

Sawmilling

SS-301N

ECTS 6,5

English language R1

E-learning R1

Teaching hours 135
Lectures 45
Exercises 90

Lecturer
Assistant professor Josip Ištvanić, Pd.D.

Associate teacher for exercises
Assistant professor Josip Ištvanić, Pd.D.

Grading
Sufficient (2) 70-79%
Good (3) 80-89%
Very good (4) 90-95%
Excellent (5) 96-100%

Course content:

Introduction to the sawmilling production. Short overview of sawmilling history. The importance of the sawmilling industry. Sawmilling raw materials. Variety of the sawmilling raw material. Measurement of round wood. Quality and characteristic defects of our most important wood species. Standard rules for sawmilling logs. Sawmilling products and residues. Main characteristics of the sawn wood. Quality and defects of sawn wood. Standard rules for sawn wood. Measurement of sawn wood. Oversizes of sawn wood. Sawmilling plant. Main parts of sawmilling plant. Other parts of sawmilling parts. Major sawmill machinery. Vertical log band saws and resaws. Other types of log band saws. Frame saws. Circular saws. Log chipping machines. Selection and working conditions of sawmill machines. Criteria for selection of sawmill machines. Significance of sawmill machines for the quantity and quality yield of logs. Capacity of major sawmill saws. Production and technological process in sawmill. Production flow and technological charts processing fir and spruce logs and hardwood logs. Log conversation methods. Conversation of logs by chipping methods. Other methods of log conversation. Sawn-wood conversation methods. Methods of sawing of more important wood species.
Recovery of the saw logs. Factor effecting log yield.

Type of course:

Sawmilling (obligatory subject, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify and evaluate sawmilling raw material and products	Exercises, exsam	C2
Carry out classification and measurement sawmilling raw material and products	Exercises, exsam	C2
Use basic skills of sawmilling technology and methods of sawing logs and sawnboards	Exercises, exsam	C2
Articulate criteria for a successful machining of sawlogs	Exercises, exsam	C2

General competences

Sawmilling products and sawmilling raw material knowledgment and practical abilities for their gradings and measurements.
Knowledgment and use of sawmilling machines, sawmilling technologies and sawing logs and sawn woods methods.
Understanding the criteria for a successful machining of sawlogs and adopting the basic skills of sawmill wood technology.

Lectures

Auditory lectures are carried out according to weekly curriculum

Exercises

As part of the exercise, there are six computing and drawing exercises related to the content of the lectures. Exercise measurements are performed in the production conditions of partner companies with emphasis on the practical application of the accepted knowledge of the lectures.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures and exercises. Designing and reviewing exercises and topics for final papers. Compiling knowledge tests and evaluating them. Providing exams and consultations. Creating teaching materials

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making exercises, conducting exams and preparing and presenting final work.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachingh ours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)				45		1
Exercises (E)				90	30	4,5
Written exam (WE)	100%	70-79%	Sufficient (2)		30	1
		80-89%	Good (3)			
		90-95%	Very good (4)			
		95-100%	Excellent (5)			
*Oral exam (OE)		Percentage of response accuracy ≥70%	Positively			
		Percentage of response accuracy <70%	Negative			
TOTA	100%	(WEx100)/100		135	60	6,5
* Only those students who want a higher final grade than those obtained on a written exam are issued to the oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score. In the case of 70% and more positive answers, the final grade can only be achieved by one step higher than the previously achieved on the written exam.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. The student can justifiably absent from the direct teaching as much as stipulated in the Rulebook on Studying.	Semester (135 hours of direct lecturer and exercies)	-
Exercises (E)	As part of the exercise, 6 counting exercises and drawings are performed. Students with task assignments and tips for making all 6 exercises, and the appearance of the file, card and inserts are downloaded from the subject's web site. When submitting the exercises, the student should explain how to solve the exercises. Exercise measurements are performed in the production conditions of partner companies with emphasis on the practical	Continuously during the term of the semester according to the agreed term. Students who	

	application of the accepted knowledge of the lectures.	have created and explained all the exercises and those accepted by the teachers can access the exam.	
Written exam	Examinations can be attended by students who have completed, reviewed and explained all exercises. Students on pre-printed exams answer questions asked by rounding off responses, describe images, draw schemes, and solve computational tasks. The written exam is evaluated according to the scale given in the methods of grading.	Exam terms	-
*Oral exame	Only those students who want a higher grade than those obtained on a written exam are issued an oral exam. The requirement to enter an oral exam is that the score of the written exam is reached in the upper score of the score scale, ie close to the score of the achieved score. They ask questions from different parts of the program content. In the case of 70% and more positive answers, only one step higher final grade than the previously achieved on a written exam can be achieved.	Exam terms	-

Obligatory literature

1. On the website http://www.pilanarstvo.com there are links to the templates and exercise tips and a wide range of useful information regarding sawmilling technology, created by: Josip Ištvanic
2. Brežnjak, M. 1997: Pilanska tehnologija drva, I dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
3. Brežnjak, M. 2000: Pilanska tehnologija drva, II dio, Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet.
4. Dević, I.; Ištvanić, J., 2003: Alati i strojevi u obradbi drva 1, Element, Zagreb, 2003.
5. Goglia, V. 1994: Strojevi i alati za obradu drva I dio, Sveučilište u Zagrebu, Šumarski fakultet

Recommended literature

1. Merzelj, F. 1996: Žagarstvo: Udžbenik, Kmečki glas, Ljubljana.
2. Gornik Bučar, D.; Merzelj, F. 1998: Žagarski praktikum, Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za lesarstvo.
3. Nikolić, M. 2004: Prerada drveta na pilanama, udžbenik, Univerzitet u Beogradu, Šumarski fakultet, Beograd

Hydrothermal wood processing

SS-302N

ECTS 6,5

English language R1

E-learning R1

Teaching hours 105
Lectures 45
Exercises 60
Field work 0

Lecturer
Professor Stjepan Pervan, PhD

Associate teacher for exercises
Miljenko Klarić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

The physical basics of drying process. The basics of wood and water relations. Shrinkage and swelling. Measurement of water content in wood by different methods. Natural drying - advantages and disadvantages of natural drying. Organization of green and dried sawn wood yard. Selection of the most favourable position of the storage yard, considering the direction of air flow, the type of stacks. Influence of climate conditions on natural drying. Protection of sawn wood on the storage yard. Basics of wood drying process. Methods of technical drying of wood. Types of wood drying regimes. Modification of the regime. Internal and external changes in wood during the drying process. Constructions of drying facilities. Types of wood drying kilns. The main and ancillary equipment of the wood drying kiln - characteristics and use. Control Regulatory Systems - Basics. Control systems for controlling wood drying - types and methods of use. Methods for measuring the drying process parameters. Power plants - Basics and Mode of Operation. Quality of wood. Input quality control, quality control during drying, output control before further processing or dispatch. Valuable standards in Croatia and the world - ways of controlling. Wood defects in the wood drying process. Influence of input quality. Types of defects - Causes and Methods to Prevent defects. Troubleshooting. Drying costs. Types of costs, calculation of drying costs. Planning investments in hydro-metal processing plants. Steaming of wood - the reasons and the ways of implementation. Wood bending.

Type of course:

Hydrothermal wood processing (compulsory, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define water and wood relationships through technological processes	exercises, lectures, exam	C4
Explain the dimensional changes of wood during hydrothermal processes	exercises, lectures, exam	C4
Define the anatomical and chemical basis of wood and the influence of anatomical characteristics on the drying process	exercises, lectures, exam	C4
Describe the determination of amount of water in the wood	exercises, lectures, exam	C4
Explain the organization of sawn wood storage yard with regard to drying	exercises, lectures, exam	C4
Explain the basics of industrial hydrothermal processes	exercises, lectures, exam	C4
Describe and define the wood drying regimes	exercises, lectures, exam	C4
Describe the types and equipment of wood dryers	exercises, lectures, exam	C4
Describe the natural and technical drying of wood - advantages and disadvantages	exercises, lectures, exam	C4
Define automation processes during drying wood	exercises, lectures, exam	C4
Describe problems and defects with wood drying	exercises, lectures, exam	C4
Distinguish wood drying kiln according to the type of process	exercises, lectures, exam	C4
Describe the bending of massive wood	exercises, lectures, exam	C4
Describe energy use during hydrothermal wood processing	exercises, lectures, exam	C4

General competences

The aim of the course is to qualify the expert for self-governing monitoring and control of the hydrothermal processing of wood**.**

Lectures

In the course of lectures, students gain knowledge about hydrothermal processing of wood.

Exercises

As part of auditory exercises, laboratory exercises and practical exercises, students receive an upgrade to the knowledge gained during the lectures.

Field work

During field work, students connect knowledge from the lessons and exercises with real production.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the colloquia and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-			45	45	3
Exercises (E)	20 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	60	15	2,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE)	80 %	60-70 %	Sufficient (2)		30	1
		71-80 %	Good (3)			
		81-90 %	Very good (4)			
		91-100 %	Excellent (5)			
TOTAL	100%	(Ex20 + PEx80)/100		105	90	6,5

Evaluation	Maximum	Grade rating	Grade	Direct	Number of	ECTS

elements	points or Share in evaluation	scale		teaching hours	average students' workload outside the direct teaching	
Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	100%	(FEx80+Ex20)/100				1
*students who do not pass through partial exam the semester, will approach the exam period that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 10 % of direct teaching hours.	semester (105 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. At the beginning of the first exercise, students will receive templates. Exercises are written by hand. For each exercise, the term in which the exercise is handed and evaluated positively, is defined. If the exercise is not handed within the defined time frame or if the exercise is not evaluated positively, then that exercise will be reviewed later after semester ends and the student will receive the seminar assignment and additional computational tasks for each exercise. The accuracy, tidiness and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Written exam	Exam can be attended by students who have completed the exercises. The exam consists of theoretical questions, computational tasks and of the sample that students must describe. For passage students must collect at least 60 % of points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula (FEx80+Ex20)/100		-

Obligatory literature

1. Pervan, S. (2000): Priručnik za tehničko sušenje drva. 272 p. SAND 2000.

Recommended literature

2. Simpson, W. T. (1991): Dry kiln operator's manual. USDA, FPL, Madison, Wisconsin, 274 p.

Panels from Fragmented Wood

SS-303N

ECTS 6.5

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45
Field work

Lecturer
Prof. Vladimir Jambreković, PhD
Assist. Prof. Nikola Španić, PhD

Associate teacher for exercises
Assist. Prof. Nikola Španić, PhD

Grading
Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:

Panels from fragmented wood – Significance of panels' appearance. Raw materials for panels' production: wood raw materials, lignocellulosics, recycled materials, synthetic adhesives, natural adhesives, mineral adhesives, hydrophobic agents, fire-resistance agents, insecticides and fungicides, waterproof resins. Share of wood price in panels' production. Wood utilization. Partition of panels from fragmented wood. Particleboards – panels with horizontal placement of particles. Panels with vertical placement of particles (extrusion panels). One-layer panels. Three-layer panels. Multi-layer panels. Panels with graduated structure. Light panels. Medium heavy panels. Heavy panels. Working panels. Frontal panels. Postforming variation. Solid extruded panels. Extruded panels with holes. Particleboards with macro particles. Flakeboard. Chipboard. Waferboard (WB). Oriented Waferboard (Waferboard plus) (OWB). Oriented Strandboard (OSB). OSB/1, OSB/2, OSB/3, OSB/4. Stone-wood panels. Light construction panels bounded with plaster. Light construction panels bounded with cement. Concrete panels from particles. Particleboards bonded with cement. Particleboards bonded with magnesite. Particleboards bonded with plaster. Particleboards reinforced with synthetic or mineral fibres. Triboard. Woodmat. Spaceboard. Lignoplastic mouldings. Werzalit mouldings. Collipress mouldings. LSL. LFL.
Fibreboards - Hardboards (HB). Medium boards (MB). Medium boards of low density (MBL). Medium boards of high density (MBH). Porous boards (SB). Dry process (MDF). HDF MDF. Lightweight MDF. Ultra-lightweight MDF. Isolation boards. Tarred fibreboards. Fibreboards bounded with cement. Fibreboards bounded with plaster.

Panels production basics - Raw material preparation. Adhesives formulations. Resinating. Panel forming. Technological parameters of panel forming. Panel tailoring and formatting. Sanding and grinding. Conditioning and equalising. Materials for panel overlaying - Natural veneers. Synthetic materials. HPL, DPL or CPL decorative laminates. Decorative papers impregnated with synthetic resins. Varnishes and enamels. Foils for 3D overlaying. PVC foils. ABS. Testing and panels properties - Physical properties. Mechanical properties. Chemical properties. Waterproof properties. Determination of panel type. Free-formaldehyde concentration. Processing properties. HRN EN standards implementation. Particleboard certification.Free-formaldehyde concentration - Situation in Croatia and in the World. Emission causes. Testing methods. Methods for emission reduction. Actual regulations about formaldehyde emission. Medical aspects of formaldehyde activity. Procedure in case of contact with formaldehyde. Application of panels from fragmented wood – Furniture. Interiour. Walls and ceiling covers. Laminate floorings. Wall constructions. Door wing fillers. Flooring underlays. Bearing elements in construction industry. Vehicles and boats.

Type of course:

Panels from Fragmented Wood (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to explain the significance of fragmented wood panels	laboratory and practical classes, colloquium, final exam	C5
to identify the basic board types	laboratory and practical classes, colloquium, final exam	B4
to identify and select the appropriate wooden raw materials for panel manufacturing	laboratory and practical classes, colloquium, final exam	C5
to identify and select the chemical components for panel manufacturing	laboratory and practical classes, colloquium, final exam	C5
to list and explain the specifics of panels properties as depending on adhesive used	laboratory and practical classes, colloquium, final exam	C5
to use basic and auxiliary raw materials for panel manufacturing	laboratory and practical classes, colloquium, final exam	C5
to choose the equipment and to explain the procedures for obtaining particleboards and fibreboards	laboratory and practical classes, colloquium, final exam	C5
to analyse the basic technological parameters in panel production	laboratory and practical classes, colloquium, final exam	C5
to analyse and explain the dependence of subsequent formaldehyde emission and technological parameters in panel production	laboratory and practical classes, colloquium, final exam	C5
to identify surface coating materials	laboratory and practical classes, colloquium, final exam	C5
to describe the panels properties as dependant on the methods of their production	laboratory and practical classes, colloquium, final exam	C5
to describe the panels properties as dependant of the overlaying material	laboratory and practical classes, colloquium, final exam	C5

General competences

Acquiring of knowledge on production processes in fragmented wood panels industry and use of the knowledge gained for the purpose of independent monitoring and control of production processes in wooden board factories.

Acquiring of knowledge on the properties of fragmented wood panels and use of the knowledge for the purpose of proper selection and use of panels with optimal characteristics.

Lectures

Exercises

As a part of the exercises, the properties of industrially produced particleboards and fiberboards are determined alongside the properties of basic and auxiliary raw materials for their production. Additionally, the required quantities of raw materials for particleboard production are determined, as well as the properties of overlaying materials and the properties of overlayed boards. The exercises are mostly of a practical nature and are carried out in a laboratory, workshop and practicum. Exercises are an upgrade to the knowledge acquired in lectures.

Working methods:

Teachers' obligations:

Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold colloquiums, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises reports within the given time frame. To attend the colloquium and exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1.5
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	30	2.5
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			

		Orderly, legible and on time	Excellent (5)			
Colloquium (macroscopic identification of certain board type; PC)	10%	The student determines the board types with the great aid from the examiner	Sufficient (2)	-	30	1
		The student determines the board types with the minor aid from the examiner	Good (3)			
		The student individually and logically determines the board types with the minor aid from the examiner	Very good (4)			
		The student individually and logically determines the board types without the aid from the examiner	Excellent (5)			
Theoretical colloquiums (TC)	70%	50-61%	Sufficient (2)	-	45	1.5
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	100%	(Ex20 + PCx10 + TCx70)/100		90	105	6.5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS**
Final exam (FE)	70 %	50-61% 62-73% 74-85% 86-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	75	2.5
TOTAL	100%	(FEx70 + PCx10 + Ex20)/100				
* students who do not pass through the semester during the semester will approach the exam time of 70% of the grade, and the remaining 30% make the grade of the exercise (20%) and the macroscopic identification plate collision (10%)						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked, and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (90 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. Through exercises, the students are introduced to the properties of raw materials for fragmented wood panels' production and the properties of industrially produced particleboards and fibreboards. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Colloquium (macroscopic identification of certain board type)	On the basis of the knowledge gained on the exercises and through consultation, the students macroscopically determine the 5 samples of fragmented wood panels. Beside the name of the board, students need to know the basic properties of a certain board type and how and where to use them. The colloquium is evaluated and participates in the final evaluation of the subject.	15. week	Students who pass the colloquium can access the exam
Theoretical colloquiums	Theoretical colloquiums consist of five theoretical questions related to knowledge gained on the lectures and exercises. The students are given the printed colloquiums and they answer the questions asked. Theoretical colloquiums are evaluated and participate in the final grade of the subject.	in accordance with the agreed terms	-
Written exam	Only the students which have submitted their exercises reports and have passes the colloquy, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula (Ex20 + PCx10 + FEx70)/100		

Obligatory literature

1. Jambreković, V.: Drvne ploče i emisija formaldehida, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 2004.
2. Bruči, V., Jambreković, V.: Ploče iverice i vlaknatice, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 1996.
3. Bruči, V., Janović, Z., Jambreković, V., Brezović, M.: Određivanje formaldehida iz drvnih pločastih materijala perforatorskom metodom, Sveučilišni laboratorijski priručnik, Šumarski fakultet, Zagreb, 1994.
4. Šumarska enciklopedija: Ploče iz usitnjenog drva, Jugoslavenski leksikografski zavod, Zagreb, 692-727, 1983.

Recommended literature

1. Bruči, V., Jambreković, V.: Razvoj proizvodnje, svojstava i primjene OSB ploča, Drvna industrija, 1998, 49(1): 41-49.
2. Jambreković, V., Bruči, V.: Stanje i razvojni trend ploča na bazi drva u svijetu, Drvna industrija, 1997, 48(1): 27-34.
3. Jambreković, V., Bruči, V.: MDF - svjetski trend, Drvna industrija, 1997, 48(2): 96-102.

Veneer and plywood

SS 304N

ECTS 6,5

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45
Field work

Lecturer
Prof.dr.sc. Mladen Brezović

Associate teacher for exercises
Prof.dr.sc. Mladen Brezović

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Wood as a raw material for production of sliced and peeled veneer. Analysis of wood raw material. Protection and storage of wood raw material. Veneers. Classification. Stages of the technological process of sliced and peeled veneer production. Mechanical and hydrothermic preparation of wood raw materials. Veneer making machines and tools. Veneer and plywood machine capacities. Defects on veneer. Veneer classing. Other types of veneers. Plywood. Definitions and classifications. Veneer plywood. Block board. Block board core. VF heating. Moulded plywood. Composite plywood. Plywood for special purposes. Structural plywood (LVL and PSL. Stages of the technological process of plywood production. Pressing parameters. Synthetic resin. Final processing of plywood and plywood classing. Mechanical and physical properties of plywood. Other relevant plywood properties. Field of application. Properties of plywood. Croatian, EN and ISO standards. Test procedures. Determination of relevant properties of plywood.

Type of course:

Veneer and plywood (compulsory course, 3. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate veneer according to the type of wood from which they are made	exercises, partial exam, short test, final exam	B4
Monitor the technological processes of veneer and plywood.	exercises, partial exam, short test, final exam	C5
Identify different types of plywood	exercises, partial exam, short test, final exam	B4
Monitor and control the appropriate pressing parameters of plywood	exercises, partial exam, short test, final exam	C5
Identify machines used in veneer and plywood industry	exercises, partial exam, short test, final exam	C5
Monitor and control veneer drying process	exercises, partial exam, short test, final exam	C4

General competences

Acquiring knowledge about production processes in the veneer and plywood industry.
Monitoring and control of production processes in veneer and plywood factories.
Identify the defects that arise in some technological stages of veneer and plywood production and know how to eliminate or reduce their adverse effect.

Lectures

Exercises

Calculation and laboratory exercises are performed. Exercises are an upgrade to knowledge gained in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Holding partial exam, short tests, seminar, written exam, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises write and present seminar, passing on short tests, partial exams, final exams.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	5 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	0	1
		Neat, legible, with bigger corrections and on time	Good (3)			
		Neat, readable with minor corrections and on time	Very good (4)			
		Neat, readable, accurate and timely	Excellent (5)			
Partial exam – sliced veneer technology (PE1)	15%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - peeled veneer technology (PE2)	15%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam - veneer plywood technology (PE3)	15%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam -	15%	60-70%	Sufficient (2)	0	15	0,5

plywood technology (PE4)		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Calculation on partial exam (PE5)	15%	60-70%	Sufficient (2)	3	12	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Short tests (ST)	10%	50-65%	Sufficient (2)	0	15	0,5
		66-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Seminar (S)	10%	$8 \leq x < 10$ points	Sufficient (2)	12	18	1
		$10 \leq x < 14$ points	Good (3)			
		$14 \leq x < 18$ points	Very good (4)			
		$18 \leq x < 20$ points	Excellent (5)			
TOTAL	100%	(Ex5+PE1x15+PE2x15+PE3x15+PE4x15+PE5x15+STx10+Sx10)/100		90	105	6,5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Final exam (FE)	85 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)			
TOTAL	100%	(FEx85+Ex5+Sx10)/100				
* Students who do not pass through the semester during the semester will approach the exam time, which makes 85% of the grade, 10% is the seminar, and 5% is the grade of the exercise.						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	Attendance of students is recorded in classes. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (90 hours of direct lecturer)	-
Exercise	Before starting the exercises, students will receive training forms. At the end of each exercise, students receive tasks to control the acquired knowledge. The accuracy, precision and the time when the exercise is delivered is evaluated.	According to the appointed time	-
Partial exam (PE1, PE2, PE3, PE4)	Partial exam are multiple choice tasks where one or more correct answers are completed. For the correct answer, 3 points are awarded, and for the wrong answer 2 points are deducted.	PE1 – 4.week PE2 – 7.week PE3 – 10.week PE4 – 13. week	-
Partial exam (PE5)	Calculation tasks	15. week	-
Short tests	Duration 15 min. 5 to 10 questions.	Before the beginning of the lecture	
Seminar	Students write a seminar paper from a selected topic. A written copy, oral and a PowerPoint presentation, and answers to questions are evaluated.	12-14. week	-
Written exam	Exam can be accessed by students who have completed exercises, passed short tests and written seminar. Pre-printed exams round off accurate answers and solve calculation tasks. The written exam is evaluated and participates in the final grade of the course	Exam terms	-
Oral exam	Students who pass a written exam are asking questions from different parts of the program content. The final grade of the course is obtained according to the formula Ex5+STx10+Sx10+WE65+OE10/100		

Obligatory literature

1. Mešić, N.,1998.: Furniri, furnirske i stolarske ploče. Grafika Šaran, Sarajevo
2. Veneer and plywood. e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=42484

Recommended literature

3. Drvna industrija. Scientific Journal of Wood Technology

Construction of Wood Products 1

SS-305N

ECTS4

English languageR1

E-learningR1

Teaching hours60
Lectures 15
Exercises45

Lecturer
Full professor Ivica Grbac,PhD
Associate professor Zoran Vlaović,PhD

Associate teacher for exercises
. Zoran Vlaović,PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Preparation of documentation with a product drawing. Classification of end wood products. Types of furniture. Storage furniture for kitchen, bathroom, bedroom, kids room, study room, dining room and sitting room, office space and special purpose rooms. Construction of structural elements with changing hinges and ornaments. Construction of drawer structural elements, placement of drawer bottoms, casement rolling doors and casement overhead doors, leg frame and feet. Dining and Home office furniture. Table classification according to its function. Modality of assembling structural elements. Overall dimensions. Structural solutions of assembling with regard to the extendable table board. Structural modelling of desk elements. Sitting furniture. Classification of furniture for sitting: and small chair, chair and armchair. Dimensions of the model base. Selection of structural solutions with the modality of assembling elements into blocks and end product. Upholstered furniture. Types: armchairs, double sofa bed, a three- seater and corner sofa beds. Upholstering methods and structural elements. Selection of structural solutions with the method of assembling elements into the systems and finished product. Upholstering models and the structures. Lying furniture. Classification according dimensions and functionality. Cradles and cots, kids' beds, bunk beds, single and double beds. Parts and the folding bed system elements. Types of bed bases and their construction. Types of beds and the structural elements. Innerspring mattresses. Waterbeds.

Type of course:

Compulsory course, 3rd semester, 2ndyear, professional study of wood technology

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify and designate structural elements of furniture (kitchen, dining room, bedroom and living room, office furniture etc.)	exercises in the computer classroom, corrections and exercise evaluation, final examination	C6
Sketch furniture and describe furniture for storage, dinning and work, seating and lying	exercises in the computer classroom, corrections and exercise evaluation, final examination	C6
Print out basic construction documentation	exercises in the computer classroom, corrections and exercise evaluation, final examination	C6
Recognize and designate hinges of furniture for storage and laying.	exercises in the computer classroom, corrections and exercise evaluation	C5
Apply software solutions (AutoCAD) for rendering technical designs or drawings.	exercises in the computer classroom, corrections and exercise evaluation	A5

General competences

Knowledge of constructing and types of furniture. Development and drawing up of technical documentation when making the final product.

Lectures

Exercises

Use of computer assisted drawing tools (AutoCAD) drawing kit at individual assignments with a purpose of application of knowledge adopted in class. Development of technically (computer) equipped exercise session, drawing kit and freehand drawing.

Working methods:

Teacher's obligations:

To hold original classes – lectures, exercises and field work. To draw up teaching material. To prepare and devise exercises, to examine and grade them. To conduct examinations and hold consultations.

Students' obligations:

regular class attendance and to actively take part at lectures and exercises, field work, preparation and submission exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0,5
Exercises (E)	30 %	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	45	30	2,5
		Partly neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, partly correct, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete and submitted on time	Excellent (5)			
Written examination (WE)	35 %	60-70%	Sufficient (2)	0	10	0,33
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral examination (OE)	35 %	60-70%	Sufficient (2)	0	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	100 %	(E×30 + WE×35 + OE×35) / 100		60	60	4

Detailed description of evaluation elements for lecturer, exercises, partial or final examinations:

Evaluation elements	Description	Deadline	Compensation
Lectures (L)	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	according to syllabus	-
Exercises (E)	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade for exercises is the arithmetic mean of grades for individual exercise grades. The requirements for taking the written examination are positively graded exercises.	according to syllabus	-
Written examination (WE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students randomly choose an assignment with the product photograph or given parameters for drawing and designing. Orthogonal projections and characteristic sections are drawn freehandedly, and the component and technical description are filled on forms prepared beforehand. The written examination is graded and included in the final grade.	examination terms	-
Oral examinatione (OE)	A requirement for taking the oral examination is to acquire sufficient scores in the written part of the examination. Students' theoretical knowledge and understanding of constructional compositions are examined. The final grade will be calculated by the formula: (V×30 + PI×35 + UI×35) / 100	examination terms	-

Obligatory literature

1. Tkalec, S. (1985): Konstrukcije namještaja, monografija, University of Zagreb, Faculty of forestry, Zagreb
2. Tkalec, S., Prekrat, S. (2000): Konstrukcije proizvoda od drva I – Osnove drvnih konstrukcija, university textbook, University of Zagreb, Fakulty of forestry, Znanje, Zagreb
3. Grbac, I. (2005): Ojastučeni namještaj – odabrana poglavlja, university textbook, University of Zagreb, Faculty of forestry, Zagreb
4. Grbac, I. (2006): Krevet i zdravlje, sveučilišni udžbenik – odabrana poglavlja, University of Zagreb, Fculty of forestry, Zagreb
5. Domljan, D., Grbac, I., Jirouš Rajković, V., Vlaović, Z., Živković, V., Župčić, I. (2015): Kvaliteta i tehnički opisi proizvoda od drva, Svezak I. Opremanje zgrada za odgoj i obrazovanje, Faculty of forestry, University of Zagreb, Croatian Chamber of Economy, Zagreb.
6. Katalozi svjetskih proizvođača okova za namještaj (Furniture Fittings Hardware Manufacturers)

Recommended literature

Production Organization 1

SS 401N

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30
Field work 0

Lecturer
Assistant professor Krešimir Greger, PhD

Associate teacher for exercises
Assistant professor Kristina Klarić, PhD
Ivana Perić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Introduction - organization as a specific science; organization as a profession; organization as an integral part of wood technology; organization and other sciences and professions; development of organizational sciences; development of organization and organizational conception before the 20th century; classical theory of organization; neoclassical theory of organization; modern theory of organization (early and modern systematic approach); information theory of organization of work; new tendencies in the development of organizational theory. Organization as an integral part of wood technology. Organizational and technological specifics of production in wood processing and furniture production. Fundamentals of the contemporary concept of functioning of an industrial company for wood processing and furniture manufacturing (JIT – CIM - PPS). Business and production logistics. Systematic approach to process management in an industrial enterprise for wood processing and furniture manufacturing. Identification of the object in the business system: business system; production system; technological system and processing system. Process-oriented organization structure of the business system of woodworking enterprises. Production and business processes in an industrial wood processing company: process definition; process types; process analysis; process efficiency; and attitude about the process organization structure. Distribution and integration of production and business processes. Processes in research and development. Development of new products: standardization; internal standardization; modular design; and phases in industrial standardization. Development of production and business. Development of wood technology and capacity: possible directions for the development of wood technology; wood processing and furniture production and the logic of designing technological systems and

technological processes. Knowledge and personnel development processes: analysis and determination of optimal personnel requirements and distribution of work as a demonstration of the complexity of the employee structure. Procurement processes, storage and logistics. Preparation of procurement. Purchasing process management: continuous procurement systems; periodic procurement systems; customized purchasing systems; purchasing system of mutually dependent materials; determining the stock of materials; determining the size of the procurement. Procurement and storage logistics: procurement logistics and warehousing. Accounting, record keeping and control of procurement activities.

Type of course:

Production Organization 1 (compulsory, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Define the concepts of organization as a science and profession.	exercises, tests, exam	D1
Determine organizational and technological specifics of production in wood processing and furniture production.	exercises, tests, exam	D1
Define objects in the business system.	exercises, tests, exam	D1
Distinguish the characteristic production processes in wood processing.	exercises, tests, exam	D1
Distinguish the processes in research and development and suggest the development of new products.	exercises, tests, exam	D1
Distinguish processes in procurement, storage and logistics and plan procurement.	exercises, tests, exam	D3
Recommend an optimal purchasing model.	exercises, tests, exam	D3
Manage the procurement process	exercises, tests, exam	D3
Prepare production and manage production processes.	exercises, tests, exam	D3

General competences

Students gain general and specialist knowledge in the following fields: development of organizational sciences, production and business processes in the wood industry, rationalization of labor, organization of procurement and optimization of supplies and logistical support.

Lectures

In the course of lectures, students gain knowledge about production organization in wood industry.

Exercises

As part of auditory exercises and computer exercises, students receive an upgrade the knowledge about production organization gained during the lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers, compiling knowledge tests, and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the tests and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	30	15	1,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Test 1 (T1)	40%	60-70%	Sufficient (2)	1	22,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Test 2 (T2)	40%	60-70%	Sufficient (2)	1	22,5	0,75
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

		60-70%	Sufficient (2)			
TOTAL	100%	(Ex20 + T1x40 + T2x40)/100		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1,5
TOTAL	100%	(Ex20 + OEx40 + WEx40)/100				

* Students who during the semester do not pass the subject by a written test shall attend the exam, that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students are checked and recorded. Student may justifiably be absent with a maximum of 15 % of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. For each exercise, students receive individual templates - tasks. The deadline for the exercise is two weeks and if the exercise is not timely submitted and the positive evaluation is not obtained, the student gets an additional task. The accuracy, tidiness and regularity of exercise are evaluated (time-honoured exercises).	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Test 1	Students who have a positive assessment of the first five exercises and who have not abstained from teaching more than 15% can access the first test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	8^{th} week	Students who pass the first test can access the second test.
Test 2	Students who have a positive assessment of all exercises and who have not abstained from teaching more than 15% can access the second test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	15^{th} week	Students who pass 1^{st} and 2^{nd} test are exempted from the exam.
Written exam	Students who have a positive assessment of all exercises can attend the exam. The exam consists of three computational tasks. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula Ex20+EEIx40+ OE40/100		-

Obligatory literature

1. Figurić, M. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Greger, K. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja (zbirka zadataka), Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.

Recommended literature

1. Sikavica, P., 2011: Organizacija, Školska knjiga d.d., Zagreb.
2. Inženjerski priručnik IP4, Proizvodno strojarstvo, Organizacija proizvodnje, Školska knjiga 2002.

Wood as a building material

SS 402N

ECTS 5,5

English language R1

E-learning R1

Teaching hours 90
Lectures 45
Exercises 45
Field work

Lecturer
Prof.dr.sc. Hrvoje Turkulin
Doc.dr sc. Vjekoslav Živković

Associate teacher for exercises
Doc.dr sc. Vjekoslav Živković
Prof.dr.sc. Hrvoje Turkulin

Grading
Sufficient (2) 60%
Good (3) 70%
Very good (4) 80%
Excellent (5) 90%

Course content:

Significance of production of wood building components in Croatia and in Europe. Specific requirements for exterior application of wood: synergistic actions of light, climatic and biological degradative factors. Technical properties of importance for building applicatioins, availability of the species: wood properties and durability. Principles of technical design of wood products for their durability: physical protection, technical detailing, surfacing and finishing, renovation of weathered products. Dimensional limitations of wood and laminating technique: tecnical principles, technical design of components, materials used, basics of the manufacturing process. Basics of building physics and principles of acousitc and thermal insulation of windows, floors, doors, walls. Windows and doors: function and design, forms and types, general functional requirements: ventilation, lighting, passage, insulation, passage. Wooden floors – phisical conditions during completion and use for sports and residential floors, materials for gluing and sealing. Review of other classes and types of wood building components and products: houses, laminated beams, wooden structures, bridges, noise barriers, cladding and facades etc.

Type of course:

Wood as a building material (compulsory course, 4 semesters, 2 year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To identify the main families of wood construction products and connect their use requirements with design and construction types. Connect the usable properties of the product with the technical properties of wood.	exam	B5
To distinguish and group the technical properties of wood essential for construction (mechanical, physical, chemical, fire resistance), to explain the aesthetic, economic and traditional values of wood for construction.	exam	B5
Appoint and compare window and door functions according to the purpose, the opening mode, according to the construction types and associate them with the usage values: illumination, visual, mental and physical connection to the environment, ventilation, climate, sound, heat insulation.	practice exercises, exam	B5
Formulate the technological process (technological map and description of operations) in industrial window and door manufacturing - Calculate and propose technical or technological parameters in industrial window or door manufacturing and formulate a way of measuring technological parameters in production.	practice exercises, exam	C7
To describe and interpret lamination technique for construction wood. Design the process of manufacturing laminated building products.	practice exercises, exam	C7
Appoint, define and compare the technical properties of interior floor components and connect them to the inner floor panel with individual elements of wood flooring: floor boards, lamel flooring, lam parquet, finished / finished parquet elements, prisms, laminate flooring.	exam	B5
Appoint and interpret the technological parameters of production, measure the technological parameters and evaluate the approximation of measured dimensions in the production of floor elements of wood.	exam	C7
Define, analyse and evaluate the physical conditions of wooden floors - substrates, insulation layers, wood flooring, surface treatment, ambient conditions: air humidity, equilibrium moisture content, temperature, dimensional changes.	practice exercises, exam	B5
Appoint and interpret the basic functional properties of different types of wood houses and lminated beams.	practice exercises, exam	B5
Demonstrate the technical principles and the design of the laminated structure and the general	practice exercises, exam	C7

technological process of making a wooden house: mechanical processing and surface treatment, transportation, construction, supervision and control in use.

General competences

Learning about the specific conditions of the use of wood in building applications and its durability, especially in use out of doors. Survey of the elementary technical detailing for establishment of structural and physical protection of wood. Provision of adequate service reqirements for joinery and other building products. Learning about the functional requirements, classes and technical details of the main groups of products: windows, doors, floors, and review of other types of wood building products.

Lectures

Exercises

Eight practical exercises are performed within laboratory exercises. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Original teaching - lectures, exercises, field work. Preparing the exercises and preparing the exams and evaluating them. Written and oral exams and consultations. Preparation and development of teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, preparation and presentation of exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	45	0	1,5
Exercises (E)	25%	Mostly inaccurate, with major corrections	Sufficient (2)	45	30	2,5
		Mostly accurate, with corrections	Good (3)			

		Exact, with minor corrections	Very good (4)			
		Accurate and error-free	Excellent (5)			
Exam (PE)	75%	60-70%	Sufficient (2)		45	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Lxy0+Exy0 + PExy0)/100		90	75	5,5

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students' workload outside the direct teaching**	**ECTS**
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		45	1,5
TOTAL	100%	(FExy0+Exy0)/100				
* Students who do not pass through the semester during the semester will approach the exam period that makes 80% of the grade, and the remaining 20% make a grade in the exercises eg						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercies	The attendance is checked and recorded. Exercises are attended by groups. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are organised in groups. As part of the exercise, 6 practical exercises from the topic subject of technological and structural development of construction products made of wood. At the beginning of the first exercise, students are introduced to the rules of preparation, teaching and assessment of exercises. The accuracy, regularity and regularity (time-honored exercises)	15. week	
Written exam	The exam can be attended by students whose exercises were evaluated positively. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	

Oral exame	Students get questions from different part of the subject program. Final mark of subject is achieved from the formula: Ex5+C1x5+C2x15+Ex75/100		

Obligatory literature

1. Šimetin: Građevinska fizika, Liber, Zagreb, 1983, str. 1-249
2. Turkulin, H. i Ljuljka, B.: Lamelirana građevna stolarija, Zagreb, 1988, str. 1-182.
3. Turkulin s sur.: Postojanost drva na pročeljima, Drvna industrija 1/ 2, str. 33-48 3/02, str. 144.154
4. Tomašević, I.: Drvo u podnim konstrukcijama Naklada autora, Zagreb, 1999.

Recommended literature

Costs and calculations

SS 403N

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work -

Lecturer
Prof. Darko Motik, Ph.D.

Associate teacher for exercises
Assist.prof. Andreja Pirc Barčić, Ph.D.
Prof. Darko Motik, Ph.D.

Grading
Sufficient (2) 51%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The analysis of the wood-technology processes system. Basic knowledge of cost management. System connections of financial bookkeeping with management cost bookkeeping. Special features of wood article production. Production performance analysis, output performance indicators. Case studies of wood processing and furniture manufacturing companies. Selection of Appropriate methods for determining performance indicators. Fundamental financial accounting determinants. Balance sheet, income statement, cash flow. Case studies from wood processing and furniture manufacturing. Cost Management. Access to cost management, Costs in business decisions. Traditional cost management concepts. Cost management models for wood industry. Cost specification in wood processing and furniture manufacturing. Specific case studies. Managerial Accounting, Accounting Concept, Wood Production Specifications, Raw Materials and Inventory, Semi-Finished Products, Finished Goods, Goods, Case Study of Wood Processing, Furniture Manufacturing and Wood and Wood Products Trading. Calculation of production of parquet flooring (mosaic parquet), Calculation of the production of finished two-layer parquet • Calculation of production of parquet flooring (mosaic parquet), Calculation of the production of finished parquet flooring, Calculation of so-called. massive parquet, Calculation of finished two-story parquet, Calculation of veneer production, Furniture calculation, Wood floor calculations, Wood flooring calculations. Opposition to conceptualization - absorption approach to costs versus marginal approach and gross profit versus contribution margin with case studies in wood processing and furniture production. An integral

managerial model of production management specializing in wood processing and furniture manufacturing with emphasis on planning, launching and calculation of production costs.

Type of course:

Production planing and calculation (compulsory, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To analyze profile of the company's wood processing and furniture manufacturing business based on provided performance and safety performance indicators	Exercises evaluation, partial exams, final exam	D2
To analyze a fundamental principle of financial accounting (Balance Sheet, Profit and Loss Account, Cash Flow Statement)	Exercises evaluation, partial exams, final exam	D2
To calculate a cost price per unit in wood processing	Exercises evaluation, partial exams, final exam	D2
To calculate a cost price per unit in furniture manufacturing	Exercises evaluation, partial exams, final exam	D2
To create a cost price per one unit of wood produces and furniture by applying calculation incomplete costs calculation method	Exercises evaluation, partial exams, final exam	D2
To implement method of calculating depreciation as a specific expense of fixed assets	Exercises evaluation, partial exams, final exam	D2
To calculate productivity cost (contribution margin) of selected wood products in wood processing and furniture manufacturing companies	Exercises evaluation, partial exams, final exam	D2
To plan production costs classification in relation to changes in the scope of production activities (fixed costs, variable costs, mixed costs, discretionary costs)	Exercises evaluation, partial exams, final exam	D2
To create a relationship model of costs, revenue and change of business activity	Exercises evaluation, partial exams, final exam	D2
To analyze the cost structure of the company and determine cost-related priorities and evaluate the type of calculations that the company applies in forming the cost of the product's cost and decide which type of calculation would be most applicable to the company being monitored.	Exercises evaluation, partial exams, final exam	D2

General competences

Student gets knowledge necessary to work in the wood industry companies on work posts with responsibilities in solving problems in planning and production calculation in company middle management
Student gets competencies for production costs calculation, production planning, recognizing cost types.
Student gets competencies for developing a specific calculation models in wood industry companies

Lectures

Lectures on theoretical basis prepare students for work on work posts with responsibilities in enterprise middle management in wood processing and furniture manufacturing in the field on production costs planning, production analysis, and calculation of various wood products.

Exercises

Exercises on individual assignments with the purpose of applying theoretical settings learned in lectures Students, besides performing exercises, need to collect data, systematize data and present the results obtained in the form of project tasks for each exercise.

Working methods:

Teachers' obligations:

To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Students' obligations:

To attend the lectures and exercises regularly and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	15	1
Exercises (E)	20%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	43	20	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	40%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			

		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	40%	51-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(E20 + PE1x40+PE2x40)/100		60	65	4

Evaluation elements	**Maximum points or Share in evaluation**	**Grade rating scale**	**Grade**	**Direct teaching hours**	**Number of average students workload outside the direct teaching**	**ECTS bodovi**
Final exam (FE)	100 %	51-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	100%	(FE100)/100				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	**Description**	**Deadline**	**Compensation**
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lecturer)	-
	Exercises are made individually. As part of the exercise, 10 individual tasks are performed (one of 10 exercises, exercise 5 is done in the form of seminar work and is presented in the last term of teaching, before the 2nd semester) At the beginning of the first exercise, students are provided with instructions on how to perform the exercises and the appearance of the collar, liner and insertion sheet in which they will print in the form. The accuracy, regularity and regularity (time-honored exercises)	According to a time schedule	

	Exercises carry 50 points.		
Partial exam I	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. and who have corrected and signed exercises 1-5. The 1. Partial exam is 100 points and it covers the issues regarding until the time of partial exam.	7th. week	
Partial exam II	Second partial exam can be attended by students who did not miss more than 15% of lectures and exercises, who have corrected and signed exercises 1-10 and who accomplished more than 50 points in the partial exam I. The II. Partial exam is 100 points.	15th. week	
Written exam	Students who did not receive a positive assessment from the exercise and the partial exams (less than 51% of the total score) or are not satisfied with a final grade will approach the written exams according to certain examination deadlines. The written exam consists of 3-4 assignments (depending on the complexity of the assignment, with each assignment max number of points)	Exam terms	
Oral exame	The requirement for the oral exam is 51 % on the written exam. The score obtained on the oral exam is the final grade in the 100% ratio. Note: The person who passed the exam via partial exames and obtained the right to a final grade, and is not satisfied with the final grade, can access the oral exam, but in that case may score a grade higher than the grade obtained by passing the exam through a partial exam . The grade given on oral exam is final and it makes 100% of the grade.	Exam terms	

Obligatory literature

1. Figurić, M. (2003): Menadžment troškova u drvno tehnološkim procesima. Šumarski fakultet Sveučilišta u Zagrebu. Zagreb.
2. Motik, D. (2002): Zbirka zadataka ekonomika proizvodnje. Šumarski fakultet Sveučilišta u Zagrebu.Zagreb.

Recommended literature

1. Samuelson, P. A., Nordhaus, W. D. (2011): Ekonomija. Mate. Zagreb

Constructions of wood products 2

SS-404N
ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45

Lecturer
Full Professor. Ivica Grbac, PhD
Associate Professor Ivica Župčić, PhD

Associate teachers for exercises
Associate Professor Ivica Župčić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Classification of wood-products for civil engineering. Doors. Classification into fronts and room doors. Selection of constructional solutions with the method of elements assembly in sets or the end product.
Windows. Windows classification according to the intended use. Classification based on the opening manner. Selection of constructional solutions with the method of elements assembly in sets or the end product. Glazing types and methods. Staircases. Staircase classification according to the intended use. Staircase components and stair kits. Separating walls. Classification of separating walls with constructional solutions. Built-in furniture. Assembly manner of built-in and wall-mounted cabinets. Linings. Lining types. Ceiling and floor lining. Classical two- and three-layer parquet floors. Floors of panels with improved surface. Solution design. Drawing up documentation with product designs. Outdoors furniture and its classification. Children's playgrounds. Distinctive features of materials and constructions for outdoor use. Sheds, fences, gazebos, flowerbeds, floor and lanes.

Type of course:

Compulsory, 4. semester, 2. year.

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to describe and explain the basic construction types of objects for civil engineering (doors, windows, stairs, separating walls) based on their basic modelling features and use;	drawing exercises, correction, exercise evaluation, final examination	C6
to define the type of wood and non-wood material for making objects for civil engineering	drawing exercises, correction, exercise evaluation, final examination	C6
to recognise the basic concepts of objects for civil engineering and interior equipment;	final examination	C6
to sketch windows and balcony doors based on the principle of functionality and safety of use;	drawing exercises, correction, exercise evaluation, final examination	C6
to sketch the outer and inner (front and room) door with a suitable door frame type based on the principle functionality and safety of use;	drawing exercises, correction, exercise evaluation, final examination	C6
to describe the method of calculating the dimensions of steps (height & width) and the staircase (walking line inclination and length) for a straight staircase and sketch it;	drawing exercises, correction, exercise evaluation, final examination	C6
to print technical documentation (component and technical description) of the door, steps and window;	drawing exercises, correction, exercise evaluation, final examination	C6
to use AUTO CAD programme as aid when designing and virtualising objects for civil engineering;	drawing exercises, correction, exercise evaluation	A5
to gather information about the assigned topic and present it	drawing exercises, correction, exercise evaluation	C6

General competences

Acquiring knowledge of designing and the types of wood products for civil engineering.
Developing and drawing up technical documentation when constructing the end product.

Type of instruction

Lectures

Exercises

Using design tools in AutoCAD software or the drawing set for individual assignments in order to apply what they have learnt in classes. Making technically equipped drawing exercises for digital and freehand sketching and sketching by the drawing set.

Working methods:

Teacher's obligations:

To hold original classes – lectures and exercises. To develop exercises, draw up tests and grade them. To conduct oral examinations and hold consultations. To draw up the teaching material.

Students' obligations:

Regular class attendance and to actively take part at lectures and exercises, preparation and submission of exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures(L)	-			15	-	0,5
Exercises (E)	30%	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	45	30	2,5
		Partly neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, partly correct, complete, not submitted on time	Very good (4)			
		Neat with minor corrections, complete and submitted on time	Excellent (5)			
Written examination (WE)	35%	60-70%	Sufficient (2)	-	10	0,33
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral examination (OE)	35%	60-70%	Sufficient (2)	-	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			

		91-100%	Excellent (5)			
UKUPNO	100%	(WEx35+OEx35 + Ex30)/100		60	60	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	in accordance with the syllabus	-
Exercises and making exercises	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade is the arithmetic mean. The requirements for taking the examination (written part) are positively graded exercises.	in accordance with the syllabus	-
Written examination (WE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students randomly choose an assignment with the product photograph or given parameters for drawing and designing. Orthogonal projections and characteristic sections are drawn freehandedly, and the component and technical description are filled on forms prepared beforehand. The written examination is graded and included in the final grade.	examination period	-
Oral examination (OE)	A requirement for taking the oral examination is to acquire sufficient scores in the written part of the examination. Students' theoretical knowledge and understanding of constructional compositions are examined. The final grade will be calculated by the formula (WEx35 + OEx35 + Ex30)/100	examination period	-

Obligatory literature

1. Turkulin, H., Jirouš-Rajković, V. i Grbac, I. (1997): *Površinska postojanost drvnih građevnih konstrukcija* (Surface Durability of the wood Building Constructions, *Šumarski list*, 121, Zagreb.
2. Turkulin, H., Ljuljka, B. (1988): *Lamelirana građevna stolarija*, Zagreb
3. Ivelić, Ž., Turkulin, H., Grbac, I., Bogner, A. (2001): *Primjena računala u dizajnu i konstrukcijama drvnih proizvoda za građevinarstvo* (Use of computers in design of wood building components), International conference: Wood in construction industry - tradition and future, University in Zagreb, Faculty of Forestry (Croatia), Zagreb
4. Grbac, I. i sur. (2001): *Obrada i uporaba jelovine* (The use and processing of fir), monography "Obična jela u Hrvatskoj", *Akademija šumarskih znanosti*, Zagreb

Furniture production 1

SS-116A

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 30
Exercises 30

Lecturer
Associate professor Goran Mihulja, PhD
Assistant professor Danijela Domljan, PhD

Associate teacher for exercises
Associate professor Goran Mihulja, PhD
Assistant professor Danijela Domljan, PhD

Grading
Sufficient (2) 51 %
Good (3) 65 %
Very good (4) 78%
Excellent (5) 90%

Course content:

Introduction: basic terms of technological processes, in furniture production, equipment and space for furniture production, classification of furniture products. Material: lumber and wood material, synthetic-wood material, soft synthetic foam material, solid synthetic material of porous and solid structure, springs and springy cores, mounts, textile material, leather and other. Process precision: technological base, shaping and dimensioning, factors effecting process precision, substituting, tolerances, hardness of different joints, measuring equipment. Mechanical shaping processes: saw shaping, routing, wood turning, drilling, bending and pressing. Shaping wood and other materials: massive wood, boards, fabric, foams. Processing of parts for assembly. Assembling. Bonding in the production of furniture and glued structures, adhesives, forming of the bonded joints and parameters affecting the strength, testing of the bonded joints. Bonding procedures in furniture production. Upholstering the final products: shaping and joining parts, assembling in parts, covering. Ecology in furniture manufacturing processes: environmental protection, ecological materials, recycling of products.

Type of course:

Furnitire prodction (compulsory course, 4. semester, 2. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the basic concepts about the technological processes of final wood processing	partial or final exam	C7
Distinguish and categorize basic final products (eg chair, bed, table, wardrobe etc);	partial or final exam	C7
Evaluate, draw up a budget and recommend the quantity of wood and non-woven materials needed for the production of certain final products or elements of final products;	laboratory exercises, corrections, and exercises evaluation	C7
Identify, describe and choose the most technologically acceptable (optimal) formatting (cutting) of wood elements in the production of final products;	exercises reports, corrections, and exercises evaluation	C7
Design the order of joining assemblies and assemblies, and the order of assembling elements into a finished product;	partial or final exam	C7
Use basic measuring equipment eg measuring strip, caliper, micrometer, comparator and line for measuring dimensions and processing accuracy and to know the working principle of modern measuring instruments such as 3D scanners;	exercises reports, corrections, and exercises evaluation	C7

General competences

Acquisition of knowledge on technological processes of furniture production, material properties important for furniture production and necessary skills for conducting technological processes of furniture production.

Type of instruction

Lectures

Mainly auditory with occasional student involvement with questions related to previously acquired knowledge from this and related lectures.

Exercises

Exercises are an upgrade to knowledge adopted in lectures. It consists of laboratory demonstrations and measurements that are limited by the practical work of the students. The report consists description of the task and measurement procedure, as well as the results and conclusions.

Working methods

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Conduct partial exams, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Accessing the partial or final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly neat and partially accurate, corrected twice and not delivered at time	Sufficient (2)	30	30	2
		Neat, partially accurate, twice corrected and delivered on time	Good (3)			
		Neat, accurate, completed but not delivered on time or Neat, with minor corrections, completed and delivered on time	Very good (4)			
		Neat, accurate, completed and delivered on time	Excellent (5)			
1st Partial exam (PE1)	40%	51-64%	Sufficient (2)	1	14	0,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
2nd Partial exam (PE2)	40%	51-64%	Sufficient (2)	1	14	0,5
		65-77%	Good (3)			
		78-89%	Very good (4)			
		90-100%	Excellent (5)			
TOTAL	100%	(E x 20 + PE1 x 40+ PE2 x 40)/100		62	58	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	51-64% 65-77% 78-89% 90-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	28	1
TOTAL	100%	(FE x 80 + E x 20)/100				

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercise	The attendance is checked, and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of classes.	semester (30 hours of direct lecturer)	-
Exercise report	Each exercise is reviewed and evaluated. Final grade is the arithmetic mean of the grade of all evaluated exercises. Requirements for accessing the written part of the exams are positively evaluated exercises.	according to Syllabus	Two terms for after deadline delivery
1st Partial exam	The partial exam has a total of 50 points, so 26 points (51%) have to be collected for the passage.	8. week	-
2nd Partial exam	Only students that passed first Partial exam can access to second one. Each of the 10 questions is scored with 5 points. The two partial exams are scored with a total of 100 points, each with 50 points. A total of 51 points is required for the passage (51%). Students who get enough points from both exam parts get the final subject grade. In that case, they can fix the grade by additional access to the oral part of the exam. The final grade is the average score from both partial exams. Oral verification is not mandatory.	15. week	-
Written exam	Examinations can be attended by students who have evaluated exercises and attended classes. The written exam is evaluated and participates in the final grade of the subject. It consists of 10 questions, each scored with 5 points. For passage it is necessary to have 26 points out of a total of 50 points (51%).	Exam terms	-
Oral exam	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge (from the script) is checked, as well as understanding and linking thematic entities.	Exam terms	It is possible to catch up at the next exam terms, the positive result of the exam written at the previous exam term is acceptable

Obligatory literature

1. Ljuljka, B.: Tehnologija proizvodnje namještaja
2. Bogner, A.: Vježbe iz tehnologije proizvodnje namještaja (skripte)

Recommended literature

1. Kotnik, D.:Površinska obdelava v izdelavi pohištva, Ljubljana, 1990, str.1-333.
2. Mihevc, V.: Kontrolne metode lepljenja in površinske obdelave lesa. Biotehniška fakulteta, Ljubljana 1987.

Woodworking tools and machinery 1

SS-406N

ECTS 6

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work 0 days

Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Assistant Professor Matija Jug

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:

The basics of cutting theory. Defining force on elementary blade, orthogonal cutting and force distribution on the actual blade. Defining basic planes and planes at cutting. Definition of basic tool angles. Tool life, tool-tip wear. Materials for woodworking tool-tips, their characteristics and typical application areas. Specific cutting pressure its meaning, influencing parameters and calculation process.
Band saws, division by site of use, basic characteristics. The basic constructive elements of band saws and their importance for the optimum functioning of the saw blades. Characteristics of band saw blades, their preparation and maintenance, basic types of saw blades and their characteristics. Saw blade and blade body materials, their characteristics and typical application areas. Band saw kinematics. Cutting force in bandsawing, cutting power, uniz capacity and specific cutting energy. Defining theoretical quality of lateral surfaces. Circular saws for longitudinal and cross cutting. Basic modes of performance and constructive elements. Tools for fastening the tool to the machine. Characteristics of circular saw blades, their preparation and maintenance, basic types of saw blades and their characteristics. Saw blade materials, their characteristics and typical application areas. Circular saw kinematics. lade body materials, their characteristics and typical application areas. Band saw kinematics. Cutting force in bandsawing, cutting power, uniz capacity and specific cutting energy. Maximization of feed speed in given sawing conditions.

Type of course:

Woodworking tools and machinery 1 (compulsory, 3. semester, 2. year)

Learning outcomes and evaluation metho

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain the term elementary blade and sketch the basic geometry of cutting-edge elements.	partial exam, final exam	C2
Explain the difference between elementary and real blade.	partial exam, final exam	C2
Identify the basic forms of tool blunting and distinguish the causes of wear that cause some form of blunting.	partial exam, final exam	C2
Differentiate the basic materials for making tool blades (tool steel, high-speed steel, hard alloy, hard metals, artificial diamonds) and basic properties of these materials that are essential for woodworking (strength, hardness, temperature stability).	partial exam, final exam	C2
Sketch the forces on the tool-tip.	partial exam, final exam	C2
Explain the role of individual cutting-edge elements during cutting.	partial exam, final exam	C2
Identify wood properties and tool-tip characteristics that affect the cutting process.	partial exam, final exam	C2
List the influential parameters and calculate the specific cutting resistance in the given processing conditions.	partial exam, final exam	C2
Calculate the technological parameters in sawing with band saws and circular saws	partial exam, final exam	C2
Sketch the band saw and circular saw blade with all the essential elements (tool diameter, tool blade angles, etc.).	partial exam, final exam	C2

General competences

Understanding the wood cutting process.
Acquiring knowledge for the selection, optimum use and maintenance of woodworking machines in primary processing.

Tipe of instruction

Lectures

Exercises

Numerical exercises related to individual machines in a particular machine group. As part of laboratory exercises, drawing exercises of selected woodworking tools are performed with all the relevant parameters related to each tool and cutting power measurement at selected machines and the

calculation of all relevant kinematic parameters, cutting forces, cutting power, unit output and specific cutting energy under the given conditions. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing partial exam, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

<table>
<tr><th>Evaluation elements</th><th>Share in evaluation</th><th>Grade rating scale</th><th>Grade</th><th>Direct teaching hours</th><th>Number of average students' workload outside the direct teaching</th><th>ECTS</th></tr>
<tr><td>Lectures (L)</td><td>-</td><td>-</td><td>-</td><td>30</td><td>0</td><td>1</td></tr>
<tr><td>Exercises (E)</td><td>-</td><td>-</td><td>-</td><td>41</td><td>19</td><td>2</td></tr>
<tr><td rowspan="4">Partial exam 1 (PE1)</td><td rowspan="4">50%</td><td>50-60%</td><td>Sufficient (2)</td><td rowspan="4">2</td><td rowspan="4">43</td><td rowspan="4">1,5</td></tr>
<tr><td>61-75%</td><td>Good (3)</td></tr>
<tr><td>76-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td rowspan="4">Partial exam 2 (PE2)</td><td rowspan="4">50%</td><td>50-60%</td><td>Sufficient (2)</td><td rowspan="4">2</td><td rowspan="4">43</td><td rowspan="4">1,5</td></tr>
<tr><td>61-75%</td><td>Good (3)</td></tr>
<tr><td>76-90%</td><td>Very good (4)</td></tr>
<tr><td>91-100%</td><td>Excellent (5)</td></tr>
<tr><td>UKUPNO</td><td>100%</td><td colspan="2">(PE1x50 + PE2x50)/100</td><td>75</td><td>105</td><td>6</td></tr>
</table>

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60% 61-75% 76-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	4	86	3
TOTAL	100%	(FEx1)/100		4	86	3
*students who do not pass through the semester during the semester will approach the exam period that makes 100% of the grade						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (75 hours of direct lecturer)	-
Exercizes	Exercise exercises include auditing exercises that deal with examples of numerical tasks related to individual chapters and laboratory drilling exercises for woodworking and measurement of technological parameters on selected machines. Exercises are, as appropriate, attended by groups. At the beginning of the first exercise, students receive task templates for all exercises, as well as the appearance of the file, the jumper and the list of suggestions. The accuracy, regularity and regularity are evaluated. Along with the regularity of lectures and exercises, a lecture and exercise report is a condition for getting a signature.	According to the agreed terms	Exceptionally, in the case of a justified reason, the student draws up the absences from the individual laboratory exercises
Partial exam 1 (PE1)	The partial exam can be accessed by all students.	9. week	
Partial exam 2 (PE2)	The second partial exam can be accessed by students who have passed the first partial exam. Students who get enough points from both partial exams get a final score.	14. week	
Written exam	The written exam consists of five numerical tasks. For the passage it is necessary to have at least 50% of the total number of points.	Exam terms	

Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked. The final grade is obtained according to the formula (FEx100)/100	Exam terms	

Obligatory literature

1. Goglia, V. 1994: Strojevi i alati za obradu drva – I dio, Šumarski fakultet Zagreb.

Recommended literature

1. P. Afanasjev: Woodworking Machinery and Cutting Tools
2. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 1, Školska knjiga Zagreb.
3. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 2, Školska knjiga Zagreb.

Production management

SS 501N

ECTS 7,5

English language R1

E-learning R2

Teaching hours 120
Lectures60
Exercises 60

Lecturer

prof. Tomislav Grladinović, PhD

Associate teacher for exercises

Ivana Perić, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Artifical In intelligence. Virtual world, learn environment. Experts systems. Modell for learning. Intelligence systems. On line decission–Work in Process. Contemporary production concept in wood industry: transfer line, flekxible production line, working centre, working cell, numerically controled machines (NC), computerized numerical controled machine (CNC) i direct numerical control machine (DNC). Characteristic technologies in wood industrty. Theoretical hypothesis necessary for manage production processs. System, information and cybernetics theory. Systemic thinking. Modelling as learning. Decission Suppor System. Characteristic conception production management in wood industry. Production management methods: Reorder Point (ROP), Material Requirements Planning (MRP), Management Resourse Planning II (MRP II), Money Resourse Planning (MRP III), Capacity Resourse Planning (CRP), Just in Time/Total Quality Control (JIT/TQC), Bussines Requirements Planning (BRP), Enterprice Resource Planning (ERP). Network production. Production preparations aims and orders. Technological, operative production preparations and work distribution. Production preparation as a part of the management management system. Work order the basic bearer of information for production management. Planning of issuing work orders, job dispstching, execution and control of their accomplishment. Production documentation as a part of the information system. Projection of the information system. Optimisation methods and technique as a support in production management modelling process. A development conceptfor computerization of the production preparation jobs. IT environment. Computer aided buissins in wood industry. Data base. Characteristic necessary of information system. A computer-adied system of plan and development of

the product (3D). Product database. Technology for numerically controled machines. Directly numerically controled machines. Adapt management. Flexble manufacturing system management.

Type of course:

Production management (obligatory course, 5th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain concepts for planning and managing production	Project assignment, oral exam	D1
Apply production processes and their application for planning material and human resources	Exercises in computer practicum, project assignment, written and oral exam	D1
Prepare the technical documentation	Project assignment, oral exam	D1
To shape the manufacturing process through phases: process selection, technology selection, process flow analysis, and spatial distribution of production resources	Exercises in computer practicum, project assignment, written and oral exam	D1
Recommend a software solution for integrated production planning and management	Project assignment, oral exam	D1
Manage a computer supported machine and production management system.	Exercises in computer practicum, project assignment, written and oral exam	D2

General competences

Apply basic business principles, basic conceptions related to management concepts (planning, organizing, controlling) manufacturing processes.
Plan and monitor production and projects and optimize resources.

Working methods

Teaching - lectures and individual project tasks
Designing and compiling tests and evaluating them.
Providing written and oral exams and consultations.
Creating teaching materials.

Lectures

Through theoretical lectures, students will acquire professional knowledge and skills on the business information systems they need to work on planning and production management in woodprocessing enterprises.

Exercises

Within the exercise, individual project tasks are carried out on computers, through which methods and techniques for planning, optimizing, performing, monitoring and analyzing production resources will be applied. Exercises are an upgrade to knowledge adopted in lectures.

Field work

Working methods

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Compiling knowledge tests and evaluating them. Providing oral exams and consultations. Creating teaching materials. Mentoring in final work.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	60	30	3
Exercises (E)	30%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	60	30	3
		Clean, easy, with bigger corrections and on time	Good (3)			
		Clean, easy, with minor corrections and on time	Very good (4)			
		Clean, easy, accurate and timely	Excellent (5)			
Final exam (FE)	70%	60-70%	Sufficient (2)	30	40	1,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(L x 30 + E x 70) / 100			100	7,5

Evaluation elements	Maximum points or	Grade rating scale	Grade	Direct	Number of average	ECTS

	Share in evaluation			teaching hours	students workload outside the direct teaching	
Final exam (FE)	100%	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	5	25	1
TOTAL	100%	(FEx 100) / 100				

Detailed description of evaluation elements for lecturer, excercises and final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures Exercises	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	Semester (120 hours of direct lecturer)	-
Exercises (E)	Exercises are attended by groups. 6 project individual tasks are performed within the exercise. In the introductory lecture, students will receive instructions on the layout of the exercises - the folder, the jumper and the proposal sheet, in which they will correspond to the set tasks in printed form. At the beginning of the exercise, students will receive templates for project assignments. Exercises are surrendered gradually after each course. The accuracy, regularity and regularity are evaluated (time-honored exercises) Exercises carry 30 points and together with exam scores make up 100 points.	According to the agreed terms	Exceptionally, in the case of a justified reason, student does the absence of a single exercise
Partial exam	Exam can be attended by students who have completed, submitted and corrected exercises. Students on pre-made exams to solve the task. Written Exam (We) is evaluated and participates 20% in the final grade of the subject	Exam terms	-
Written exam	Students who pass a written exam are asked for oral questions from different parts of the subject's program content. The oral exam (Uispt) participates 50% in the final grade of the subject The total rating is calculated according to the formula: $(V \times 30 + I_{pis} \times 20 + U_{ispt} \times 50) / 100$	Exam terms	-

Obligatory literature

1. Grladinović T.: Upravljanje proizvodnim sustavima u preradi drva i proizvodnji namještaja, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1999., str. 1-298.
2. Burmec, j., Burmec, S.: Modeliranje poslovnih procesa, Školska knjiga, Zagreb, 2017.

3. Jelačić, D.: Upravljanje proizvodnim sustavima u drvnoj industriji (zbirka zadataka), Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 1995., str. 1-128.

Recommended literature

1. Majdandžić, N.: Izgradanja informacijskih sustava proizvodnih poduzeća, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 2004
2. Majdandžić, N.: Upravljanje proizvodnjom, Strojarski fakultet u Slavonskom Brodu, Slavonski Brod, 1991.
3. Schroeder, R.G.: Upravljanje proizvodnjom, M.E.P., Zagreb, 1996. str. 1- 672.

Furniture production 2

SS502N

ECTS 4

E-learning R1

Teaching hours
Lectures 15
Exercises 45

Lecturer
Professor Vlatka Jirouš-Rajković

Associate teacher for exercises
Assistant professor Josip Miklečić

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 91%

Course content:

Introduction to wood finishing. Substrate types and surface finishing materials. Prepare the wood surface: sanding, brushing, resin removing. Wood bleaching. Materials for wood coloring, pore filling, improvement of electrical properties and accentuation of surface texture. Decorative-protective materials: impregnation, primers, exterior stains. The composition of wood coating materials. Natural materials in wood finishing. Wood coating materials: nitrocellulose lacquers, alkyd varnishes, polyurethane varnishes, acid-curing coatings, polyester coatings, acrylic lacquers, high solids coatings, powder coatings, water-based coatings, UV-coatings. Nanocoatings in wood finishing. Methods of applying waxes,varnishes, lacquers and stains. Drying and hardening of coating materials. Ecological issues and legal regulations. Removing and renovation of old coatings. Surface finishing quality testing.

Type of course:

Furniture production 2 (compulsory, V semester, III year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Identify types and grades of sanding materials for hand and machine sanding of wood.	laboratory exercises, midterm exams, exam, homework	B3, C7
Prepare and apply different kinds of wood putties and fillers on wood surface.	laboratory exercises, midterm exams, exam, homework	B3, C7
Use hand tools and machines for preparation of wood surface.	laboratory exercises, midterm exams, exam	C7
Identify and apply different kinds of wood stains.	laboratory exercises, midterm exams, exam, homework	B3, C7
Prepare and apply different kinds of wood bleaches.	laboratory exercises, midterm exams, exam, homework	B3, C7
Identify and apply different kinds of wood coating materials (oils, waxes, varnishes, lacquers, exterior stains).	laboratory exercises, midterm exams, exam, homework	B3, C7
Use and mantain spray gun.	laboratory exercises, midterm exams, exam	C7
Recognise potential hazards of wood finishing.	laboratory exercises, midterm exams, exam, homework	C7
Ensure that working conditions comply with health and safety requirements.	laboratory exercises, midterm exams, exam, homework	C7
Test the properties of liquid wood coating materials.	laboratory exercises, midterm exams, exam	C7

General competences
Apply acquired knowledge from the fields of study and self-expansion of knowledge.
Rational Thinking and Independence in Decision Making
Development of responsibility and ethics
Developing skills for analysis and synthesis

Forms of teaching

Lectures

Exercises

Laboratory exercises are supplement to lectures. Students make 8 exercises according to instructions given in MERLIN. Completed exercises (worksheets) are a precondition for obtaining signatures. Worksheets (excercises) must be submitted in pre-defined terms and for this the students earn points.

Working methods:

Teachers' obligations: Teaching - lectures, exercises, homework. Providing partial exams, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations: Regular attendance and active participation in lectures and exercises, preparation and submission of laboratory worksheets within the deadline.Solving and submitting homework. Passing partial exams or examination.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachingh ours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-		-	15	0	0,5
Exercises (E)	20 %	2 poinst for each task (worksheet) that was submitted on time, 4 points for project task	-	45	15	2
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points. To gain access to the second partial exam must achieve a minimum of 15 points.	-	1	15	0,5
Partial exam (PE)	30 %	Students can achieve a maximum of 30 points.	-	1	15	0,5
Homework (H)	20 %	2 point for each homework that was submitted on time	-	-	15	0,5
TOTAL	100%	From all the elements of monitoring and checking the student can achieve a maximum height of assessment of 100 points, which makes 100 % of the grade. For the passing grade, the student must have a minimum of 50 points or 50 % of the grades. Scale rating is as follows:	-	62	60	4
		50 – 60 %	Sufficient (2)			
		61 -75 %	Good (3)			
		76 – 90 %	Very good (4)			
		91 – 100 %	Excellent (5)			
TOTAL	100%	(Ex20+PEx30+Hx20)/100		124	120	8

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60 % 61-75 % 76-9 0% 91-100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	100%	(FEx100)/1000		2	30	1
* Students who do not pass through the semester during the semester will be admitted to the exam period, which consists of a written and oral part of the exam.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance of the students is recorded. Students are allowed 20 % absence from lectures and 10 % from excersises. Exercises are attending in groups. Exercises tasks are submitted within a predefined time limit, and timely delivery of the correct work sheets is scored.	semester	-
Submission of worksheets from laboratory work (excercises)	Exercises are attended in groups. Students must submit worksheets in a predefined period of time and timely submitted worksheets are scored.	According to weekly class schedule	-
Partial exams	There are two partial exams. Each brings 30 points. At the first partial exam a student must achieve at least 50 % to gain access to second partial exam.	VIII week XV week	-
Homework	There are 10 homework.. Each on-time delivered homerwork brings 2 points.	According to weekly class schedule	-
Written exam	A student who failed to pass an examination by continuous collection of points during the semester has the right to attend the exam. Prior to exam exercise woorksheets must be submitted for review.	Exam terms	-
Oral exame	Prerequisite for oral exam is minimum score of 50 in written exam	Exam terms	-

Obligatory literature

1. Ljuljka, B., Jirouš-Rajković, V., 2006: Osnove površinske obrade drva. Šumarski fakultet & Sand, Zagreb, 2006.

2. Ljuljka, B. 1990: Površinska obrada drva. Sveučilište u Zagrebu. Šumarski fakultet, Zagreb.

Recommended literature

1. Kotnik, D.:Površinska obdelava v izdelavi pohištva, Ljubljana, 1990, str.1-333.
2. Jajić, M., Živanović-Trbojević, R: Površinska obrada drveta. Beograd 2000., str.1-400.
3. Alić, O. 1997: Površinska obrada drveta. Mašinski fakultet Sarajevo.

Woodworking tools and machinery 2

SS-503N

ECTS 5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work 0 days

Lecturer
Associate Professor Igor Đukić

Associate teacher for exercises
Assistant Professor Matija Jug

Grading
Sufficient (2) 50%
Good (3) 61%
Very good (4) 76%
Excellent (5) 90%

Course content:

Wood planers, basic division according to the number of planes processed in one passage. Basic parts of wood planing machines. Geometrical features of the planer tool, blade attachment systems in the working head. Impact of tool fixing and knife sharpening on the quality of machined surfaces. Kinematics of wood planing, Cutting force, cutting power, quality of machined surface and specific cutting energy in wood planing. Division of milling machines, their basic characteristics, and typical examples of use with respect to the product obtained (semi-finished product). Basic characteristics and division of milling tools. Kinematics of milling, cutting forces, cutting power and quality of machined surface. Specific cutting energy in milling wood. Wood lathes, base parts and distribution according to the direction of the feed motion. Typical products (semi-products) resulting from machining on wood lathes. Basic characteristics of wood turning knives. Kinematics of turning. Cutting forces in turning, cutting power and machined surface quality. Specific cutting energy in wood turning. Drills, basic construction details and typical examples of use in woodworking. Division of drill bits and their application area, geometrical characteristics of drill bits. Drilling kinematics. Drilling forces, cutting strength and specific cutting energy.

Type of course:

Woodworking tools and machinery 2 (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Differentiate the basic types of woodworking machines and tools, with or without forming a shaving (planers, mills, drills, lathes)	partial exam, final exam	C2
Differentiate the basic materials for making tool blades for planers, mills, drills and lathes	partial exam, final exam	C2
Sketch the tools for planers, mills, drills and lathes with all the essential elements	partial exam, final exam	C2
Sketch the basic parts of planers, mills, drills and lathes with all the essential elements	partial exam, final exam	C2
Sketch and explain all of the important technological parameters during planing, milling, drilling and turning	partial exam, final exam	C2
Calculate the technological parameters for basic types of woodworking machines (planers, mills, drills and lathes)	partial exam, final exam	C2

General competences

Understanding the wood cutting process.
Acquiring knowledge of the machines and tools for final wood processing.
Creating the basics that allow project assignments to manufacturers of special equipment.

Tipe of instruction

Lectures

Exercises

Numerical exercises related to individual machines in a particular machine group. As part of laboratory exercises, drawing exercises of selected woodworking tools are performed with all the relevant parameters related to each tool and cutting power measurement at selected machines and the calculation of all relevant kinematic parameters, cutting forces, cutting power, unit output and specific cutting energy under the given conditions. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing partial exam, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Taking the partial exam and final exam.

Methods of grading

Elementi praćenja	Udio u ocjeni	Bodovna skala/ocjena	Ocjena	Broj sati direktne nastave	Broj sati rada prosječnog studenta izvan direktne nastave	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	-	-	-	41	19	2
Partial exam 1 (PE1)	50%	50-60%	Sufficient (2)	2	28	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	50%	50-60%	Sufficient (2)	2	28	1
		61-75%	Good (3)			
		76-90%	Very good (4)			
		91-100%	Excellent (5)			
UKUPNO	100%	(PE1x50 + PE2x50)/100		75	75	5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	50-60% 61-75% 76-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	4	56	2
TOTAL	100%	(FEx100)/100		4	56	2
* Students who do not pass through the semester during the semester will approach the exam period that makes 100% of the grade						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation

Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (75 hours of direct lecturer)	-
Partial exam 1 (PE1)	The partial exam can be accessed by all students.	9. week	
Partial exam 2 (PE2)	The second partial exam can be accessed by students who have passed the first partial exam. Students who get enough points from both partial exams get a final score.	14. week	
Written exam	The written exam consists of five numerical tasks. For the passage it is necessary to have at least 50% of the total number of points.	Exam terms	
Oral exame	The requirement for the oral part of the exam is sufficient number of points collected on the written part of the exam. Theoretical knowledge, ie. understanding and detailed examination of the subjects studied in the lectures, is checked. The final grade is obtained according to the formula (FEx100)/100	Exam terms	

Obligatory literature

1. Goglia, V. 1994: Strojevi i alati za obradu drva – I dio, Šumarski fakultet Zagreb.

Recommended literature

1. P. Afanasjev: Woodworking Machinery and Cutting Tools
2. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 1, Školska knjiga Zagreb.
3. Šavar, Š. 1990: Obrada metala odvajanjem čestica, Svezak 2, Školska knjiga Zagreb.
4. *** Leitz Lexicon

Production Organization 2

SS 504N

ECTS 5.5

English language R1

E-learning R1

Teaching hours 75
Lectures 30
Exercises 45
Field work 0

Lecturer
Assistant professor Krešimir Greger, PhD

Associate teacher for exercises
Assistant professor Kristina Klarić, PhD
Ivana Perić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Basics of production theory. Division of production: division by type of production, flexible production and division of production types depending on the parameter p, q. Principles of designing technological systems. Designing and technological recognition of products; assembly of elements in the technological system; breakdown of elements in the technological system; designing an additional element (intermediate storage) between system elements; harmonization of the level of incomplete production; characteristics of realization of the overall task in complex technological systems. Capacity: production and business cycle as a fundamental problem of process management. Production processes: preparation of production; technological preparation of production; operational preparation of production; management of production processes. Technological processes: the breakdown of technological processes; structure of the technological process; the principles of setting up technological processes; the order of designing technological processes; designing the flow of the technological process through the matrix; some characteristic technological processes in processing; wood and furniture production; work place. Logistics of production and internal transport. Processes of comparative production. Time study. Study and time analysis: determining the working hour's structure; establishing basic technological and support time; determining the time norms and the time of the work order; monitoring of time norms. Processes of labor rationalization. Teaching processes in work. Maintenance of devices and plants. Processes in ensuring and controlling the quality of products, production and business. Processes in finance and accounting.

Type of course:

Production Organization 2 (compulsory, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Distinguish production types in wood processing.	exercises, tests, exam	D3
Recognize the main processes in wood processing and furniture manufacturing.	exercises, tests, exam	D3
Plan and analyse the study of time.	exercises, tests, exam	D3
Review and recommend the rationalization of work.	exercises, tests, exam	D3
Evaluate the capacities of technological processes.	exercises, tests, exam	D3
Recognize the principles of designing technological systems in industrial wood processing.	exercises, tests, exam	D3
Determine places of quality control in the technological process and for finished products.	exercises, tests, exam	D3
Distinguish processes in maintaining devices and plants in the wood processing industry and organize the maintenance of devices and plants.	exercises, tests, exam	D3
Recognize accounting processes.	exercises, tests, exam	D3

General competences

Students gain general and specialist knowledge in the following fields: the basis of production theory, basic processes in the wood industry, rationalization of work, study of work and analysis of working time in the wood industry.

Type of instruction

Lectures

In the course of lectures, students gain knowledge about production organization in wood industry.

Exercises

As part of auditory exercises and computer exercises, students receive an upgrade the knowledge about production organization gained during the lectures.

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Designing topics for seminar papers, compiling knowledge tests, and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the tests and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	30	0	1
Exercises (E)	20%	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	30	2,5
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Test 1 (T1)	40%	60-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Test 2 (T2)	40%	60-70%	Sufficient (2)	1	30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
		60-70%	Sufficient (2)			
TOTAL	100%	(Ex20 + T1x40 + T2x40)/100		75	90	5,5

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students' workload outside the direct teaching	ECTS

Final exam (FE)		60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)	4	56	2
TOTAL	100%	(Ex20 + EEx40 + OEx40)/100		4	56	2
* Students who during the semester do not pass the subject by a written test shall attend the exam, that makes 80% of the grade, and the remaining 20% make a grade out of the exercise.						

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	**Compensation**
Attendance of lectures and exercises	The attendance of the students are checked and recorded. Student may justifiably be absent with a maximum of 15 % of direct teaching hours.	semester (75 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. For each exercise, students receive individual templates - tasks. The deadline for the exercise is two weeks and if the exercise is not timely submitted and the positive evaluation is not obtained, the student gets an additional task. The accuracy, tidiness and regularity of exercise are evaluated (time-honoured exercises).	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Test 1	Students who have a positive assessment of the first five exercises and who have not abstained from teaching more than 15% can access the first test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	8^{th} week	Students who pass the first test can access the second test.
Test 2	Students who have a positive assessment of all exercises and who have not abstained from teaching more than 15% can access the second test. Test 50% comprise the knowledge acquired in lectures (theory), and 50% on the knowledge acquired exercises (tasks).	15^{th} week	Students who pass 1^{st} and 2^{nd} test are exempted from the exam.
Written exam	Students who have a positive assessment of all exercises can attend the exam. The exam consists of three computational tasks. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula Ex20+EIx40+ OE40/100		-

Obligatory literature

1. Figurić, M. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.
2. Greger, K. 2000: Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja (zbirka zadataka), Sveučilište u Zagrebu, Šumarski fakultet, Zagreb.

Recommended literature

1. Sikavica, P., 2011: Organizacija, Školska knjiga d.d., Zagreb.
2. Inženjerski priručnik IP4, Proizvodno strojarstvo, Organizacija proizvodnje, Školska knjiga 2002.

Technological properties of wood

SS121

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work

Lecturer
Prof. Tomislav Sinković, PhD.

Associate teacher for exercises
Assistant prof. Tomislav Sedlar, PhD.
Branimir Jambrekovićmag. ing. techn. lign.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The behavior of wood in processing, processing and mechanical disintegration, as well as the characteristics that it has manifested in these processes. Processing and woodworking. Physical and mechanical properties of wood and their influence on the technological characteristics of wood. Wood cutting theory. The theory of wood cutting and the influence of physical and mechanical properties of wood on the process of wood cutting. Influence of water content on the technological characteristics of wood. Effect of temperature on the technological characteristics of wood. Wood deformation at different water and temperature content. Impact of load speed on the technological characteristics of wood. The influence of anatomic material and wood texture on the technological characteristics of wood. Processing and analysis of the results of testing wood resistance to abrasion. Influence of the angle of the direction of the fibre towards the direction of force of the technological characteristics of wood. Factors that affect the mechanical properties and the technological characteristics of wood. The impact of wood defects on the technological characteristics of wood. Technological characteristics and workiness of domestic commercial wood species.

Type of course:

Technological properties of wood (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Determination of the influence of physical and mechanical properties of wood on the technological characteristics of wood processing	Exercises evaluation, partial exams, final exam	B1
Determining the impact of wood defects on the technological characteristics of wood processing	Exercises evaluation, partial exams, final exam	B1
Determination of the basic technological characteristics of wood relevant for certain types of mechanical wood processing	Exercises evaluation, partial exams, final exam	B1
Valuation of wood technology characteristics for certain types of mechanical wood processing	Exercises evaluation, partial exams, final exam	B1
Practical identification of technological characteristics on domestic and foreign types of wood	Exercises evaluation, partial exams, final exam	B1
Valuation of wood species according to the technological characteristics of wood	Exercises evaluation, partial exams, final exam	B1

General competences

Type of instruction

The object of the object is to acquire knowledge about the characteristics of wood in the basic process of wood processing. The influence of macroscopic, physical and mechanical properties of wood and wood defects on the technological characteristics of wood. Technological characteristics for some commercial domestic and foreign types of wood.

Lectures

Lectures on theoretical bases are prepared by students to acquire knowledge about macroscopic characteristics, physical and mechanical properties of commercial wood species on the technological characteristics of wood, which facilitate the production of exercises and complete Overcoming the material.

Exercises

Task exercises with the purpose of applying the theoretical settings learned in lectures with computer work and use of computer programs. Creation of technically equipped exercises

Working methods:

Teachers' obligations:

Maintaining original lessons - lectures, exercises. Developing exercises and compiling knowledge tests and evaluating them. Providing colloquia, written and oral exams and consultation. Creating teaching materials.

Studenats' obligations:

To attend the lectures and exercises regularely and to activelly participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	45	2
Exercises (E)	70%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	45	0	1,5
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Ex70 + PE1x30)/100		61	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	100 %	61-70% 71-80% 81-90%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1

		91-100%				
TOTAL	100%	(FEx100)/100		2	30	1
* students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (60 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester.	end of semestar	
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises.	end of semestar	
Writen and oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1.Bađun, S.: Tehnološke karakteristike drva I, skripta, Zagreb, 1979,str.1-50.
2. Govorčin,S.; Sinković,T.: Tehnološke karakteristike drva, interna skripta, Zagreb, 2004, (CD)

Recommended literature

1. Giordano, G.: Tecnologia del legno, Volume l, Torino, 1971, str. 1-1086.
2. Koh, P.: Processi mehaničeskoj obrabotki drevesini, Moskva, 1969, str. 1-325
3.Kollmann F. R., Cote, W A Jr Principles of Wood Science and Technology l solid Wood, New York, 1968, str. 1-592.
4. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Methods and materials for wood protection

SS-122

ECTS points 4

English language R1

E-learning R1

Hours of classes 60
Lectures 15
Exercises 45
Field work 0

Lectures teacher
Associate Prof. Marin Hasan, PhD

Exercises teacher
Associate Prof. Marin Hasan, PhD

Grades
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introductory, it will be explained to the students the preventive and repressive procedures in wood protection. In general, it will be explained processes without pressure and processes with pressure applied, coating, immersion, wetting, diffusion, empty and full cells process, double vacuum, fumigation and anoxi process. Through lectures and exercises, it will be explained wood preservatives – differentials and properties by different keys, environmentally friendly preservatives, legal regulations. Following terms will be especially explained: permeability, surface tension, penetration and absorption, fixation, leaching, toxicity, water repellency and vapor permeability. The use of traditional and new modern wood preservatives will be explained particularly in the light of the new European standards and environmental regulations.

Type of course:

Methods and materials for wood protection (elective Course, 5. Semester, 3. Year)

Learning Outcomes and Methods of Verification

Learning Outcomes (LO)	Methods of Verification	Correlation with LO of the Study Program
Based on the results of laboratory tests, independently determine the biological resistance of wood to the applicable standards and to recommend hazard class in which such wood can be used.	exercises 1 and 2, 1st colloquium, final exam	C5
Assess the risk of using biodegraded wood in the production and / or use of wooden products.	exercises 1 and 2, 1st colloquium, final exam	D6
Explain the difference between decontamination and wood protection procedures and propose the required procedure in the given example.	exercises 3 – 7, 1st colloquium, final exam	B4
Differentiate and define wood preservatives according to the aggregation state, the origin of the active component and the nature of the solvent.	exercises 3 – 7, 1st colloquium, final exam	C4
Propose the appropriate wood preservative and procedure for the given product (in the given hazard class), respecting the ecological principles of wood protection and describe the advantages and disadvantages of the proposed.	exercises in general, 2nd colloquium, final exam	D6
For the selected product and the conditions of use, in which the wood product is used, to recommend adequate physical, structural (and chemical) protection.	exercises in general, 2nd colloquium, final exam	D5
Recommend steps of restoration, adequate preventive or repressive protection procedures and choose adequate protective agent(s) depending on the type of wood product(s), the place of use and the degree of destruction.	exercises in general, 2nd colloquium, final exam	D6
Distinguish modified wood from natural and explain their advantages and disadvantages.	exercise 6, 2nd colloquium, final exam	C5
When designing new products from wood to anticipate the conditions of its use and possible mechanisms of degradation and to choose wood with needed natural resistance and to the recommend needed protection.	exercises in general, 2nd colloquium, final exam	D6
Independently or in a team develop a project (expert opinion) and present it in front of a group of people.	seminar paper, final exam	D6

General Competencies

Adoption of the principles of wood protection, purpose of protection, application of procedures and preservatives, impact of physical, chemical and structural properties on wood protection.

Type of instruction

Lectures

Lectures are held in the classroom or in the field work according to ERR guidelines, with explicit insistence on the more active participation of students in the learning process.

Exercises

Part of calculation exercises as well as some of the exercises on introduction to laboratory work are held in classroom and student practice room, and laboratory measurement exercises on prepared wooden specimens are held at the Laboratory for Anatomy and Wood Protection.

Teachers' obligations:

Maintaining the original teaching – lectures, exercises and field work. Developing exercises and topics of seminar papers, collecting literature for seminar papers, compiling knowledge tests and evaluating them. Reviews of written exercises and of seminar papers. Providing colloquia, oral exams, consultations and seminars. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises, making and delivering exercises and seminars within the given time frame. Passing the colloquia, written and oral exams.

Grading method = Taking exam

Tracking elements	Grading share	Score scale / Grading	Grade	Number of Direct Teaching Hours	Number of working hours of an average student beside direct teaching	ECTS credits
Lectures (L)	–	–	–	28		1
Making Exercises (E)	20%	Correct exercises with less than 15 % of acceptable deficiencies	Sufficient (2)	13	30	1.5
		Correct exercises with less than 10 % of acceptable deficiencies	Good (3)			
		Correct exercises with less than 5 % of acceptable deficiencies	Very good (4)			
		Correct exercises with less than 1 % of acceptable deficiencies	Excellent (5)			
1st and 2nd Colloquium in written form	40%	60-70%	Sufficient (2)	2	26	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Final exam – oral exam (OE)	40%	60-70%	Sufficient (2)		18	0.5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
or		Seminar paper with less	Very good (4)	2		

Seminar paper – SEM*		than 8 % of acceptable deficiencies				
		Seminar paper with less than 1 % of acceptable deficiencies	Excellent (5)			
TOTAL	100%	(E×20 + (C1+C2) ×40 + OE×40) / 100 (E×20 + (C1+C2) ×40 + SEM×40) / 100		45	74	4
* students who pass all three colloquia and choose to do seminar papers don't need to complete the final exam; the defended seminar paper changes the final oral exam.						

Tracking elements	**Maximum points ar grading share**	**Score scale / Grading**	**Grade**	**Number of Direct Teaching Hours**	**Number of working hours of an average student beside direct teaching**	**ECTS credits**
Final Exam* (FE) Written part (W) + Oral part (O)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)		44	1.5
TOTAL	100%	(E×20 + FE×80) / 100			44	1,5
* students who don't pass all three colloquia during the semester have to take final exam consisting of a written and oral part, and they make up to 80 % of the total grade, while the remaining 20 % make a grade of exercises						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Tracking elements	**Description**	**Deadline**	**Recoupment**
Lectures + Exercises (laboratory work)	The presence of students is checked and recorded during the lectures. A student may justifiably be absent with a maximum of 15% of direct teaching hours.	semester (60 direct teaching hours)	-
Making Exercises (E)	Exercises are attended by groups. As part of the exercise, 8 practical exercises. At the beginning of the first exercise, students will receive templates with the look of the file, inserts and worksheets on which the students will handle and teach their exercises. Each exercise is reviewed twice. If the grade is inadequate or not reviewed, it can be submitted within the probationary period (the student has the right to submit a maximum of two exercises within the probationary period, otherwise the right to sign the course is lost).	according to the agreed delivery dynamics	One probationary period for submitting the exercises for revision.
First Colloquium	The first colloquium contains the following material: wood preservatives, preventive and repressive protection of wood.	7th week	-

(C1)	Both colloquia have 20 questions and each question equals one point. Partially correct answers (semi-points) or negative points does not exist. The minimum number of points for passage the colloquium is 12 (12 of 20 = 60%).		
Second Colloquium (C2)	Second Colloquium are available to students who have passed the first colloquium. The second colloquium contains the following material: Wood modification and sterilisation, phytosanitary standard, classification, reuse and recycling of chemically preserved wood waste. Both colloquia have 20 questions and each question equals one point. Partially correct answers (semi-points) as well as negative points does not exist. The minimum number of points for the passage each colloquium is 12 (12 points of 20 = 60%). Both colloquia are scored with a total of 40 points, with a total minimum of 24 of 40 points being needed for the pass (60%). Students who get enough points from both colloquia only access the oral part of the exam, and if they successfully defend the seminar paper (the minimum grade is very good (4)), they get a final grade on the subject with no need of taking oral part of the exam. The final grade is the sum of Exercises (E), Colloquia (C1 and C2) and Oral Exam (OE) or Seminar (SEM): (E×20 + (C1+C2) ×40 + OE×40) / 100 or (E×20 + (C1+C2) ×40 + SEM×40) / 100	14^{th} week	-
Seminar paper	Seminar work are available to all students. Seminar work is submitted for review by arrangement with the teachers throughout the semester. The final version is submitted to the 14^{th} week and defending in the 14^{th} or 15^{th} week of the semester, provided that the student has passed both colloquia. A written part of the seminar and oral presentation are evaluated (defence in front of the whole group of students). Overall rating of the seminar paper should not be less than very good (4) in order to replace the oral exam. The final grade is the sum of Exercises (E), Colloquia (C1 and C2) and Seminar (SEM) (E×20 + (C1+C2) ×40 + SEM×40) / 100	14^{th} and 15^{th} week	-
Final exam (FE) written part	The written exam consists of 40 questions, and each question carries one point. Partially correct answers (half-points) and negative points does not exist. The minimum number of points for the passage is 24 (24 of 40 = 60%). After completing the written part of the exam, students have a break (how much is needed for the teacher to review the written assignments) and afterwards (the same day) students that passed written part of exam approach the oral part of exam in groups of two to four students.	examination periods	-
Final exam (FE) oral part	The requirement for the oral part of the exam is enough points collected either in colloquia or on the written part of the exam. Theoretical and practical knowledge of the student is	examination periods	-

	checked through questions from practical examples / real problems. The final grade is obtained according to the formula: (E×20 + FE×80) / 100		

Obligatory literature

1. Unger, A., Schniewind, A.P., Unger, W.: CONSERVATION OF WOOD ARTIFACTS, Springer, 2001.
2. Richardson, B.A.: WOOD PRESERVATION second edition, E & FN SPON, London, 1993, (selected chapters).
3. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom. (selected chapters).
4. Proceedings of the International scientific conferences: WOOD IN THE CONSTRUCTION INDUSTRY, (Despot, R. i Jambreković, V. Editors); (publication years: 2000 – 2004), Zagreb: Faculty of Forestry.
5. Eaton, R. A., Hale, M. D. C.: WOOD, DECAY, PESTS AND PROTECTION, Chapman & Hall, 1994. United Kingdom (selected chapters).
6. Bravery, A. F., Berry, R. W., Carey, J. K., Cooper, D. E.: RECOGNISING WOOD ROT AND INSECT DAMAGE IN BUILDINGS, BRE Bookshop, Second edition, 1992. Garston, Watford, United Kingdom (selected chapters).

Recommended literature

1. Hasan, M., Despot, R.: ZAŠTITA DRVA I – Abiološki čimbenici, lignikolne bakterije i gljive, ksilofagni kukci i morski štetnici. Skripta za studente drvne tehnologije iz predmeta Zaštita drva I i Patologija drva. Sveučilište u Zagrebu, Šumarski fakultet, 2018. (at the web page: http://www.sumfak.unizg.hr/OdsjekKolegij.aspx?mhID=3&mvID=74 under the course Zaštita drva I (Wood protection I), there is a link to download the script).
2. Reinprecht, L.: PROCESY DEGRADACIE DREVA, Technicka Univerziteta vo Zvolene, Zvolen, 2001. (selected chapters).
3. Reinprecht, L.: REKONŠTRUKCIA OBJEKTOV Z DREVA, Monografia, Technicka Univerziteta vo Zvolene, Zvolen, 2000. (selected chapters).
4. Špoljarić, Z: ZAŠTITA DRVA (Impregnacija), skripta za slušače DT odsjeka VII stupnja nastave Šumarski fakultet Zagreb, 1973.
5. Glavaš M.: GLJIVIČNE BOLESTI ŠUMSKOG DRVEĆA. Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, 1999. (selected chapters).
6. Vasić, K.: ZAŠTITA DRVETA 1: KSILOFAGNI INSEKTI, Naučna knjiga, Beograd, 1971 (selected chapters).
7. Petrović, M.: ZAŠTITA DRVETA 2: TRULEŽ I OBOJENOST DRVETA, Naučna knjiga Beograd, 1980. (selected chapters).

Computer Aided Construction

SS-123

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work 0

Lecturer
Professor Silvana Prekrat, Ph.D.

Associate teacher for exercises
Professor Silvana Prekrat, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Introduction. The definition of construction and tasks of constructor.
Technical drawing with the basics of drawing at computor.
CAD – CAM systems.
Programs for automatic constructing.
Computor graphics – basic elements, 2D systems, 3D systems.
Construction of final wood products at computer.

Type of course:

Computer Aided Construction (Elective course, 5th semester, 3th year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Set the differences between CAD programs according to various criteria	Exercises, exam	A5
Create 2D construction documentation using a computer	Exercises, exam	A5
Provide the definition of CAD / CAM system and its advantages in furniture designing and manufacturing	exercises, exam	A5

Provide a definition of the specifications for the purchase of a CAD program	exercises, exam	A5
Create simple 3D virtual models	exercises, exam	A5

General competences

Skills of using computer for construction documentation
Knowledge about software for computer drawing.

Lectures

Exercises

Exercises include simple 2D technical drawings and 3D models on computers in a computer classroom. Exercises are an upgrade to knowledge adopted in lectures.

Working methods:

Teachers' obligations:

Maintaining original teaching - lectures, exercises. Creating teaching materials. Preparing and designing exercises for their review and evaluation. Maintain consultation and exam and evaluate tasks during exercise and exam.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises . During the semester, it is mandatory to hand over exercises on time and correction within the given deadline.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	0			15	0	0,5
Exercises (E)	80%	Partial understanding of the adopted subject, poor student activity and the quality of the project task solution.	Sufficient (2)	45	45	3
		Partial understanding of the adopted subject, good student activity and quality of the project task solution.	Good (3)			

		Very well applied and adopted material, very good student activity and quality of the project task solution.	Very good (4)			
		Exceptional engagement, excellent applied and adopted material, excellent student activity and the quality of the project task solution.	Excellent (5)			
Final exam (FE)	20%	60-70%	Sufficient (2)	0	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(E×80 + FE×20) / 100		60	60	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	The attendance is checked and the presence of students is recorded. The student can justifiably be absent with a maximum of 20% of the tuition.	according to silabus	
Excercises	The exercises are checked and recorded by the presence of students. The student can justifiably absent with a maximum of 10% of the exercise. .	According the sylabus	
Final exame	Requirements for attending a written exam are assignments and positive evaluated exercises, ie project assignment and all other assignments. The final grade is obtained according to the formula: (E × 80 + FE × 20) / 100	Exam terms	

Obligatory literature

1. Tkalec, S. Prekrat, S. (2000): Konstrukcije proizvoda od drva – osnove drvnih konstrukcija, Sveučilišni udžbenik Šumarski fakultet i Znanje, Zagreb
2. Konstrukcije proizvoda od drva I e-kolegij na sustavu za udaljeno učenje: https://moodle.srce.hr/2018-2019/course/view.php?id=41658

Recommended literature

1. Hamad M. (2019): AutoCAD 2019 Beginning and Intermediate

Transport and Storage

SS124

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work 0

Lecturer
Professor Ružica Beljo Lučić, Ph.D.
Assistent professor, Matija Jug, Ph.D.

Associate teacher for exercises
Assistent professor, Matija Jug, Ph.D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

The concept and definition of transport and storage in general. Importance of transport and storage in industrial branches.
Carrying capacity, capacity, determination of required storage area.
Division of transport equipment. Constant and intermittent transport means. Conveyors, boundaries, industrial vehicles, motor vehicles, road vehicles. Wood conveyors in the wood industry, wood particle separators.
Characteristics of transported materials in the wood industry. Loose materials, liquid materials, pieces of material. Analysis of transported materials.
Transport equipment in the wood industry. Electric motors, hydraulic drives, pneumatic actuators and internal combustion engines.
Components of transport equipment. Steel ropes, chains and wheels.
The role of the air conveyor system for suction and transport of wood particles. Calculation of required dimensions of wood particle separators, piping, electric motors and fans.

Type of course:

Transport and storage (compulsory, 5. semester, 3. year undergraduate professional study)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
identify and select a transport equipment at a certain stage of the technological process, produce a schematic representation of a smaller woodworking industry according to the type of production	correction and evaluation of exercises	A2, A3, A4
Calculate the capacity, the carrying capacity of the transport equipment depending on the parameters of the technological production process (belt, roller and chain conveyors), the cranes, the vehicles, the lift	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Determine resistance when moving the loads and calculate the required power output	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Dimension and select the components of the loads and loads handling (steel rope and chain strength, pallet, platform) depending on the type of loads, its weight and the mode of engagement (acceptance)	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Calculate all required parameters of the air conveyor system, determine static pressure drop in the system, air flow rate, air flow, air force and and calculate the fan's utility and system utility.	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Select the ventilator according to the calculated system parameters	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Independently make the calculation of steel ropes for the selected type of bar, winch (freewheeling or on a slope)	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Independently make a calculation for the air conveyor system and transport of fragmented wood	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4
Individually determine the required storage space, calculation and floor plan view	correction and evaluation exercises, partial exams, final exam, final oral exam	A2, A3, A4

General competences

The students acquire basic technical and technological knowledge and skills to supervise and monitor the operation of transport equipment in wood processing plants and furniture production and storehouses and to solve less complex tasks of selecting and optimizing the operation of transport equipment.

Lectures

Different teaching methods, such as ex cathedra lectures, debating, learning in pairs and quizzes are used.

Exercises

Exercises are performed in the hall with a sufficient number of jobs and in the laboratory.

Working methods:

Teachers' obligations:

Teaching - lectures, exercises. Applying different teaching methods to help students gain knowledge and acquire learning outcomes. Designing topics for group work of students and compiling knowledge tests and evaluating them. Providing partial exams, oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises, creation and presentation of exercises and topics. Attending partial exams or the final exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-		-	15	0	0,5
Partial exams (PE)	60 %	60%	sufficient (2)	1	45	1,5
		71%	good (3)			
		81%	very good (4)			
		91%	excellent (5)			
Oral exam (OE)	30 %	Checking what has been resolved on the written part of the exam			20	0,7
Self-done exercises (E)	10 %	Making four exercises. The average score of these exercises enters the average final grade.		30	10	1, 3
TOTAL	100 %	(PEx60+OEx30+Ex10)/100		46	75	4

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students	ECTS

					workload outside the direct teaching	
Lectures (L)	-		-	15	0	0,5
Final exam (FE) (written)	60 %	60%	sufficient (2)		45	1,5
		71%	good (3)			
		81%	very good (4)			
		91%	excellent (5)			
Oral exam (OE)	30 %	Checking what has been resolved on the written part of the exam			20	0,7
Self-done exercises (E)	10 %	Making four exercises. The average score of these exercises enters the average final grade.		30	10	1,3
TOTAL	100 %	(FEx60OEx30+Ex10)/100		45	75	4
* Students who do not pass through the semester during the semester will be admitted to the examination and oral examination						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + Exercises	The attendance is checked and the presence of students is recorded. The student may have a maximum of 3 hours of lecture classes and 2 hours of excercises work.		-
Making exercises	Exercises are attending the semester. Each independent exercise reviewed twice. The second review exercise results in a score of poor in the case of its inaccuracies. The last month in the semester is conditional, and the last deadline for submitting the exercises evaluated by the grade is insufficient.		
Three colloquium	During the course, students write three partial exams (colloquium). At each of the colloquium it is necessary to collect 9 points out of 15 possible (60 %). The average score of all three partial exams makes the final mark.	During semester	There is no possibility of repeating the Colloquium
Final exam	The material is heard during the whole semester.	Exam period	-

Obligatory literature

1. Sever, S.: Transport u drvnoj industriji, autorizirani rukopis, Zagreb, 1988, str. 1-26, 50-231.
2. Hamm, Đ.: Transportni uređaji, ŠE, svezak 3, JLZ "Miroslav Krleža", Zagreb, 1987, str. 521-529.

3. Biljan M.: Dizalice, ŠE, svezak 1, JLZ, Zagreb, 1980, str. 346-357.

Recommended literature

1. Oluić, Č.: Transport u industriji, Rukovanje materijalom I. dio, Sveučilišna naklada, Zagreb, 1991, str. 1-278.
2. Madjarević, B.: Rukovanje materijalom, Tehnička knjiga, Zagreb, 1972, str. 1-476.
3. Biljan, M.: Transport, Poglavlje u DI-priručniku, Tehnička knjiga, Zagreb, 1968, str. 339-378.
4. Svjatkov, S. V.: Pneumatski transport usitnjenog drveta, Sarajevo, 1969, str. 1-376.

Power supply in wood industry

SS125

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45

Lecturer
Prof.dr.sc. Stjepan Risović

Associate teacher for exercises
Doc.dr sc. Branimir Šafran
Marko Rastija, mag. ing. mech.

Grading
Sufficient (2) 50 - 67 %
Good (3) 68 - 78 %
Very good (4) 79 - 89 %
Excellent (5) 90 - 100 %

Course content:

Heat, mechanical and electric energy in wood industry. Fuels used in wood industry: wood residues. Power plants in wood industry (boiler room, water preparation, hot water production, saturated steam, superheated steam, hot oil, hot air). Heat transfer, heat loss, heat exchanger, heating, heat recuperation.Electric energy in wood industry. Electrotermic in wood industry Electric motor drives (EMD) in wood industry and mechanical power needs, diagram of electric motor drive Compressors and pneumatics; hydraulic power. Combustion, heating value, chimney gasses, ash. Rational energy production-consumption in wood industry plants and energy issues in typical wood industry technologies. Ecology and energy, waste water, wood residues, sludge. Technical and other procedures for pollution reduction

Type of course:

Power supply in wood industry (elective course, 5. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Introduce the importance of using heat energy in woodworking processes	written exam, oral exam	A3, A4
Calculate the savings of electricity when using a motor with frequency and voltage regulation	written exam, oral exam	A3, A4
Create a plan for selecting hydraulic and pneumatic systems in the wood industry	written exam, oral exam	A3, A4
Predict the amount of wood residue that is generated in the wood processing industry by machining	written exam, oral exam	A3, A4
Point out advantages and disadvantages of the simultaneous production of heat and electricity	written exam, oral exam	A3, A4
Design a system for the production of thermal energy for the needs of the technological process	written exam, oral exam	A3, A4
Present and explain the costs of investment and profits in the production of densified wood	written exam, oral exam	A3, A4
Improve the method of disposal of ash produced during combustion of biomass	written exam, oral exam	A3, A4
Evaluate quality of solid biofuels according to standards	written exam, oral exam	A3, A4

General competences

Technical technological knowledge for rational use of energy

Lectures

Exercises

Exercise part of the teaching program is carried out in a laboratory where on the basis of specific measurements the calculations of observed systems and principles are carried out. The second part of the exercises are calculation tasks where the theoretical knowledge adopted in the lectures is upgraded with aim of better understanding of the subject.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Providing oral exams and consultations. Creating teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Laying the exams.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	-
Excersizes (E)	-	-	-	45	0	-
Written exam (WE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		30	2,0
Oral exam (OE)	50 %	50 - 67 % 68 - 78 % 79 - 89 % 90 - 100 %	Sufficient (2) Good (3) Very good (4) Excellent (5)		20	2,0
TOTAL	100 %	(WEx50 + OEx50)/100		60	50	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures + exercizes	The teaching attendance is checked and recorded. Students may be absent with a maximum share of 20 % of direct teaching.	semester (60 hours of direct lecturer)	-
Written exam	Exams can be attended by students who have sufficient teaching attendance. Students solve tasks and answer asked questions. The written exam is evaluated and participates in the final grade.	Exam terms	-
Oral exam	Students who pass written exam are areasked for questions from different parts of the teaching program content. The final grade is obtained according to the formula: (WEx50 + OEx50/100		

Obligatory literature

1. Skripte (materijali za kopiranje)
2. Kraut: Strojarski priručnik, Tehnička knjiga, Zagreb
3. Požar, H. 1992: Osnove energetike I, Školska knjiga, Zagreb.
4. Požar, H. 1988: Osnove energetike II, Školska knjiga, Zagreb.
5. Požar, H.1992: Osnove energetike III, Školska knjiga, Zagreb.

Technology of Panels from Fragmented Wood

SS-126

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work

Lecturer
Assist. Prof. Nikola Španić, PhD

Associate teacher for exercises
Assist. Prof. Nikola Španić, PhD

Grading
Sufficient (2) 50%
Good (3) 62%
Very good (4) 74%
Excellent (5) 86%

Course content:

Particleboards technology – Technological phases and operations in particleboards production process. Resources, types and shapes of raw materials. Raw materials stocks. Raw materials preparation. Wood fragmentation. Particle types. Sawn particle. Milled particle. Particle-fibrous material. Particle fabrication. Chippers. Chips characteristics. Flakers. Mills. Physical-morphological properties of particles. Fragmented wood transport. Particle stocks. Particle dosage. Particle drying. Drying mechanism. Drying oven types. Mechanical-contact drying ovens. Mechanical-convectional drying ovens. Pneumatic-convectional drying ovens. Drying oven capacity. Heat utilization. Wood species shapes and dimension influence on drying. Average moisture value. Varying of input moisture. Drying-oven loading system. Fire protection. Particle sorting. Screens. Air separators. Particle dosage. Adhesives. Adhesives based on amino resins. Polycondesation reactions. Urea-formaldehyde (UF) adhesives. UF adhesives curing. Catalysts (hardeners). Melamine-formaldehyde (MF) adhesives. Phenol-formaldehyde (PF) adhesives. Resol type resins. Novolac type resins. Resorcyl-formaldehyde (RF) adhesives. Poly-isocyanate (polyurethane) adhesives. Tannin adhesives. Sulfonic adhesives. Furfural adhesives. Hydrophobic agents. Retardants. Adhesives and chemical additives preparation. Particle resinating. Forming stations. Particle mat forming. Waferboards forming. Oriented particles mat forming. Influential parameters of mat forming. Prepressing. Wetting. Mat preheating. Presses for particleboard production. Multi-level presses. Press control devices. Press capacity. Continuous presses. Press temperature. Temperature and moisture dependence. Steam impact. Pressing pressure. Pressing time. Panels' formatting. Grinding. Conditioning. Veneering. Overlaying with synthetic materials.

Fibreboards technology – Technological phases in fibreboards production process. Dry procedure. Wet procedure. Chipping with cutters (cut-machines). Sorting. Chips transport. Additive separation. Chip preparation (hydrothermal, chemical). Defibration (fibrillation). Mechanical grinding wood mills. Mills with stone segments. Mills with steel cogs. Explosive reactor (Mason's cannon). Apslunds defibrillator. Post fibrillation. Rafiners. Fibre sorting. Pulp. Pools with rotating stirrers. Dosage chambers. Transfuse chambers. Long screen. Vacuum draining. Pressure draining. Mat formatting. Mat drying. Raw materials and additives. Fibre drying. Paraffin and adhesives addition. Vibratory stations. Mat pressing. Temperature and pressure during pressing. Heat induced curing. Wetting. Conditioning. Formatting. Painting and overlaying.

Type of course:

Technology of Panels from Fragmented Wood (elective course, 2. semester, 1. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to identify production technologies	laboratory and practical classes, seminar paper, final exam	C5
to design the characteristics of wooden and non-wooden raw materials for panel production	laboratory and practical classes, seminar paper, final exam	C5
to design the characteristics of panels made out of fragmented and defibrated wood	laboratory and practical classes, seminar paper, final exam	C5
to explain the influence of raw material characteristics and pressing parameters on panel properties	laboratory and practical classes, seminar paper, final exam	C5
to determine the technological legitimacy and to manage production processes	laboratory and practical classes, seminar paper, final exam	C5
to evaluate the significance of each phase of technological process of panel production	laboratory and practical classes, seminar paper, final exam	C5
to optimize panel properties by correcting the technological parameters	laboratory and practical classes, seminar paper, final exam	C5
to prepare the conditions for conditioning and moisture content equalisation	laboratory and practical classes, seminar paper, final exam	C5
to classify raw panels	laboratory and practical classes, seminar paper, final exam	C5
to recommend the technical conditions for the panel overlaying	laboratory and practical classes, seminar paper, final exam	C5
to evaluate the influential factors affecting the overlaying quality	laboratory and practical classes, seminar paper, final exam	C5
to determine the panel quality according to technical standards	laboratory and practical classes, seminar paper, final exam	C5
to apply the technical regulations for wooden boards	laboratory and practical classes, seminar paper, final exam	C5
to design new technologies in the production of fragmented wood panels	laboratory and practical classes, seminar paper, final exam	C5

General competences

Acquiring of knowledge on technical regulations, planning and production management and particle and fibreboard quality assurance of boards produced without bonding material, with synthetic or mineral bonding material, in dry and wet processes, by cold or hot pressing or using moulding pressing matrices.

Lectures

Exercises

As part of the exercises the required quantities of basic (wood) and auxiliary raw materials (resins, hardeners, hydrophobic agents) required for the production of particleboards are determined matematicaly, and the parameters of particleboard pressing are also defined. Additionally, in workshop and laboratory, exercises are conducted where in multiple terms, the properties of particleboards that are experimentally produced using wood and alternative lignocellulosic raw materials, the properties of boards produced using significantely different technological parameters and of board that are produced out of raw materials with inferior properties are determined. Panels' surface overlying with natural and/or synthetic materials alongside characterization of such prepared panels is also done on the exercises. Exercises are an upgrade to the knowledge acquired in lectures.

Working methods:

Teachers' obligations:

Holding the original lessons - lectures, exercises. Designing and compiling knowledge tests and evaluating them. To hold written and oral exams and consultations. Creating teaching materials.

Students' obligations:

Regular attendance and active participation in lectures and exercises. Writing and submitting the exercises report and seminar paper within the given time frame. To attend the exam.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachin ghours	Number of average students' workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	0.5
Exercises (E)	20%	Partially disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	15	2
		Orderly, legible, with major corrections and on time	Good (3)			
		Orderly, legible, with minor corrections and on time	Very good (4)			
		Orderly, legible and on time	Excellent (5)			

Seminar paper (SP)	10%	Partially disordered, incomprehensible and illogically conceived text, with major corrections and on time	Sufficient (2)	-	30	1
		Orderly, legible and logically conceived text, with major corrections and on time	Good (3)			
		Orderly, legible and logically conceived text, with minor corrections and on time	Very good (4)			
		Orderly, legible and logically conceived text, without corrections and on time	Excellent (5)			
Exam (EX)	70%	50-61%	Sufficient (2)	-	15	0.5
		62-73%	Good (3)			
		74-85%	Very good (4)			
		86-100%	Excellent (5)			
TOTAL	100%	(Ex20 + SPx10 + PEx70)/100		60	60	4

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance is checked, and the attendance of the students is recorded. Student may justifiably be absent with a maximum of 10% of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. There are 4 exercises in total. Exercises 1 and 2 are conducted in practicum and are of computational type. Exercises 3 and 4 are of a practical character and are carried out in a workshop / laboratory. At the beginning of the first exercise, students receive templates for all exercises; they are acquainted with the details of each exercise, and how to submit the exercises report. The accuracy, legibility and regularity (submission on time) is evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason, the student is allowed to compensate his/hers absence on the individual exercise
Seminar paper	In their seminar paper the student process the results obtained on exercises. More precisely, the aim of the seminar paper is to compare the properties of examined boards as depending on their type. Theoretical part is performed through the study of relevant literature that they define in coordination with the course lecturer. The project task is submitted at the end of the semester, in the form of a written report.	15. week	Students who submit and their seminar paper is evaluated positively can access the exam
Written exam	Only the students which have submitted their exercises reports and whose project task report is evaluated positively, can take the final written exam. The students are given the printed exam form and they answer the questions asked. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exam	Students that pass the written exam are asked questions from different parts of the program content. The final grade of the subject is obtained according to the formula (Ex20 + SPx10 + EXx70)/100		

Obligatory literature

1. Bruči, V., Jambreković, V.: Ploče iverice i vlaknatice, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 1996.
2. Bruči, V., Janović, Z., Jambreković, V., Brezović, M.: Određivanje formaldehida iz drvnih pločastih materijala perforatorskom metodom, Sveučilišni laboratorijski priručnik, Šumarski fakultet, Zagreb, 1994.
3. Jambreković, V.: Drvne ploče i emisija formaldehida, Sveučilišni udžbenik, Šumarski fakultet, Zagreb, 2004.

Recommended literature

1. Maloney, T. M.: Modern particleboard & dry-process fiberboard manufacturing, Forest Products Society Madison, Wisconsin, 1993.

Composite Plywood

SS-127

ECTS 4

English language ---

E-learning ---

Teaching hours 60
Lectures 15
Exercises 45
Field work

Lecturer
Associate Professor Jaroslav Kljak, Ph. D.

Associate teacher for exercises
Associate Professor Jaroslav Kljak, Ph. D.

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Composite plywood panels with sandwich and laminate structure. Core - materials and properties (foam, honeycomb, corrugated cores), core production. Faces - materials and properties (phenol and melamine foils, decorative and protected foils). Types and properties of resins (polycondesation, polymerisation, polyadditon). Technological parameters of composite plywood production. Sandwich panels manufacturing. Materials selection for core and faces. Interaction between wood and non-wood layers with respects to its physical and mechanical properties. Determination of relevant properties of composite plywood. Use of composite panel.

Type of course:

Compoiste Plywood (elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Select materials for making composite plywood.	knowledge test, final exam	C5
Determine the technological parameters for pressing different types of composite plywood.	knowledge test, final exam	C5
Determine the physical and mechanical properties of composite plywood panels.	knowledge test, final exam	C5

General competences

A course objective is getting knowledge about composite plywood panels, its properties, and basic technological parameters of production.

Lectures

Exercises

Working methods:

Teachers' obligations:

Teaching activities - lectures, exercises. Creating knowledge tests and evaluation. Providing oral exams and consultations. Preparing teaching materials.

Studenats' obligations:

Regular attendance and active participation in lectures and exercises. Taking exam.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Final exam (FE)	80 %	60-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	60		4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	The attendance is checked and the attendance of the students is recorded. A student may justifiably miss no more than 15% hours of all lectures and exercises.	semester (60 hours of direct lecturer)	-
Written exam	Examinations can be attended by students who attended lectures and exercises. The students in the written exam (multiple choice question), choose the correct answers. The written exam is evaluated and participates in the final grade of the subject.	Exam terms	
Oral exame	After passing a written exam, students are asked questions from different parts of the lecture content.		

Obligatory literature

1. Kljak, J.; Brezović, M.; Jambreković, V., 2003.:Analiza interakcije strukturnih materijala kompozitnoga uslojenog drva. Drvna industrija 54 (2): 177.
2. Kljak, J.; Brezović, M.; Jambreković, M., 2002.: Varijabilni čimbenici vodootpornosti furnirske ploče. Drvna industrija 53 (3) : 153-158.
3. Brezović, M. 1997.: Mogućnost izrade ploča od uslojenog drva strukturno zaštićenih kemijskim vatrozaštitinim sredstvima. Drvna industrija 48 (2) 86-95.
4. Brezović, M., Jambreković, V., Kljak, J., 2002.: Utjecaj karbonskih vlakana na neka relevantna svojstva furnirskih ploča. Drvna industrija (53) 1: 23-31.
5. Mešić, N. 1998.: Furniri, furnirske i stolarske ploče., Grafika šaran, Sarajevo.
6. …: HRN EN, ISO, ASTM norme

Recommended literature

Special drying methods

SS-128

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work 0

Lecturer
Professor Stjepan Pervan, PhD

Associate teacher for exercises
Miljenko Klarić, PhD

Grading
Sufficient (2) 60 %
Good (3) 71 %
Very good (4) 81 %
Excellent (5) 91 %

Course content:

Physical basics of other special methods of wood drying. Measurement of drying parameters in special methods. Vacuum drying - basics and performance of discontinuous and continuous vacuum drying. Condensation drying - basics and performance. Vacuum-press procedure - application. HF Drying - basics and performance. Microwave drying - basics and performance. Advantages and disadvantages of special drying methods. Regimes of special drying methods. Wood defects in special drying methods. Cost of special drying methods.

Type of course:

Special drying methods of (elective course, 6. semester, 3. year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
Explain special drying methods	exercises, lectures, exam	C4
Distinguish the processes of special drying methods	exercises, lectures, exam	C4

Understanding the energy needs of some special drying methods	exercises, lectures, exam	C4
Know to choose the appropriate level of special drying technology according to production requirements	exercises, lectures, exam	C4
Distinguish process errors on the material during special drying	exercises, lectures, exam	C4
Explain the drying defects with special methods	exercises, lectures, exam	C4

General competences

The aim of the course is to qualify the expert – specialist for self-governing: complete work on monitoring, controlling, analysing and modification of less used unconventional drying processes of solid wood.

Lectures

In the course of lectures, students gain knowledge about special drying methods of wood.

Exercises

As part of auditory exercises, laboratory exercises and practical exercises, students receive an upgrade to the knowledge gained during the lectures.

Field work

During field work, students connect knowledge from the lessons and exercises with real production.

Working methods:

Teachers' obligations:
Maintaining original lessons - lectures, exercises. Designing topics for seminar papers and compiling knowledge tests and evaluating them. Providing colloquia, oral exams and consultations. Creating teaching materials.

Students' obligations:
Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given deadlines. Taking the colloquia and exam.

Methods of grading=Taking exam

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			15	15	1
Exercises (E)	20 %	Partly disordered and incomprehensible, with major corrections and on time	Sufficient (2)	45	15	2
		Neat, legible, with major corrections and on time	Good (3)			
		Neat, legible, with minor corrections and on time	Very good (4)			
		Neat, legible, accurate and on time	Excellent (5)			
Partial exam (PE)	80 %	60-70%	Sufficient (2)		30	1
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100 %	(Ex20 + PEx80)/100		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Final exam (FE)	100 %	60-70 % 71-80 % 81-90 % 91-100	Sufficient (2) Good (3) Very good (4) Excellent (5)			1
TOTAL	100%	(FEx80+Ex20)/100				1

Detailed description of evaluation elements for lecturer, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercises	The attendance of the students is checked and recorded. Student may justifiably be absent with a maximum of 10 % of direct teaching hours.	semester (60 hours of direct lecturer)	-
Exercises	Exercises are attended in groups. At the beginning of the first exercise, students will receive templates. Exercises are written by hand. For each exercise, the term in which the exercise is handed and evaluated positively, is defined. If the exercise is not handed within the defined time frame or if the exercise is not evaluated positively, then that exercise will be reviewed later after semester ends and the student will receive the seminar assignment and additional computational tasks for each exercise. The accuracy, tidiness and regularity are evaluated.	in accordance with the agreed terms	Exceptionally, in the case of a justified reason.
Written exam	Exam can be attended by students who have completed the exercises. The exam consists of theoretical questions, computational tasks and of the sample that students must describe. For passage students must collect at least 60 % of points.	Exam terms	-
Oral exam	Students who pass a written exam are asked questions from different parts of the program. The final grade of the subject is obtained according to the formula **(FEx80+Ex20)/100**		-

Obligatory literature

1. Pervan, S. (2000): Priručnik za tehničko sušenje drva. 272 p. SAND 2000.

Quality assurance of finished products

SS-129

ECTS 4

English language R1

Teaching hours 60
Lectures 15
Exercises 45

Lecturer
Full Professor. Ivica Grbac, PhD

Associate teacher for exercises
Associate Professor Ivica Župčić, PhD
Associate Professor Zoran Vlaović, PhD

Grading
Sufficient (2) 60%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

History of furniture quality testing in Croatia and worldwide. Basics concepts of the quality assurance for products and services. Viewpoints of manufacturers, consumers and society. Quality and innovation.
Quality systems according to HRN ISO 9000: 2000, HRN EN ISO/IEC 17025: 2000 standards, basic features of the MÖBELFAKTA furniture quality system that has been withdrawn. Quality mark in Croatia and worldwide with reference to the quality labelling of high-quality products. General remarks about the Croatian system for setting standards in the field of wood, wood products and furniture. Basic features of standards for wood, veneer, wood panels and wood semi products, furniture, wood in civil engineering and other wood and wood products related products. Basics of the European legislation with a special focus on the Directive 2001/95/EC of the European Parliament and of the Council on general product safety and methods of testing the product in Croatia. Methods of testing furniture and wooden joinery, wood, wood materials, textiles, leather, glass, synthetic materials, hardware etc. Office furniture – worktables and counters, cabinets and partitions, office work chairs – dimensions. Mechanical safety requirements. Testing methods. Outdoor furniture – sitting furniture and camping tables, tables for domestic and public use. General safety requirements. Mechanical safety requirements and methods of testing tables and sitting furniture. Requirements for furniture flammability – Assessment of the flammability of the bed – mattress and the upholstered bed base and the assessment of the flammability of upholstered furniture – Ignition source: lighted cigarette. Ignition source: equal to the match flame. Furniture for lying – cradles, cribs and foldable cribs, playpens for domestic use. Beds and mattresses. Bunk beds for domestic use. Foldaway beds – Measurement methods and the recommended tolerance. Safety requirements and testing methods.

Testing methods for determining functional features. Kitchen furniture – coordination measures for kitchen furniture and kitchen appliances. Safety requirements and testing methods for built-in and free-standing kitchen cabinets. Storage furniture – Safety requirements and testing methods. Sitting furniture. Row stools – Testing methods to determine strength and durability. Mechanical and constructional safety requirements. Testing methods for determining the durability of reclining and/or swinging mechanisms and functional mechanisms for switching from a sitting to a lying position. Tables – Testing methods for determining strength, durability and stability. Mechanical and constructional safety requirements. Furniture – Testing the resistance of the surface – Impact resistance. Testing the resistance of the surface to cold liquids. Testing the resistance of the surface to heat with humidity. Testing the resistance of the surface to dry heat. Children's high chairs – Safety requirements. Testing methods. Window: wind- and rain proofness, acoustic insulation, durability. Door: safety windproofness, acoustic insulation, deformability under different weather conditions and durability.

Type of course:

Selective course, 3. semester, year 3

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
to recognise and describe the quality factors of end products (constructional, technological, economic, aesthetic, ergonomic etc.)	final examination	C6
to recognise current technical regulations (HRN EN standards) in furniture safeguarding and control	exercises, correction, exercise evaluation, final examination	C6
to describe furniture by using applicable HRN EN standards (testing school furniture, office furniture, lying and sitting furniture)	exercises, correction, exercise evaluation, final examination	C6
to recognise factors influencing product durability and reliability (the quality of in-built material and construction)	final examination	C6
to describe the flammability of upholstered furniture according to applicable HRN EN standards	exercises, correction, exercise evaluation, final examination	C6
to gather, group and process information about the given topic and to present it	exercises, correction, exercise evaluation	C6

General competences

acquiring knowledge of furniture quality, factors influencing quality and testing methods;

Lectures

Exercises

Furniture testing in an accredited furniture and furniture parts testing laboratory in accordance with HRN EN standards. Making exercises based on conducted laboratory testing.

Working methods:

Teacher's obligations:

to hold original classes – lectures and exercises. To develop exercises and draw up tests and grade them. To conduct oral examinations and hold consultations. To draw up the teaching material.

Students' obligations:

regular class attendance and to actively take part at lectures and exercises, preparation, submission and oral presentation of exercises within the set deadline. Taking examinations.

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-			15	-	0,5
Making Exercises (E)	30%	Partly neat and partly correct, corrected twice, not submitted on time	Sufficient (2)	45	20	2,16
		Partly neat and partly correct, corrected twice, submitted on time	Good (3)			
		Neat, partly correct, complete, not submitted on time	Very good (4)			
		Neat, with minor corrections, complete and submitted on time	Excellent (5)			
Written examination (WE)	35%	60-70%	Sufficient (2)	-	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Oral examination (OE)	35%	60-70%	Sufficient (2)	-	20	0,67
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			

TOTAL	100%	(WEx35+OEx35 + Ex30)/100	60	60	4

Detailed description of evaluation elements for lectures, exercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Lectures	Student' attendance is checked and recorded. Student may be absent from no more than 20% of lectures.	in accordance with the syllabus	-
Exercises and making exercises	Student' attendance is checked and recorded. Student may be absent from no more than 10% of exercises. Exercises are checked and graded. The grade is the arithmetic mean. The requirements for taking the examination (written part) are positively graded exercises and an oral presentation given of the assigned product tested in the Laboratory.	in accordance with the syllabus	-
Written examination (WE)	Students whose exercises have been graded and who regularly attended classes may take the examination. Students randomly choose a paper with questions. The written examination is graded and included in the final grade .	examination period	-
Oral examination (OE)	A requirement for taking the oral examination is to acquire sufficient scores in the written part of the examination Students' theoretical knowledge and understanding of methods and procedures for testing furniture and other wood products will be examined. The final grade will be calculated by the formula (WEx35 + OEx35 + Ex30)/100	examination period	-

Obligatory literature

1. Crosby, P.B.: Kvaliteta je besplatna, Zagreb, 1989, p. 1-218.
2. Grbac, I.: Istraživanje kvalitete ležaja i poboljšanje njegove konstrukcije, dissertation, Faculty of Forestry, Zagreb, 1988, p. 1-583.
3. Ivelić, Želimir; Grbac, Ivica; Ljuljka, Boris (2003): Normizacija u području proizvodnje i ispitivanja kvalitete namještaja, Conference "Croatian Standardisation and Related Activities", Dubrovnik, Cavtat 10-12 April 2003, Croatian Society of Structural Engineers, p. 329-336
4. Ljuljka, B.: Kvaliteta namještaja, Šumarska enciklopedija II, LZ, Zagreb, 1983, str. 484-490.
5. Grbac, I. (2004): Ojastučeni namještaj, university textbook, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.
6. Grbac, I. (2006): Krevet i zdravlje, university textbook, selected chapters, University of Zagreb, Faculty of Forestry, Zagreb.

Enterpreneurial business planning

SS-130

ECTS 4

English language R1

E-learning R1

Teaching hours 60
Lectures 15
Exercises 45
Field work 00

Lecturer
Prof. Denis Jelačić, PhD.

Associate teacher for exercises
Prof. Denis Jelačić, PhD.

Grading
Sufficient (2) 61%
Good (3) 71%
Very good (4) 81%
Excellent (5) 91%

Course content:

Plan and project. Approach to planning and enterpreneurial business planning, business plan, venture, project, investment project and investment study with implication to wood processing and furniture manufacturing. Enterpreneurial projects. Information on enterpreneur – investor. Analysis of purchase and sell market with examples from wood industrial branche. Technological-technical analysis of the business organization in wood processing and furniture manufacturing, location analysis. Financial preparation of a project, efficiency evaluation, purpose of enterpreneurial business plan, structure of enterpreneurial business plan, optimal enterpreneurial decision making. Important business and time components of a project and business plan. Company value. Restrictions in business of enterprises in wood processing and furniture manufacturing. Basics of economical calculations, interest calculation, simple and komplex interest calculation, loan repayment, economical evaluation of investment project.
Return of investment period, profit, profit rate.

Type of course:

Enterpreneurial business planning (elective course, 6th semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcomes (LO)	Evaluation methods	Connection with the study program LO
To establish the parameters of business plan or investment study;	Exercises evaluation, partial exams, final exam	D1
To establish market components and to analyze purchase and sell market	Exercises evaluation, partial exams, final exam	D1
To make technical-technological analysis, location analysis of the business plan	Exercises evaluation, partial exams, final exam	D1
To make financial preparation of a project with important time milestones	Exercises evaluation, partial exams, final exam	D1
To make economical calculation and to establish return of investment period	Exercises evaluation, partial exams, final exam	D1

General competences

Student gets knowledge necessary to work in the industrial branche on work posts with responsitilies in enterprise management in the field of business planning.

Lectures

Lectures on theoretical basis prepare students for work on work posts with responsitilies in enterprise management in wood processing and furniture manufacturing in the field of business planning with practical examples and with computer technology aid, which make exercises and the whole subject easier to acquire.

Exercises

Exercises on individual tasks with a purpose to implement theoretical basics learned on the lectures in a work in computer practicum using computer softwares. Making of technicaly prepared projects of the complete business plan or investment study.

Working methods:

Teachers' obligations:

To give lectures and exercises in full. To create exercises and tests for partial exams and final exams and to evaluate them. To give partial exams, to give consultations and final exams. To make teaching equipment/helpers.

Studenats' obligations:

To attend the lectures and exercises regularely and to actively participate in them, to make exercise and provide them within deadlines. To attend partial exams and final exam..

Methods of grading

Evaluation elements	Share in evaluation	Grade rating scale	Grade	Direct teachinghours	Number of average students workload outside the direct teaching	ECTS
Lectures (L)	-	-	-	15	0	1
Exercises (E)	40%	Partly orderly and understandable, with major improvements required and on time	Sufficient (2)	43	30	2
		Orderly, readable, with major improvements required and on time	Good (3)			
		Orderly, readable, with minor improvements required and on time	Very good (4)			
		Orderly, readable, accurate and on time	Excellent (5)			
Partial exam 1 (PE1)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
Partial exam 2 (PE2)	30%	61-70%	Sufficient (2)	1	15	0,5
		71-80%	Good (3)			
		81-90%	Very good (4)			
		91-100%	Excellent (5)			
TOTAL	100%	(Ex40 + PE1x30+PE2x30)/100		60	60	4

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the	ECTS bodovi

					direct teaching	
Final exam (FE)	100 %	61-70% 71-80% 81-90% 91-100%	Sufficient (2) Good (3) Very good (4) Excellent (5)	2	30	1
TOTAL	100%	(FEx100)/100		2	30	1
* students who don't pass the partial exams during the semester have to attend the final exam which is 100% of the grade.						

Detailed description of evaluation elements for lecturer, excercises, partial or final exams

Evaluation elements	Description	Deadline	Compensation
Attendance of lectures and exercies	Students attendance is checked and notified. Student can miss 15% of the classes justifiably the most.	semester (15 hours of direct lectures)	-
Exercise project	Exercises are given in groups and student make exercise project individually. Each project is complex (1 project) and it is been made in parts corresponding to teaching parts. Student presents the whole project at the end of semester, and each part is evaluated on lectures during the semester. The project is 40 points and together with partial exams points it makes 100 points (100%).		
Partial exam 1	First partial exam can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 1 is 30 points and it covers the subject lectured until the time of partial exam.	7^{th} week	
Partial exam 2	Partial exam 2 can be attended by students who did not miss more than 15% of lectures and exercises. Partial exam 2 is 30 points and it covers the subject between partial exam 1 and time of partial exam 2. Students who collect enough points in two partial exams and in exercise project pass the subject and get the final grade.	13^{th} week	
Oral exame	Students who did not pass the subject through partial exams and exercise project (less the 61% of points), or who are not satisfied with the grade, can attend the final oral exam in given exam periods. The grade given on oral exam is final and it makes 100% of the grade.	In given exam periods	

Obligatory literature

1. Salvatore, D. 2005: Ekonomija za poduzetnike, Mate d.o.o., Zagreb.
2. *** 1999: Poslovni plan poduzetnika, Masmedia, Zagreb.

Recommended literature

1. Osmanagić Bedenik, N. 2002: Operativno planiranje, Školska knjiga, Zagreb.
2. Bangs, D. H. Jr. 1998: Kako napraviti poslovni plan, Jakubin i sin, Zagreb.

Professional practice

SS-50473

ECTS 18

Teaching hours 270

Gradeing
Insufficient (1)
Sufficient (2)
Good (3)
Very good (4)
Excellent (5)

Course contents:

Professional practice is an obligatory subject at undergraduate study and implies a student's time-load equivalent of 18 ECTS credits. During VI. semester of undergraduate studies it is required to complete a professional practice in a total duration of 270 hours. By the course completion, students are required to undertake professional practice in woodworking companies. Professional practice is a basic precondition for final paper. The student carries out professional practice in a company that carries out professional tasks within its core business which contain the elements of the professional profile that the student will acquire after graduation.

Type of course:

Professional practice (obligatory course, VI semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcome (LU)	Verification method
Apply the basic skills of sawmill technology, logging and logging techniques, and identify indicators of the success of sawmill processing	Professional practice work log
Describe, differentiate and explain the basic industrial hydrothermal processes	Professional practice work log
Analyze, differentiate and explain the basic characteristics of the production of crushed wood panels	Professional practice work log
Distinguish and recognize the basic features of veneer and laminated veneer production	Professional practice work log
Identify, describe, sketch and construct basic construction types of furniture and construction products	Professional practice work log
Define, recommend and manage the basic processes in the wood industry and determine the basic cost models and calculations	Professional practice work log
Analyze, differentiate and explain basic machines and tools in wood processing	Professional practice work log
Explain basic concepts about technological processes of furniture production, differentiate and categorize basic groups of furniture and adhesives	Professional practice work log

General competencies

The professional practice in production facilities completes the theoretical knowledge acquired during the course of a professional undergraduate study with examples from practice. The student focuses on the analytical approach of collecting data on the factors of the production process or the business of the company. On the basis of recording and studying production processes, the student proposes improvements to improve the process that is the subject of his professional practice.

Working methods:

Obligations of the Head of Professional Practice:

Organize professional practice, design tasks that students will independently solve, and be available for consultation during and after fieldwork. Inroduce students with rules of conduct in professional practice. Provide necessary assistance and instructions to the student in solving problems with professional practice. Review and evaluate the Professional Practice Work Log.

Student obligations:

Actively participate in professional practice. Respect the rules of conduct in professional practice. Write a Proffesional Practice Work Log.

Methods of grading

Evaluation elements	Maximum points or Share in evaluation	Grade rating scale	Grade	Direct teaching hours	Number of average students workload outside the direct teaching	ECTS bodovi
Work Log	100 %	See description	sufficient (2)	270	270	18
			good (3)			
			very good (4)			
			excellent (5)			
TOTAL	100%			270	270	18

Based on the evaluation of the student's work in the professional practice and on the basis of the Proffessional Practice Work Log signed by the Coordinator and the Head of the Professional Practice, the grade for the professional practice is set.

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Evaluation elements	Description	Deadline	Compensation
Work performance of a student during professional practice	a) High work performance b) Satisfactory work performance c) Weaker performance than expected without justified reasons		
Application of theory in practical work during professional practice	a) Demonstrates the exceptional skill of applying theory in practical work b) Recognizes the theoretical framework in practical work c) Does not integrate the theoretical framework with practical work		
Students skill to solve a problem during professional practice	a) Very skilled in problem solving, innovative and creative b) able to solve a given problem in a familiar manner c) Does not show satisfactory ability to solve the problem		
Students ability to make decisions during professional practice	a) Decides on its own, based on a thorough analysis of (changing) circumstances b) Decisions are satisfactory in known situations c) Often makes the wrong decisions without analyzing the situation		
Ability to co-operate in the team during professional practice	a) Work in line with others, contributes to group relationships and effectiveness b) Relations with others are consistent in normal circumstances, but do not stand out c) Non-communicative and withdrawn to the extent that it negatively affects the group		
Communication skills of the student during professional practice	a) Extremely clear, well organized and convincing communication, written and spoken b) Satisfactory written and spoken communication skills c) Poor writing and speaking skills		
Motivation and responsibility of a student during professional practice	a) High degree of motivation in work and collective and social responsibility b) Sufficient motivation for work and accountability c) Poorly motivated, uninterested and lacking sense of responsibility towards the job		

Obligatory literature

1. Ordinance on studying at undergraduate and graduate studies at the Faculty of Forestry of the University of Zagreb http://www.sumfak.unizg.hr/site/assets/files/3174/14_pravilnik_o_studiranju_na_preddiplomskim_i_diplomskim_studijima.pdf
2. Guidelines for conducting professional practice

Final paper

DT-SS 132

ECTS 4

Gradeing
Sufficient (2)
Good (3)
Very good (4)
Excellent (5)

Course Content:

Final paper is individual written work based on professional research. It is written in a professional form and implies a student's time burden of research work equivalent to a score of 4 ECTS. The final paper is usually made during the 6th semester of the undergraduate study, and ends with defense (presentation and answering questions).

Type of course:

Final paper – Wood technology (obligatory course, VI semester, 3rd year)

Learning outcomes and evaluation methods

Learning outcome (LU)	Verification method
be able to apply the previous knowledge to solve a professional problem for the chosen topic	Final paper
create a timetable for work in accordance with the given deadlines for final paper development in phases	Final paper
design a methodology for writing professional paper	Final paper
apply the methodology of writing professional paper	Final paper
present your work in written and oral form	Final paper, Final paper defense

General competencies

Final paper is a work in which a student analyzes and demonstrates knowledge of the foundation of the profession, that is, demonstrates the ability for collecting literature and interpreting the previous knowledge, and their application. It involves the application of knowledge acquired through the study program, the ability to solve a particular professional problem using available literature, experience in writing professional papers and oral presentations.

Other

A student under the guidance of a mentor conducts a research and writes a final paper on the subject accepted by the Vice dean of Wood technology department . Final paper is defended before the mentor for the grade, which ends the undergraduate study.

Working methods:

Teacher responsibilities:

Organize consultations every week according to the schedule. Provide the student with the necessary help and instructions when submitting themes and planning final work. Lead a student when setting up a subject, analyzing and processing data. Introduce the student with the ethical approaches to writing the final paper. Review the final work and give the finishing instructions before binding. Support the student prepare for the final work defense.

Student Responsibilities:

Report the topic of final paper, conduct research and develop paper in accordance with the Guide setting apperance of final papers. Attend consultations and present progress in research and paper development. Observe and follow the instructions of the mentor. Observe the ethical approach to writing the final paper. Prepare the presentation and defend the final paper before the mentor.

Methods of grading

Monitoring elements	Share in grade	Score scale/grade	Grade	Number of direct work hours	Number of hours for an average student outside the direct lectures	ECTS
Final paper	70%	See decription	sufficient (2)		90	3
			good (3)			
			very good (4)			
			excellent (5)			
Final paper defense	30%	See decription	sufficient (2)		30	1
			good (3)			
			very good (4)			
			excellent (5)			
TOTAL	100%			-	120	4

Detailed description of evaluation elements for lecturer, excercises, partial or final exams:

Monitoring elements	Description	Deadline	Compensation
Final paper	sufficient (2) - There are material gaps in the paper, the basic terms are superficially explained and there is no deeper knowledge of the subject good (3) - Only some of the relevant aspects of the topic are presented, the literature has been processed correctly, but only partially. The scientific and vocabulary is basic very good (4) - The paper is well structured, facts are presented, relevant theories and up-to-date data, literature is correctly processed, but access is lacking in creativity. excellent (5) - The paper is logically well structured factually accurate and conceptually well defined, the structural parts are connected, relevant and recent literature is used, and the approach to theme from different perspectives is visible.		
Final paper defense	sufficient (2) - Exposure is the presentation of the read text, the answers to the questions are scarce. good (3) - The presentation is clear and informative, but without the ability to connect theory with practice. Ability to answer only simple questions. Very good (4) - The presentation is clear and substantive, the answers to the questions are only correct and do not indicate deeper consideration of the topic. excellent (5) - The presentation is clear, highly informative, answers to the questions are accurate and creative.		

Obligatory literature

1. Ordinance on studying at undergraduate and graduate studies at the Faculty of Forestry of the University of Zagreb
2. Form PDS 01 Request for approval of the topic of final paper
3. Instructions on appearance and content of the final paper
4. Available at http://www.sumfak.unizg.hr/hr/studiji/studij-drvne-tehnologije/preddiplomski-strucni-studij/dokumenti/