



University of Zagreb Faculty of Forestry

Course Catalogue for Incoming Students

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Study at Faculty of Forestry

The Faculty of Forestry is an internationally recognized institution which offers a high level of education for careers in forestry, wood processing and furniture manufacture. The Faculty is a place for permanent education and for the development of an intellectual with a broad spectrum of knowledge, whose work is recognized not only in the professional field but also in the social life of Croatia. The Faculty draws on the celebrated past and activities of its forerunners. We are a renowned profession which has its written rules and values, but also unwritten rules which you will learn in practice. We are well known for our close collaboration and solidarity.

Incoming Students

Exchange students are students participating in a formal exchange programme between their home university and the University of Zagreb (i.e. Erasmus+, CEEPUS, Bilateral agreements etc.)

Incoming students can choose courses from the list „Courses in English Available to Incoming Students in Academic Year 2019./2020.“ in this catalogue, published on Faculty’s website. Courses in catalogue are divided according to study level (undergraduate or graduate) and according to Faculty sections (Forestry, Wood Technology). Undergraduate students can choose courses only from the undergraduate level but graduate students can choose from both levels. All courses are awarded with credits using the ECTS system.

At the moment, Faculty of Forestry does not offer full degree study programs (undergraduate or graduate) in English language.

Study Programmes

Faculty of Forestry offers 3 Undergraduate Study Programmes, 5 Graduate Study Programmes, 8 Specialist Postgraduate Study Programmes and one Postgraduate Doctoral Study Programme.

Undergraduate Study Programmes (BSc)
Forestry
Urban Forestry, Nature Conservation and Environmental Protection
Wood Technology
Graduate Study Programmes (MSc)
Forestry - Silviculture and Management Planning with Wildlife Management
Forestry - Techniques, Technologies and Forestry Management
Urban Forestry, Nature Conservation and Environmental Protection
Design of Wood Products
Wood Technology Processes
Specialist Postgraduate Study Programmes (8)
Postgraduate Doctoral Study Programme (1)

The undergraduate study programmes have duration of 3 years (6 semesters; 180 ECTS credits).

The graduate study programmes have duration of 2 years (4 semesters; 120 ECTS credits).

Upon graduation there is a possibility to continue the studies at the doctoral level in duration of 3 years (180 ECTS) or at specialist level in duration of 2 years (120 ECTS).

At all programme levels, students participate in classes in newly equipped classrooms and laboratories, and at the training and research forest centres.

Field classes enable students to acquire practical knowledge, and are held at the Faculty's 5 forest centres.

These are distributed among all the important climatic zone forest communities in Croatia, of which the Faculty is particularly proud.

Learning outcomes at program level

Undergraduate Study Programmes (BSc)

Forestry

By completing this study programme, students will acquire the following competences to enable them fully to: perform the activities of forest district officer, or expert associate in all forestry activities; work on conducting the forest inventory and participate in implementing the forest management programme; perform all professional field work on the establishment, care and renewal of forest stands; become acquainted with mechanical equipment, techniques and standard technologies applied in forestry - primarily in obtaining wood from natural forests, forest cultures and plantations. Furthermore, Bachelors of Forestry are trained to perform professional work on the amelioration and planning of forestland in the Mediterranean region, to protect forests against abiotic and biotic factors, especially against forest fires, and to manage the professional tasks of implementing wildlife management programmes and plans, organising hunting grounds, and cooperating on the drafting of environmental studies and spacial plans. They will also be acquainted with the techniques and technology of building forest roads, the sale of wood assortments, the organisation of production in forestry, and health and safety at work in forestry. They are qualified to carry out individual work in private enterprises and as forest district officers, or to be involved in team work related to all other tasks in forestry, nature and environmental protection.

Urban Forestry, Nature Conservation and Environmental Protection

The undergraduate study of Urban Forestry, Nature Conservation and Environmental Protection is a new study programme based on the reform of similar studies in Europe, and partly derived from previous study programmes in the Forestry Section.

A Bachelor of Urban Forestry, Nature Conservation and Environmental Protection is qualified to be a professional associate in performing forestry tasks carried out in urban environments (biological and technical work in the planning of parks and green areas, plant protection in urban areas, arboculture, nursery production, seed production, etc.) and tasks related to nature conservation and environmental protection (professional tasks in protected nature sites, cooperation in conducting environmental impact studies and drawing up spatial plans, integrated environmental management and legislation, environmental monitoring, etc.).

Wood Technology

The undergraduate study of Wood Technology provides basic knowledge of a broad range of technical and natural sciences and professional knowledge and skills required by the modern development of wood processing industries: knowledge about the structure of wood and the technical characteristics of wood; basic knowledge of wood protection; and basic technical knowledge to monitor and control the work of machinery and transport equipment. Students will be qualified to supervise wood-technology processes and conduct particular technological operations, participate in the procurement of materials and other equipment, inspect product and performance quality, and acquire professional and operational knowledge to manage wood technology processes.

Bachelors of Wood Technology are qualified to perform professional tasks in all types of enterprises involved in wood processing: they can work as associates in activities related to the trade and distribution of wood products,

and perform particular activities and tasks in wood industry enterprises. Bachelors of Wood Technology are also qualified to supervise the process of drying wood and wood material, to monitor the implementation of technological procedures in a sawmill, in the area of the production of wood veneer, plywood and chipboard sheets, in furniture production, wood joinery, and other wood products.

Graduate Study Programmes (MSc)

Forestry - Silviculture and Management Planning with Wildlife Management

The competences acquired by completing this study programme are as follows: knowledge of the status and trends of the forestry profession in the country and in the world; full competence to manage forest ecosystems in all their aspects and to implement a forest management programme; to be involved in the establishment and cultivation of forests, the amelioration and planning of forest areas in the Mediterranean region, and in the protection of forests against abiotic and biotic factors, especially against fires; to draw up forest and wildlife management programmes and plans; the organisation of hunting grounds; to draw up environmental impact studies; to draw up forest area spatial plans; to perform the activities of expert manager and supervisor of nature conservation and environmental protection; to be involved in the market placement of wood assortments; to be competent in health and safety at work in forestry, in the organisation of forestry production, and in the management of all forestry activities; and to be prepared for professional and scientific development in various forms of training and postgraduate studies.

A Master of Science in Silviculture and Management Planning with Wildlife Management is fully prepared for individual and team work in the field of silviculture and in the protection of forests, the planning of forests and wildlife activities, and possesses additional applied knowledge in the field of techniques, technology and forestry management.

Students will be qualified to perform the following tasks: the most complex tasks in all forms of forest organisations from forest districts to a complex company; the tasks of county and state inspectors; tasks in forest and wildlife advisory services; the tasks of expert associates in research institutions in the field of forestry and wildlife management, of directors, expert managers and supervisors at protected nature sites, of managers and associates in the trade of forest products; forest entrepreneurial tasks and activities; teaching in secondary vocational and related schools; and tasks and activities in publishing and the media with regard to the forestry profession.

Forestry - Techniques, Technologies and Forestry Management

The competences acquired by completing this study programme are as follows: knowledge of mechanical equipment, techniques and standard and cutting-edge technologies applied in forestry, primarily in obtaining wood from natural, even-age selection forest stands, cultures, plantations and energy forests; knowledge of timber and non-timber forest products and their movement from the place of production to the market through the forest and over a network of forest and public roads; knowledge of the methods of preparing and planning technical forestry work; methods, techniques and technologies of opening up forests, or of designing and building a network of forest roads; selection of mechanical equipment and technologies based on cost analyses and other criteria; knowledge of managing forest, human and technical resources, and marketing knowledge related to forest timber products and non-timber forest products. Students will additionally acquire applied knowledge in ecology and forest protection, as well as forest management.

The study programme develops the students' management competence and capacity to make independent and team decisions of a professional (business) nature, and the capacity to embark on a doctoral study and to follow professional research paths.

Students will be qualified to perform the following tasks: complex tasks in forestry related to forest offices and forest districts as the lowest forestry structural units in the vertical structure; tasks of county and national institutions in charge of forestry; inspection services; activities and tasks of forestry entrepreneurship; activities and tasks in development, research and educational institutions; trade in forest products in domestic and foreign markets; trade in equipment; professional publishing and media activities.

Urban Forestry, Nature Conservation and Environmental Protection

The competences acquired by completing this study programme are as follows: knowledge of urban forestry, nature conservation and environmental protection in the country and in the world; competence to draw up environmental impact assessment studies; planning and management in forest ecosystems of protected nature sites; spatial analysis and evaluation; integrated protection in protected nature sites; environmental monitoring; soil and water management and protection; recovery of degraded habitats; wildlife management; competence to draw up environmental impact studies and manage specific urban forest ecosystems; to conduct analyses and evaluations and the landscaping of park areas; knowledge of horticultural dendrology, ornamental plant production, integrated protection of woody species in urban areas; planning and management of forestry activities in urban environments; competence to draw up management programmes and plans in protected nature sites and urban forest ecosystems; and to be prepared for professional and scientific professional development in various forms of training and postgraduate studies.

By acquiring knowledge and skills through this graduate study programme, a Master of Urban Forestry, Nature Conservation and Environmental Protection is fully prepared for individual work and team work in the field of urban forestry, nature conservation and environmental protection.

Students will be qualified to perform the following tasks: the most complex tasks in all types of organisation of protected nature sites (strict nature reserves, national parks, special nature reserves, nature parks, natural monuments or features, protected landscapes, forest parks, and monuments of park architecture) of state, county and city administrations, including advisory services and inspection; tasks within the framework of horticultural and utility companies; tasks of expert associate and manager in research and scientific institutions in the field of urban forestry; nature conservation and environmental protection; tasks of professional manager and supervisor in nature conservation and environmental protection; teaching and education in secondary vocational and related schools; and tasks and activities in publishing and the media related to urban forestry, nature conservation and environmental protection.

Wood Technology Processes

The competences acquired by completing this study programme are as follows: knowledge of the status and trends in the wood processing sector in the country and abroad; scientific knowledge about wood as a renewable resource; full competence to manage wood technology processes, production planning and accounting; management of all activities in the wood industry; being prepared for professional and scientific development in various forms of training and postgraduate studies. A Master of Science in this area is fully prepared for individual work and team work in the field of sawmilling and hydrothermal wood processing, wood protection, in the field of technology for the production of veneers, plywood and chipboard sheets, and technology for the production of final wood products, especially the management of the surface processing of wood and wood products. A Master of Science in this field deals with technology design, production development and advancement, production optimisation, and also possesses additional applied knowledge in the field of techniques and management in the wood industry. He or she is expected to write a thesis which is either an experimental professional or research paper.

Masters of Science are qualified to perform the most complex tasks in all types of wood processing companies, and in trade and consultancy and design companies; they can work as expert associates in research institutions in the field of wood and wood technology, as managers and associates in trade in wood products; they may

perform activities and tasks in a wood industry enterprise, work as teachers in secondary vocational and related schools, and perform tasks and activities in publishing and the media with regard to the wood processing profession.

Wood Product Design

The competences acquired by completing this study programme are as follows: knowledge of the status and trends in the wood processing sector in the country and abroad; scientific knowledge about wood as a renewable resource; full competence to manage wood technology processes, production planning and accounting; management of all activities in the wood industry; being prepared for professional and scientific development in various forms of training and postgraduate studies. A Master of Science in this area is fully prepared for individual work and team work in the field of sawmilling and hydrothermal wood processing, wood protection, in the field of technology for the production of veneers, plywood and chipboard sheets, and technology for the production of final wood products, especially the management of the surface processing of wood and wood products. A Master of Science in this field deals with technology design, production development and advancement, production optimisation, and also possesses additional applied knowledge in the field of techniques and management in the wood industry. He or she is expected to write a thesis which is either an experimental professional or research paper.

Masters of Science are qualified to perform the most complex tasks in all types of wood processing companies, and in trade and consultancy and design companies; they can work as expert associates in research institutions in the field of wood and wood technology, as managers and associates in trade in wood products; they may perform activities and tasks in a wood industry enterprise, work as teachers in secondary vocational and related schools, and perform tasks and activities in publishing and the media with regard to the wood processing profession.

Academic Calendar 2019/2020

Will be published soon.

Student Support

Faculty of Forestry

International Relations Office

- room 146 (yellow building)
- International Relations Coordinator
Ms Katarina Korov
Phone: +385 99 263 3048
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- ECTS Coordinator
Assistant Professor Andreja Pirc Barčič, PhD
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Courses in English Available to incoming students in Academic Year 2019./2020.

Forestry Section Courses - Undergraduate Study Programmes (BSc)

ARBORICULTURE (code: 33828)

Original course title	Arborikultura	Status	obligatory
Semester	summer	Course teacher	doc. dr. sc. Vinko Paulić, doc. dr. sc. Damir Drvodelić
ECTS	5	Study level	BSc

Learning outcomes

Outcomes of this course are to introduce students to care and management of trees and small groups of trees. Through this course student will be introduced on characteristics of site for establishment of trees, assessment of benefits from newly planted trees, selection of plants, modifying and managing the site, planting techniques and special management practice in managing trees in urban areas.

Course content

Aims of this course are to introduce students to theoretical background and practical skills needed for managing plantings and trees. Increase in urbanization of built areas and growing need of citizens for recreation and awareness on importance of trees and greenery on quality of life sets challenge for increased care of city greenery. In wider context this course will encompass all other plantings of natural or artificial origin. Due to severe conditions for planting trees in urban and periurban areas, major attention would be given on improvement of conditions for growth and development of city greenery. Special consideration would be given to topic of pruning of individual branches and whole tree crowns with objective of reducing potential for property damage and personal injury. Assessment of tree value and tree inventory are also encompassed through course. The course is set on basis of modern forestry science and it is executed through lectures, exercises, field work and term papers. Teaching is performed with aid of modern teaching equipment.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer in English. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Grey, G.W. The Urban Forestry: Comprehensive Management. New York. 1996.
2. Harris, W.R. Arboriculture, Integrated management of Landscape Trees, Shrubs, and Vines. Prentice Hall. Fourth edition. 2004.
3. Brown, G.E. The Pruning of trees, Shrubs and Conifers. Timber press Oregon. 2004.
4. Shigo, A,L. Moderne Bumpflege: Grundlage der Baumbiologie. Bernard Thalacker Verlag. 1994.
5. Shigo, A,L. Modern Arboriculture. 1991.
6. Gilman, E, F. Illustrated Guide to Pruning. Delmar. Second Edition. 2002.
7. Badler, Hartmut. Die Wurzeln der Stadbaume. Paul Parey Verlag.Berlin. 1998.
8. Miller, RW. Urban forestry: Planing and Managing Urban Green Spaces, 2nd ed. Upper Saddle River, NJ: Prentice Hill. 1997

Forms of teaching

Lectures, exercises, field work and term papers.

Assessment methods

Written and oral examination-passing of written part conditional for oral exam entry. Preconditions: course attendance, finished exercise and field work.

BASIC OF WILDLIFE MANAGEMENT (code: 33863)

Original course title	Osnove lovnog gospodarjenja	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Marijan Grubešić, prof. dr. sc. Krešimir Krapinec, doc. dr. sc. Kristijan Tomljanović
ECTS	6	Study level	BSc

Learning outcomes

Students will be introduced to hunting as a complex area that includes biological, technical and economic part. Through lectures, exercises and field work will be prepared for the tasks to be carried out in practice on the task of breeding, protection and hunting of wild animals.

Course content

Historical hunting review. Hunting management as a sporting, recreational and economic activity. Understanding the types of wildlife begins its classification in the scientific, legal and hunting grounds. Then, each and every species of game is processed morphologically and biologically in detail. Wild game breeding techniques such as natural breeding, breeding in a fenced area and combined breeding. Disease and wildlife protection provides an overview of infectious, non-parasitic, arthritic and artificial growing diseases.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer in English. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

Zoologija divljači i lovna tehnologija; LOVSTVO; Lovstvo 1967: Lovački priručnik

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentations.

Forestry Section Courses - Graduate Study Programmes (MSc)

DESIGN OF FOREST ROADS (code: 33908)

Original course title	Projektiranje šumskih prometnica	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Tibor Pentek
ECTS	6	Study level	MSc

Learning outcomes

The primary aim and task of this course is, through theory and practice to introduce students with the forest road design process, methods and techniques of collecting, processing field data and critical interpretation of the results. Students are trained for independent collecting and analysing of comprehensive documentation necessary for the main project of forest road through different working methods.

Course content

This course describes the second phase of establishing an optimal forest road network in the field – the designing phase. It describes a complex design process, defines the main types of projects with an emphasis and a detailed classification for the main project of a forest road. Students will gain knowledge regarding technical conditions and prescribed technical characteristics of forest roads in Croatia and the world. Students are familiarised with working phases in the field, methods and procedures of collecting field data using the classical working method and learning how to process collected field data in various software. Within the framework of the curriculum are the rules and professional settings that students need to observe in detail and during the development of horizontal and vertical alignment of the forest road. The horizontal/vertical alignment and the cross-sections are thoroughly analysed. Students learn about the methods of studying the horizontal curves, the extension of the pavement in the horizontal curves and the transitional curves. Students are introduced with the problem of unobstructed and rounded joints, vertical curves, and with defining the final vertical alignment. They also gain

knowledge on earth works estimations, distribution diagrams, equalization and material transport. Various techniques and technologies of forest road construction and maintenance are presented to the students together with various methods of improving soil characteristics during the construction of forest roads.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Pentek, T., 2014: Projektiranje šumskih prometnica (.pptx i .pdf predavanja 1-16), Šumarski fakultet Sveučilišta u Zagrebu.
2. Pičman, D., 2007: Šumske prometnice (sveučilišni udžbenik), Šumarski fakultet Sveučilišta u Zagrebu, s. 1-460, odabrana poglavlja.
3. Šikić, D. i dr., 1989: Tehnički uvjeti za gospodarske ceste, Znanstveni savjet za promet JAZU, Zagreb, s. 1-40, odabrana poglavlja.
4. Anon., 2002: Forest Road Engineering Guidebook, B.C. Ministry of Forests, p. 1-208, odabrana poglavlja.
5. Anon., 2011: Colorado Forest Road Field Handbook, Colorado State Forest Service, p. 1-142, odabrana poglavlja.
6. Lacombe, G., 1999: Forest Roding Manual, Liro Forestry Solutions, New Zeland, p. 1-404, odabrana poglavlja.
7. Ryan, T. et al., 2004: Forest Road Manual, Guidelines for the design, construction and management of forest roads, COFORD, Dublin, p. 1-156, odabrana poglavlja.

Forms of teaching

30 hours of lectures, 30 hours of parctical work, 4 days of field education.

Assessment methods

Verbal examination.

MECHANISATION OF TIMBER LOGGING (code: 33901)

Original course title	Mehanizacija pridobivanja drva	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Marijan Šušnjar, doc. dr. sc. Zdravko Pandur
ECTS	7	Study level	MSc

Learning outcomes

Choose the most suitable forest machine based on technical, ergonomic and environmental properties in certain forest stand conditions.

Critically evaluate the application of different performance of forest machines depending on the work area.

Develop guidelines for the operation of forest vehicles in order to increase productivity and reduce the impact on soil and environment.

Course content

Chainsaws - historical development, parts and appliances, energy and environmental characteristics of two-stroke engines, chain saw chain, ergonomic features, noise and vibration measurement, guidelines for the development of chainsaw blades.

Harvester - historical development, technical features, harvester-forwarder system, harvester heads, ergonomic, energy and environmental features harvester.

Skider- historical development, construction types, application and development of skidders in Croatia, parts, technical features, transmission, diesel engine principle, skidder load distribution per axles, skidder pulling feature and tractive performance, ergonomic features, FOPS and ROPS features of cabins, forest winches, winch drive, nominal power of the winch, resistance forces, choice of winch rope.

Adapted Agricultural Tractor - history of forestry applications, hydraulic tractor hoisting, tractor stability during timber extraction, tractors with forest semi-trailers, tractors with forest winches, tractors with hydraulic cranes, silvicultural tractors - technical features

Forwarder - historical development, construction, application and development of forwarders, parts, technical features, transmission, bogie wheel system, environmental benefits of forwarders, calculation of forwarder wheel index.

Forest trucks for transport of timber - construction and forestry upgrades, permitted axle and dimension loads.

Forest cable yarders - technical features, ropes, strains in ropes, carriages.

Chippers for forest biomass- technical features

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Powerpoint presentations from lectures
2. Almqvist, R. Gellerstedt, S., Tobish, R. , 2005: Ergonomic Checklist for Forest Machines. A handbook produced by ErgoWood, a project co-financed by the European Commission Swedish University of Agricultural Sciences, Uppsala, Sweden, 1-23
3. Anttila, T., 1998: Predicting the rut formation in forest soils by use of the WES method. Department of Forest Resource Management University of Helsinki, Publications 17, 1 – 53.
4. Arnup, R.W., 1998: 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.
5. Directive 2002/44/EC Of the European Parliament and of the Council: The minimum health requirement regarding the exposure of workers to the risks arising from physical agents (vibration). Official Journal of the European Communities, 177.p.
6. EU-OSHA, 2008: Occupational safety and health in Europe's forestry industry. European agency for safety and health at work. <https://osha.europa.eu/en/publications/e-facts/efact29/view>. 1-13.
7. Gellerstedt, S., Eriksson, G., Frisk, S., Hultåker, O., Synwoldt, U., Tobish, R. Weise, G., 2006: European ergonomic and safety guidelines for forest machines. A handbook produced by ErgoWood, a project co-financed by the European Commission Swedish University of Agricultural Sciences, Uppsala, Sweden, 1-101.
8. Hellström, T., Ringdahl, O., 2011: Intelligent vehicles in forestry. Umeå University. 1-46.
9. Horvat, D., Šušnjar, M., 2003: Temeljni sigurnosni i tehnički zahtjevi ISO normi za konstrukciju skidera, studija u okviru projekta "Razvoj, izrada i ispitivanje prototipa specijalnog šumskog vozila - skidera mase 7t", programa TEST Ministarstva znanosti, obrazovanja i športa RH, 1-98.
10. Inoue, M., Tsujii, T., 2003: Management, technology and system design of mechanized forestry in Japan. Textbook of forestry mechanization technology, Forestry Mechanization Society, Akasaka, Minato-ku, Tokyo, Japan, Forestry Machine Series No. 92, 1-122.
11. Lewark, S., 2005: Scientific reviews of ergonomic situation in mechanized forest operations. Swedish University of Agricultural Sciences, Uppsala, Sweden, 1-182.
12. Löfroth, C., Rådström, L., 2006: Fuel consumption in forestry continues to fall. Results from Skogforsk No. 3.
13. Rieppo, K., Kariniemi, A., Haarlaa, R., 2002: Possibilities to develop machinery for logging operations on

sensitive forest sites. Department of forest resource management, University of Helsinki, Finland, Publications 29, 1-30.

12. 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.

13. Wong, J., Y., 2001: Theory of ground vehicles. J. Wiley & Sons Inc. USA. 1-528.

Forms of teaching

45 hours of lectures, 30 hours of practical work (18 hours of calculation tasks and 12 hours of measurement tasks), 3 days of field education.

Assessment methods

The evaluation of students' knowledge and achievements has been conducted during the classes and by written and oral exams.

APPLIED ZOOECOLOGY (code: 73827)

Original course title	Primijenjena zoekologija	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Josip Margaletić
ECTS	2	Study level	MSc

Learning outcomes

This course should familiarize students with history and development of zoecology as a science as well as basic environmental concepts and principles. Students are acquainted with the basic ecological factors that lead to the excessive reproduction of certain animal species which can result in significant damage in forest as well as urban ecosystems.

Course content

The course is planned to cover following topics: Zoecology as a Science. Organism, set of organisms and space. Abiotic (temperature, humidity, light, air etc.), biotic (homotypic, heterotypic, self-preservation) and trophic (type and manner of nutrition, quantity and quality of food) factors that affect the body. Increasing animal species as a possible cause of damage to tree species in urban environments and in protected natural facilities. Ecological valences of animal groups. Spatial distribution of animal populations in urban and forest ecosystems. Habitus and genetic structure of the population (natality, mortality, age structure). Population theories (physical, biotic, trophic, township theory, constitutive, synthetic). Zoocenosis. Organization of animal communities. Zoogenic succession. Periodicity of animal groups inhabiting forest ecosystems of protected natural and urban green areas. Linkage of animal population structure with changes in urban greenery and forest ecosystems. Impact of man on animal ecosystems.

Language

All teaching activities will be held in Croatian. Foreign students will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Foreign students will be provided to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Androić, M. 1970. Osnovi zoekologije s osobitim osvrtom na entomofaunu. Izdavačko-tiskarsko poduzeće 'A.G. Matoš', Samobor. 152 str.
2. Elton, C. 1968. Animal Ecology, Metheun&Co. Ltd and Science Paperbacks, London, 207 pp.
3. Stoddart, D.M. 1979. Ecology of small mammals. Chapman and Hall Ltd., London. 279 pp.
4. 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.
5. Zabel, C.J., Anthonz, R.G., 2003. Mammal Community Dynamics, Cambridge University Press, 709 pp.

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentations.

BEHAVIOURAL ECOLOGY (code: 73822)

Original course title	Behavioural ecology	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Josip Margaletić
ECTS	2	Study level	MSc

Learning outcomes

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

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 individual interests, social behaviour and life history and the role of behavioural ecology in conservation biology).

Language

All teaching activities will be held in Croatian. Foreign students will have the opportunity to attend additional office hours with the lecturers and be provided with teaching materials and literature in English.

Literature

1. Alcock J. Animal Behavior: An Evolutionary Approach. Seventh Edition. Sunderland (MA): Sinauer Publishers, 2001
2. Eibel-Eibesfeldt, I. Grundriss der vergleichenden Verhaltensforschung. München : Verlag Piper, 1969.
3. Pullin, A. S. Conservation Biology. Cambridge University Press, 2002.

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentations. Obligatory class attendance.

ETHOLOGY (code: 86139)

Original course title	Ethology	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Josip Margaletić
ECTS	2	Study level	MSc

Learning outcomes

This course should familiarize students with central features of animal behaviour and importance of different behavioral 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.

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.

Language

All teaching activities will be held in English as well as all learning material in English will be provided to the students.

Literature

1. Alcock J. Animal Behavior: An Evolutionary Approach. Seventh Edition. Sunderland (MA): Sinauer Publishers, 2001
2. Bolton, M. Conservation and the Use of Wildlife Resources. Chapman & Hall, 1997.
3. Caro, T., ed. Behavioral ecology and conservation biology. Oxford University Press, New York, 1998.

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentations. Obligatory class attendance.

INNOVATION IN FORESTRY (code: 33956)

Original course title	Inovacije u šumarstvu	Status	elective
Semester	winter	Course teacher	izv. prof. dr. sc. Mario Šporčić
ECTS	2	Study level	MSc

Learning outcomes

After completing this course the student will be able to:

Present basic theoretical insights on innovation. Argue the importance and need to strengthen innovation in forestry. Analyze innovation processes and innovation types. Assess the level of innovation activity in the company and the impact of internal and external factors. Suggest measures to upgrade innovation activities. Evaluate the degree of creativity of individual people. Formulate procedures to encourage creative thinking and

innovative problem solving. Design innovative solutions and projects in the field of forestry production and operations. Support an innovative projects by knowing the legal regulation and institutional support of innovation activities in Croatia (and Europe).

Course content

Definition and types of innovation. Models and phases of innovation process. Innovation systems and innovation at company Level. Influencing factors of innovation activity. Innovation monitors. Role and importance of innovation. Characteristics and status of innovation in forestry - framework conditions for innovations, innovation behavior of forest owners and forest managers, types of innovations, degree of novelty and outcome of innovations, impulses and information for innovation, support and obstacles. The relationship between creativity and inventiveness. Process and phases of creative thinking. Characteristics of creative people. Techniques of encouraging creative thinking. Evaluation and selection of ideas/solutions. Obstacles to creativity. Examples of good practice from European and Croatian forestry - implemented innovations in the field of wood and non-wood products, environmental and recreational services, technological and organizational innovations. Legal regulation and institutional support for innovation in Croatia (and Europe).

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer in English. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Srića, V.: Creativity and Innovation Management: A storytelling approach. Kindle Edition, 2016. 177 p.
2. Šporčić, M., Posavec, S., Landekić, M., Pentek, T., Poršinsky, T., Lepoglavec, K., 2014: Development and Implementation of Innovations in Croatian Forestry.
3. Proceedings of JOINT 5th FEC & 47th FORMEC conference „Forest Engineering: Propelling the Forest Value Chain“, Gerardmer, France, 23-26 September 2014, 8 p.
4. Martinić, I., Vondra, V., Šporčić, M., 2007: Development of a new concept for improvement of forest techniques in Croatia – Areas of possible contributions. Croatian Journal of Forest Engineering, vol. 28 (1): 47-55.
5. Martinić, I., Šporčić, M., Vondra, V., 2006: Inovacijski procesi kao ključ provedbe Hrvatske šumarske politike. Glasnik za šumske pokuse, pos. izdanje 5: 703-715.
6. Rametsteiner, E., Weiss, G., Kubeczko, K.: Innovation and entrepreneurship in forestry in central Europe. Leiden Brill Academic Publishers, 2005., 179 p.
7. OECD, 2005: Guidelines for Collecting and Interpreting Innovation Data. Oslo Manual, 3rd edition. OECD, Luxembourg, 162 p.
8. Srića V.: Kako postati pun ideja. M.E.P. Consult, Zagreb, 2003.

Forms of teaching

Interactive lectures, student presentations, solving of individual problem tasks (15 hours of lectures).

Assessment methods

The evaluation of students` knowledge and achievements has been conducted during the classes and by written exams.

PLANNING OF TECHNOLOGICAL OPERATIONS (code: 33955)

Original course title	Planiranje tehnoloških operacija	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Tomislav Poršinsky
ECTS	2	Study level	MSc

Learning outcomes

To measure, analyse and categorise terrain characteristics to determine terrain trafficability. Select a suitable timber harvesting system based on terrain trafficability and vehicle mobility. Prepare documentation for a timber harvesting plan. Categorise different logistic systems in long distance timber transport. Choose a suitable method of calculating the cost of timber harvesting. Calculate the cost of machine operating hours.

Course content

Methods of planning technological operations for felling, delimiting, timber extraction and long distance transport. Preparation of documentation for timber harvesting plans, data analysis, computer simulations. Application of GIS and GPS in planning process of timber harvesting. Planning working operations from a strategical, to tactical and operational level in real conditions. Logistics in long distance transport - examples and state-of-the art technologies.

Language

All teaching activities will be held in Croatian and foreign students will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials.

Literature

1. B.C. Ministry of Forests. 2001. Forest Development Plan Guidebook. 2nd ed. For. Prac. Br., B.C. Min. For., Victoria, B.C. Forest Practices Code of British Columbia Guidebook.
2. Operational Efficiency in Forestry – Volume 2: Practice. A Logger's Guide to Forest Planning
3. Robert M. Shaffer, Extension Specialist, Timber Harvesting, Virginia Tech.
4. Sundberg, B. and Silversides, C.R., 1988. Operational efficiency in forestry: vol. 1: Analysis (Vol. 29). Springer Science & Business Media.

Forms of teaching

15 hours of lectures.

ZOOECOLOGY IN FORESTRY (code: 73826)

Original course title	Zoekologija u šumskim ekosustavima	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Josip Margaletić
ECTS	2	Study level	MSc

Learning outcomes

Students are acquainted with the basic ecological factors that 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.

Course content

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.

Language

All teaching activities will be held in Croatian. Foreign students will have the opportunity to attend additional office hours with the lecturers and be provided with teaching materials and literature in English.

Literature

1. Androić, M. 1970. Osnovi zoekologije s osobitim osvrtom na entomofaunu. Izdavačko-tiskarsko poduzeće 'A.G. Matoš', Samobor. 152 str.
2. Elton, C. 1968. Animal Ecology, Metheun&Co. Ltd and Science Paperbacks, London, 207 pp.
3. Stoddart, D.M. 1979. Ecology of small mammals. Chapman and Hall Ltd., London. 279 pp.
4. 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.
5. Zabel, C.J., Anthonz, R.G., 2003. Mammal Community Dynamics, Cambridge University Press, 709 pp.

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentation.

ENVIRONMENTALY SOUND TECHNOLOGIES

(code: 52493)

Original course title	Okolišno prihvatljive tehnologije	Status	obligatory
Semester	summer	Course teacher	prof. dr. sc. Tibor Pentek, prof. dr. sc. Tomislav Poršinsky doc. dr. sc. Zdravko Pandur
ECTS	4	Study level	MSc

Learning outcomes

Choose the most suitable forest machine for sensitive sites and damaged forest stands. Propose technical solutions on forest vehicles to reduce damage to forest soil. Calculate the energy balance of timber harvesting technologies. State modern technical solutions in the construction of forest vehicles. Plan the movement of forest vehicles in order to reduce fuel consumption and exhaust emissions. Differentiate and compare existing methods of soil bearing capacity estimation and critically evaluate their suitability for forestry. Measure soil bearing capacity based on current moisture content. Choose suitable forestry equipment (tires, chains and tracks) with the aim of increasing the environmental benefits but without decreasing the efficiency of the vehicle. Predict possible stand damage (soil, standing trees, water bodies etc.) due to timber harvesting operations and reduce damage to an optimal level.

Course content

Application of forest vehicles on sensitive sites. Tyres for forestry vehicles, semi-tracks and wheel chains. Technical solutions for reducing the mass of forest machinery and vehicles. Fuel consumption in the operation of forest vehicles. Influence of operating conditions on fuel consumption. Quantities and composition of exhaust gases. Ecological norms for exhaust gases. Technical measures for reducing the amount of harmful exhaust gases. Definition of energy balance, type and method of calculation, energy consumption of forest vehicles. Biofuels and biodegradable oils for lubrication and hydraulic systems. Development and construction of hybrid drives of forestry vehicles. Remote monitoring systems for forest machines and vehicles. Life cycle Assessment in forestry - its pros and cons and applicability in different conditions. Morphological analysis of vehicles. GIS applicability in determination of sensitive sites and bottle necks in relation to harvesting technologies.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Powerpoint lectures Anon., 2012: FP Inovation. Timber Transport Research – FERIC's Star Truck Project. Logging-on newsletter. Available on http://www.loggingon.net/timber-transport-research-ferics-star-truck-project_news_op_view_id_43
2. Finpro, 2010: Ev technologies in working machinery – Global view. 1-62.
3. Hellström, T., Ringdahl, O., 2011: Intelligent vehicles in forestry. Umeå University. 1-46.

4. Löfroth, C., Rådström, L., 2006: Fuel consumption in forestry continues to fall. Results from Skogforsk No. 3.
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. Rieppo, K., Kariniemi, A., Haarlaa, R., 2002: Possibilities to develop machinery for logging operations on sensitive forest sites. Department of forest resource management, University of Helsinki, Finland, Publications 29, 1-30.
7. 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

Forms of teaching

30 hours of lectures, 30 hours of practical work (calculation tasks and measurement tasks), 3 days of field work.

PLANNING OF FOREST ROAD NETWORK (code: 33904)

Original course title	Otvaranje šuma	Status	obligatory
Semester	summer	Course teacher	prof. dr. sc. Tibor Pentek
ECTS	6	Study level	MSc

Learning outcomes

The main goal of this course is to introduce students to the planning phase of establishing a forest road network. Students gain theoretical and practical knowledge and skills needed to address the issue of forest accessibility on primary and secondary forest infrastructure network with the aim of optimising the network through the rationalisation of construction costs, road maintenance and timber harvesting.

Course content

In this course, students gain knowledge on the first phase of establishing an optimal network of forest roads – the planning phase. The importance of the planning process in establishing a primary or a secondary forest infrastructure network is emphasised, as well as the historical development of forest access and accessibility on a national and an international level. Students learn the differences between the classical, relative and targeted forest accessibility. Students learn about the functional approach in terms of an economic, technical-technological, environmental-ecological and sociological aspect all in correlation to the forest accessibility. The course uses the Geographical Information System (GIS) as the basis for making the best possible decisions in forest accessibility. GIS and GPS (Global Positioning System) are used for the development of forest road catalogues. Students make detailed analysis of the methodological studies of primary and secondary forest infrastructure network through different computer models and computer simulations of individual solutions.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Pentek, T., 2009: Otvaranje šuma (*.pptx predavanja 1-15), Šumarski fakultet Sveučilišta u Zagrebu.
2. 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.
3. Pičman, D., 2007: Šumske prometnice (sveučilišni udžbenik), Šumarski fakultet Sveučilišta u Zagrebu, s. 1-460, odabrana poglavlja.
4. Dietz, P., H. Löffler, & W. Knigge, 1984: Walderschließung, Eine Lehrbuch für Studium und Praxis unter besonderer Berücksichtigung des Waldwegebaus. Verlag Paul Parey, Hamburg und Berlin, p. 1-196, odabrana poglavlja

Forms of teaching

30 hours of lectures, 30 hours of practical work, 2 days of field education.

Assessment methods

Verbal examination.

WILDLIFE MANAGEMENT I (code: 33891)

Original course title	Lovno gospodarenje I	Status	obligatory
Semester	summer	Course teacher	prof. dr. sc. Marijan Grubešić, prof. dr. sc. Krešimir Krapinec, doc. dr. sc. Kristijan Tomljanović
ECTS	3	Study level	MSc

Learning outcomes

Students will be introduced to game breeding technology in open hunting areas and enclosed space. It emphasizes the technical and economic elements of game breeding. Through lectures, exercises and field work will be presented obligations technologists on the farming and protection of wildlife.

Course content

Technology breeding of a certain species of wildlife in nature. Growing game in a fenced area. Technical elements of fenced hunting grounds and farms, fencing, fencing facilities and facilities in fenced area intended for game and hunters. Wildlife protection. Damage caused by game as well as damage prevention measures. Economic elements of game breeding, wild game products, and marketing of wild game and hunting management. Technology breeding of a certain species of wildlife in nature. Growing game in a fenced area. Technical elements of fenced hunting grounds and farms, fencing, fencing facilities and facilities in fenced area intended for game and hunters. Wildlife protection. Damage caused by game as well as damage prevention measures. Economic elements of game breeding, wild game products, and marketing of wild game and hunting management. Teaching will take place using modern aids and materials recorded and prepared by domestic and foreign hunting grounds and game farms. Through field teaching students will be introduced directly to open hunting grounds, enclosed farms and pheasant.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer in English. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

Zoologija divljači i lovna tehnologija; LOVSTVO; Lovstvo 1967: Lovački priručnik

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Written exam. Term papers and student oral presentations.

WILDLIFE FEEDING (code: 33924)

Original course title	Ishrana divljači	Status	elective
Semester	summer	Course teacher	prof. dr. sc. Krešimir Krapinec
ECTS	2	Study level	MSc

Learning outcomes

Assessment of habitat evaluation methods for small and big game rearing. Trophic capacity improving. Game and wildlife shelter designing.

Course content

Introduction to game and wildlife feeding ecology. Classification of fodders. Types of game and wildlife game and shooting crops and specificity on the animal feeding type level. Types of fodder plants and fodder crops arrangement. Types of shooting crops and arrangement of game and shooting crops in hunting grounds

Language

All teaching activities will be held in Croatian. Foreign students will have the opportunity to attend additional office hours with the lecturers and be provided with teaching materials and literature in English.

Literature

1. Weis, G. B., 1997: Anlage und Pflege von Wildäsungsflächen. Nimrod – Verlag, Suderburg., 320 pp.
2. Ian McCall, I., 1988: Woodlands for Pheasants. The Game Conservancy, Fordingbridge, 99 pp.
3. Robertson, P. A., 1992: Woodland Management for Pheasants. Forestry Commission Bulletin 106, London, 18 pp.
4. Anon., 1994: Game and shooting crops. The Game Conservancy, Fordingbridge, 97 pp.

Forms of teaching

Lectures, individual student oral presentations and term papers.

Assessment methods

Student oral presentations. Obligatory class attendance

Wood Technology Section Courses - Undergraduate Study Programmes (BSc)

TRANSPORT EQUIPMENT IN WOOD INDUSTRY (code: 33637)

Original course title	Transportna tehnika u drvnoj industriji	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Ružica Beljo Lučić
ECTS	5	Study level	BSc

Learning outcomes

This course aims at the acquisition of basic technical and technological knowledge related to monitoring and control of the work of transport equipment in wood industry, as well as to assessment and adaptation of the capacity of means of transport and their coordination with technological procedures. The course provides basic ground for the solution of less complex tasks and issues related to transport of wood and wooden materials. An individual should be able to:

- 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.
- Analyze influential factors on the basic characteristics of transported materials.
- 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.
- 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.
- 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.
- 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.
- Select the ventilator for the air conveyor system depending on the system parameters.

Course content

Purpose and task of transport. Historical development of transport. Basic forms of transport and transport equipment. Maximum load and capacity of means of transport of periodical and continuous supply. Measures of assessment 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 means of transport in wood industry. Means of transport in wood industry. Means of periodical supply. Winches. Lifts. Cranes. Industrial vehicles. Hand-operated industrial vehicles. Motor-operated industrial vehicles. Road vehicles. Manipulators, industrial robots. Means of continuous supply. Conveyors. Mechanical conveyors with a hauling element (belt conveyors, track conveyors, chain conveyors, elevators). Mechanical conveyors without a hauling element (roller, vibrating, worm, and gravity conveyors). Air conveyors. Components of air conveyors. Control of an exhaust system. A mean of transport in the function of the production technological process. Transport systems in a sawmill, in production plants of particle boards, in production plants of veneer and plywood and in production plants of furniture. Characteristics of transport equipment important in terms of choice and efficient application. Storage facilities in wood industry.

Language

Individual tasks and lectures in English.

Literature

1. Sever, S. 1988: Transport u drvnoj industriji, autorizirani rukopis, Zagreb, 1 - 26, 50 - 231.
2. Oluić, Č. 1991: Transport u industriji, Rukovanje materijalom I. dio, Sveučilišna naklada, Zagreb, 1 - 278.
3. Koharić, V.: Mehaničke operacije, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje, 1994.
4. Sandor, N.: Woodshop Dust Control, The Taunton Press, 2002.
5. Beljo Lučić, R. 2014: Transport in wood industry, presentation in Power Pointu (in English).

Forms of teaching

Independent solving of individual problem tasks, two written exams in the course of the lectures, a midterm exam related to practical work

Assessment methods

Written – calculations, oral – in case of a negative result or if students have not taken exams in the course of the lectures.

WOOD AS A BUILDING MATERIAL (code: 33647)

Original course title	Drvo u graditeljstvu	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Hrvoje Turkulin
ECTS	4	Study level	BSc

Learning outcomes

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 requirements 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.

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 acoustic 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.

Language & forms of teaching

Individual consultations and seminars in English, laboratory work in bilingual explanations by lecturers.

Literature

1. Turkulin i dr. 2002: Durability of wooden facades. *Drvna ind.* 53(1):33-48 i 53(3): 44-54.
- 2.*** 2005: Collection of offprints on the topic of durability and surface protection of wood in building. Faculty of Forestry, Zagreb University
- 3.*** 1993: Wood building technology. Ottawa: Canadian Wood Council. 3.Tomašević, J. (1999): Wood in flooring structures. Zagreb: Author's edition
4. PROHOLZ: Wood as construction material. ProHolz Austria, Vienna 2013.

Assessment methods

Verbal examination. Preconditions: positive consultations and revision of written reports.

WOOD CHEMISTRY (code: 46405)

Original course title	Kemija drva	Status	obligatory
Semester	winter	Course teacher	izv. prof. dr. sc. Alan Antonović
ECTS	8	Study level	BSc

Learning outcomes

The aim of the course is to provide the student with knowledge about wood elementary and group chemical composition as well as various wood chemical processing technologies (biorefineries). During the lectures students will learn to categorize, differentiate, define and apply chemical low and high molecular weight components and draw them out, name and describe their structural formulas. Furthermore, students will be able to describe and explain the polymerization mechanisms of biochemical pathways for the construction of all wood chemical substances, to explain their distribution in wood cells, and to describe, define and draw chemical bonds between different wood chemical components. During the practical work in the chemical lab, students will learn to organize and prepare chemical analyzes, isolate different wood chemical substances by knowing the isolation methods and handle different types of instruments for the analysis of wood chemical substances. Finally, students will know how to link and apply the acquired knowledge of wood chemistry in several curriculum programs at senior years of wood technology study, especially in various chemical wood processing technologies.

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, polysaccharides, cellulose, molecular and supramolecular properties, nature and classification of polyoses, xylans, mannans, glucans, galactans, pectins, fundamentals of aromatic compounds, phenols, precursors of lignin, synthesis 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.

Language

Teaching will be conducted in English and forms of instruction are a combination of presentations and practical work in chemistry lab. Studying the student's knowledge is done by the tasks they need to do during the classes and they need to write a "Chemical log". The final evaluation of the knowledge is done by written and oral exam.

Literature

1. J. Baeza, J. Freer, Chemical Characterization of Wood and Its Components in Wood and Cellulosic Chemistry, ed: D. N.-S. Hon, N. Shiraishi, Marcel Dekker, Inc., New York, 2001., pp. 275. - 384.
2. D. Fengel, G. Wegener, WOOD, Chemistry, Ultrastructure, Reactions, Walter de Gruyter, Berlin-New York, 1989.
3. D. N.-S. Hon, N. Shiraishi, Wood and Cellulosic Chemistry, Marcel Dekker, Inc. New York, 2001.

Forms of teaching

Lectures 2 (h/w)
Laboratory work 4 (h/w)

lectures, practical work in chemical lab, individual project tasks

Assessment methods

Colloquia, written exam, oral exam

FURNITURE DESIGN (code: 33661)

Original course title	Oblikovanje namještaja	Status	elective
Semester	summer	Course teacher	Danijela Domljan, PhD, assistant professor; Ivica Grbac, PhD, full professor
ECTS	3	Study level	BSc

Learning outcomes

The aim of the course is to provide the student to overcome and understand both theoretical, practical and methodological principles of furniture design as a complex interdisciplinary process aimed at developing skills for independent analytical and creative design and action.

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. Through the practical tasks/projects students will learn design methods and set design requirements in the aim to design a good product/ project concept.

Language

Teaching will be conducted in English. All forms of instruction are a combination of implementation of theoretical and practical skills in project tasks, gaining the knowledge of the teamwork, discussions, design methods (brainstorming, design analyses, etc.), presentations and exercises. The final evaluation of the knowledge is done by project presentation (oral presentation and final project map) of the student.

Literature

1. Ashby, M., Johnson, K (2002). Materials and Design, The Art and Science of Material Selection in Product Design. Oxford, UK: Elsevier Butterworth-Heinemann.
2. Lefteri C. (2007). Making it. Manufacturing techniques for product design, London, UK: Laurence King Publ. Ltd.
3. Neufert, E.; Neufert P. (2000): Architect's Data, 3rd ed., Blackwell, Science.
4. Panero, J.; Zelnik, M. (1979): Human dimensions & interior space. A Source Book of Design Reference Standards. Arch. Press, London.
5. Papanek, V. (1972): Design for the real world. Pantheon Books.
6. Pevsner, N. (2011): Pioneers of Modern Design, From William Morris to Walter Gropius, Penguin, London.
7. Quarante, D. (1994.): Elements du design industriel. 2ieme Edition, Paris, Ed. Maloine. (in croatian: (1991). Osnove industrijskog dizajna, Arhitektonski fakultet, Interfakultetski studij dizajna, Zagreb).
8. Thompson, R. (2007). Manufacturing processes for design professionals, Thames & Hudson, London, UK.
9. Thompson, R. (2011). Product and furniture design, the manufacturing guides, London, UK: Thames & Hudson.
10. Design journals and reviews

Forms of teaching

Education is provided in forms of course attendance and practical seminar and project tasks which follow the program units. Student is obliged to solve individual seminars and teamwork project tasks (furniture design concepts), to do field research, consultations, learn and use design methods to solve problems in design process. - Project task; - Seminar works;- Field work (visit of exhibitions, fairs or event related to arts or to furniture manufacture or design).

Assessment methods

Seminar presentation; Project presentation (map); Oral exam - Final presentation of the design concept in the project.

Wood Technology Section Courses - Graduate Study Programmes (MSc)

TECHNOLOGICAL PRODUCTION MANAGEMENT (code: 33707)

Original course title	Tehnološka priprema rada	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Denis Jelačić
ECTS	5	Study level	MSc

Learning outcomes

Student will get knowledge necessary for working in an enterprise on positions at all levels of management and project management. Student will get knowledge on preparing full technological documentation for existing or new products and production program.

Course content

Goals and tasks of production management in wood processing and furniture manufacturing. Technological and operational technology management and work allocation. Production management as a part of management subsystem. Production order as a basic information carrier for production management. Planning, launching, executing and control of production orders. Technological production management. Preparing of products constituents and their types. Material quantity estimation. Time cycle estimation, unit production time, production cycle time. Estimation of flow coefficient. Production cycle planning. Production order priorities. Material requirements planning. Optimal stock quantities methods. Capacity requirements planning. Production processes control and registration. Work allocation and production order settlement. Completing and launching of production documentation. Reporting and analysis of production plan fulfilment. Production statements, production order statements and analysis of fulfilment.

Production management documentation. Production management documentation flow-chart as a part of information subsystem. Management-information system designing in wood processing and furniture manufacturing. Basics for management-information system designing. Systematical, analytical and synthetical approach to designing.

Language

In agreement with the students enrolled in the course, the lecturer will provide as many teaching elements in English as possible, or in both English and Croatian for mixed groups (i.e., bilingual teaching materials and bilingual exams). Level 2 also includes additional individual consultations with foreign students (as in Level 1) for the teaching elements which will be held in Croatian.

Literature

1. Reid, R.D., Sanders, N.R.: Operations Management, Wiley, 2002.
2. Evans, J.R.: Applied Production and Operations Management, West, 1993.
3. Meredith, J.R.: The Management of Operations; A Conceptual Emphasis, Wiley, 1992.

Forms of teaching

Education is provided in forms of course attendance and practical exercises which follow the program units. Beside that, student is obliged to solve individual project tasks, to do field research, different aspects of consulting asking for help in solving problems in project management.

Assessment methods

Knowledge will be checked constantly by tracking students achievements, by evaluation of project tasks and seminars and by final written and oral exams (if necessary).

TECHNOLOGY OF WOOD BUILDING COMPONENTS (code: 33697)

Original course title	Tehnologija drvnih proizvoda za graditeljstvo	Status	obligatory
Semester	winter	Course teacher	prof. dr. sc. Hrvoje Turkulin
ECTS	5	Study level	MSc

Learning outcomes

Understanding of the connection between the function, service compliance and technical detailing of particular wood building components: windows, balcony 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.

Course content

Wooden windows and doors: function, general service requirements, types of products. Building physics – technical details in design of acoustic and thermal insulation 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.

Language & Forms of teaching

Individual consultations and seminars in English, laboratory work in bilingual explanations by lecturers.

Literature

1. Turkulin i dr. 2002: Durability of wooden facades. *Drvna ind.* 53(1):33-48 i 53(3): 44-54.
- 2.*** 2005: Collection of offprints on the topic of durability and surface protection of wood in building. Faculty of Forestry, Zagreb University
- 3.*** 1993: Wood building technology. Ottawa: Canadian Wood Council. 3.Tomašević, J. (1999): Wood in flooring structures. Zagreb: Author's edition
4. PROHOLZ: Wood as construction material. ProHolz Austria, Vienna 2013.

Assessment methods

Written and verbal examination. Preconditions: positive consultations and revision of written reports.

FURNITURE AND INTERIOR DECORATION (code: 33711)

Original course title	Namještaj i opremanje prostora	Status	elective
Semester	winter	Course teacher	Danijela Domljan, PhD, assistant professor; Ivica Grbac, PhD, full professor
ECTS	4	Study level	MSc

Learning outcomes

The aim of the course is to provide the student to overcome and understand both theoretical, practical and methodological viewing the space; to measure, imagine, plan, design and equip functional space units as well as to master analytical methods and harmonize functional groups of furniture with space according the function and users. Development of skills for comprehensive equipping of the interior with furniture and other equipment in the interior.

Course content

Introduction to space design – a designers' approach. Typology and requirements of the space. Aesthetic and functional components of space. Basic principles of interior design. Public Spaces and Private Spaces. Functional groups of rooms and furniture. Elements of architectural design. - Etiological review through interior design. - Introduction to theory of space planning. Organization and design of space. Ground-plan communication of rooms with furniture. Design principles and elements of dwelling space. Analysis of dwelling units and their function. – Modulor: Human being as organizational module of a space. - Design principles of space and furniture. Trends in designing contemporary space and furniture. Modern components in quality validation of practical and technical objects of industrial design in interior. Functional and design analysis of contemporary furniture and objects for use. Colours and materials in space. - 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.

Language

Teaching will be conducted in English. All forms of instruction are a combination of implementation of teoretical and practical skills in project tasks (interior design field project), gaining the knowledge of the teamwork, discussions, design methods (brainstorming, design analyses, etc.), presentations and exercises. The final evaluation of the knowledge is done by project presentation (oral presentation and final project map) of the student.

Literature

1. Asensio, P. (2002): Furniture design/Möbel Design/ Design de meubles/Meubles de diseño, teNeues Publishing Group, NewYork US, Dusseldorf Germany, London Uk, Barcelona Spain.
2. Ashby, M., Johnson, K (2002). Materials and Design, The Art and Science of Matreial Selection in Product Design. Oxford, UK: Elsevier Butterworth-Heinemann.

3. Cerver, F. A. (2000): Modernes wohnedesign; Könnemann, Köln
4. Lefteri C. (2007). Making it. Manufacturing techniques for product design, London, UK: Laurence King Publ. Ltd.
5. Neufert, E.; Neufert P. (2000): Architect's Data, 3rd ed., Blackwell, Science.
6. Panero, J.; Zelnik, M. (1979): Human dimensions & interior space. A Source Book of Design Reference Standards. Arch. Press, London.
7. Thompson, R. (2007). Manufacturing processes for design professionals, Thames & Hudson, London, UK.
8. Thompson, R. (2011). Product and furniture design, the manufacturing guides, London, UK: Thames & Hudson
9. *** (1999): Living spaces, Ecological Building and Design, Öko test, Könnemann, English Edition, (Edit.: Schmitz-Gunther T.), Mladinska knjiga tiskarna d.d., Ljubljana.
10. Design journals and reviews

Forms of teaching

Education is provided in forms of course attendance and project tasks which follow the program units. Student is obliged to solve individual tasks (seminars) and teamwork project tasks, to do field research upon field project, consultations, learn and use design methods to solve problems in interior design process. - Project tasks; - Seminar works;- Field work (interior design field project; visit of exhibitions, fairs or event and companies related to arts, design and furniture production).

Assessment methods

Seminar presentation; Project presentation (map); Oral exam - Final presentation of the design concept in the project.

PHISYCAL AND MECHANICAL PROPERTIES OF WOOD (code: 33945)

Original course title	Osnove tehnologije drva	Status	elective
Semester	winter	Course teacher	Prof. dr. sc. Tomislav Sinković
ECTS	2	Study level	MSc

Learning outcomes

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.

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 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 same species. Defects of wood. Classification. Natural defects, reaction wood, compression and tension wood, cross grain, variations in log form and shakes.

Language

Teaching will be conducted in English and forms of instruction are a combination of presentations and exercises. Studying the students' knowledge is done by the tasks they need to do during the classes. The final evaluation of the knowledge is done by interviewing the student.

Literature

Horvat, I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
 Karahasanović, A.: Nauka o drvetu, Sarajevo 1988, str. 1-426.
 Ugrenović, A.; Horvat, I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.
 Govorčin, S.; Sinković, T.: Ispitivanje fizikalnih i mehaničkih svojstava drva, 2004, Zagreb, interna skripta
 Giordano, G.: Tecnologia del legno, Volume I, Torino, 1971, str. 1-1086.
 Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
 Kollmann F. R., Cote, : Principles of Wood Science and Technology I solid Wood, New York, 1968, str. 1-592.
 Walter, F.: Pruftechnik der Holzindustrie, Leipzig, 1977, str. 1-318.
 Tsoumis, G.: Science and Technology of Wood, New York, 1991, str. 1-233.

Forms of teaching:

Lectures 1 (h/w)

Assessment methods:

oral exams

PROJECT MANAGEMENT (code: 33728)

Original course title	Upravljanje projektima	Status	elective
Semester	winter	Course teacher	Denis Jelačić
ECTS	4	Study level	MSc

Learning outcomes

Student will get knowledge necessary for working in an enterprise on positions at all levels of management and project management. In fields of investments planning student will get knowledge necessary to start and investment program and necessary for business planning in the company.

Course content

Projects within production system. Activities in the projects, project management, project management methods and techniques, Gantt charts forwards and backwards, network charts, network charts types and their application, resources necessary to do the project in wood processing and furniture manufacturing. Plan and project. Business plan and project approach, business plan, enterprise, project, investment project and investment study with examples from wood processing and furniture manufacturing. Entrepreneurial projects. Entrepreneur – investor information, analysis of purchase and sale markets with examples from wood branches, technical-technological analysis of production organization in wood processing and furniture manufacturing, location analysis, financial preparation of a project, efficiency evaluation, purpose of a business plan, entrepreneurial business plan structure, optimal entrepreneurial decision making, important business and time components of projects and business plans. Company value. Company business restrictions in wood processing and furniture manufacturing, basics of business accounting, interest account, simple and complex interest account, business with banks, loans, loan payments, economic evaluation of investments project. Time to pay-off of invested means, profits, profits rates.

Language

In agreement with the students enrolled in the course, the lecturer will provide as many teaching elements in English as possible, or in both English and Croatian for mixed groups (i.e., bilingual teaching materials and bilingual exams). Level 2 also includes additional individual consultations with foreign students (as in Level 1) for the teaching elements which will be held in Croatian.

Literature

1. Maylor, H.: Project Management, Prentice Hall, 2010.
2. Meredith, J.R., Mantel, S.J.: Project Management; A Managerial Approach, Wiley, 2012.

Forms of teaching

Education is provided in forms of course attendance and practical exercises which follow the program units. Beside that, student is obliged to solve individual project tasks, to do field research, different aspects of consulting asking for help in solving problems in project management.

Assessment methods

Knowledge will be checked constantly by tracking students achievements, by evaluation of project tasks and seminars and by final written and oral exams (if necessary).

QUALITY MANAGEMENT AND ASSURANCE (code: 33727)

Original course title	Upravljanje i osiguranje kvalitete	Status	elective
Semester	winter	Course teacher	doc. dr. sc. Krešimir Greger
ECTS	4	Study level	MSc

Learning outcomes

Students are trained to solve the issues of management and quality insurance by gaining general and specific knowledge in the field of management and quality insurance adjusted to specific production problems in wood processing and furniture manufacture.

Course content

Introduction. Basic concepts of management and quality insurance. 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 insurance (Crosby, Juran, Taguchi, Ishikawa, etc.). Position of quality in an organisation. The definition of full quality control, quality insurance, quality management and full 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 insurance. Development of management and quality insurance. Stages and steps in the development of management system and quality insurance; Comparison of traditional and modern firm organisation in wood processing and furniture manufacture. Methods and techniques of quality insurance; Quality circle, relation between production and process; Specific features of methods and techniques in management and quality insurance in plants for wood processing and furniture manufacture. International standard systems; New trends

in the development of quality insurance and management; European standardisation procedure, certification, and co-ordination of standards; System of management and quality insurance; System of standards, requirements, control, supervision, and system certification.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Figurić, M., (2000): Proizvodni i poslovni procesi u preradi drva i proizvodnji namještaja. Zagreb: Šumarski fakultet.
2. Gryna, F. M.; Chim Hai Chua, R.; De Feo, J. A. (2006): Juran's Quality Planning and Analysis: For, Enterprise Quality, McGraw-Hill Series in Industrial Engine, ISBN 0071254218.
3. Porter, L.; Tanner, S., (2012): Assessing business excellence, 2. izdanje, Routledge.
4. Dahlgaard, J. J.; Kristensen, K.; Khanji, G. K., 2007: Fundamentals of Total Quality Management, Routledge, UK.

Forms of teaching

Students do projects on management and quality insurance in a firm. Field work in specific productions.

Assessment methods

Tests in practical work, written exam, completed project, report on fieldwork, oral exam.

WOOD MODIFICATIONS (code: 33666)

Original course title	Modifikacije drva	Status	elective
Semester	winter	Course teacher	prof. dr. sc. Hrvoje Turkulin
ECTS	4	Study level	MSc

Learning outcomes

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.

Course content

Analysis of the grounds for wood modification (natural shortcomings-hygroscopicity, liability to weathering and biological deterioration), and improvement of technical properties – mechanical, thermal, acoustic properties, adhesion and permeability. Review of the modification technologies: surface modifications (physical – roughness and plasma treatments, application of chemical treatments, irradiations, finishing). Bulk wood modifications (heat treatments, acetylation, densification, infiltration, cell wall modifications, enzymatic modifications). Theoretical and practical aspects of wood modification by laboratory heat treatment, acetylation, surface treatments (NaOH, cytric acid, DMDHEU, HALS and UV primers), by impregnation (oil and PEG): measurements of the changes in dimensional stability, hygrophobicity (contact angle), colour fastness, surface integrity, strength changes, biological resistance. Review of the potential commercial applications of modified wood.

Language

All teaching activities will be held in Croatian. However, foreign students in mixed groups will have the opportunity to attend additional office hours with the lecturer and teaching assistants in English to help master the course materials. Additionally, the lecturer will refer foreign students to the corresponding literature in English, as well as give them the possibility of taking the associated exams in English.

Literature

1. Hill, C (2006): Wood modifications. Wiley
- 2.*** 2005: Collection of offprints on the topic of wood modification processes and technology. Faculty of Forestry, Zagreb University

Formsof teaching

Lecturing: obligatory lectures, practica and completion of written reports. One day of field studies and completion of a written review. Examination: consultations and revision of written reports and reviews. Verbal examination.

Assessment methods

Verbal examination. Preconditions: positive consultations and revision of written reports.

INVESTIGATION OF PHYSICAL AND MECHANICAL PROPERTIES OF WOOD (code: 33714)

Original course title	Istraživanje fizikalnih i mehaničkih svojstava drva	Status	obligatory
Semester	summer	Course teacher	Prof. dr. sc. Tomislav Sinković
ECTS	5	Study level	MSc

Learning outcomes

A student gains knowledge of scientific approach to investigation of physical and mechanical properties of wood. Preparation and leading for investigation of physical and mechanical properties of wood. Analysis of results of physical and mechanical properties and their influence on different use of wood species.

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, thomographi, ray x, b, g. 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, b, g). Methods for determination of moisture content (ove-drying, distillation, titration, electrical moisture meters, ray x, b, g). 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.

Language

Teaching will be conducted in English and forms of instruction are a combination of presentations and exercises. Studying the students' knowledge is done by the tasks they need to do during the classes. The final evaluation of the knowledge is done by interviewing the student.

Literature

Horvat, I. i drugi: Osnove nauke o drvu, Zagreb, 1985, str. 28-66
 Karahasanović, A.: Nauka o drvetu, Sarajevo 1988, str. 1-426.
 Ugrenović, A.; Horvat, I.: Tehnologija drveta, Zagreb, 1950, str. 1-502.
 Govorčin, S.; Sinković, T.: Ispitivanje fizikalnih i mehaničkih svojstava drva, 2004, Zagreb, interna skripta
 Giordano, G.: Tecnologia del legno, Volume I, Torino, 1971, str. 1-1086.
 Giordano, G.: Tecnologia del legno, Volume 111, Torino, 1976, str. 1-1351.
 Kollmann F. R., Cote, : Principles of Wood Science and Technology I solid Wood, New York, 1968, str. 1-592.
 Walter, F.: Pruftechnik der Holzindustrie, Leipzig, 1977, str. 1-318.
 Tsoumis, G.: Science and Technology of Wood, New York, 1991, str. 1-233.

Forms of teaching

Lectures 2 (h/w), laboratory work 2 (h/w), field work 2 (days)

Assessment methods

Oral exams

INTERNATIONAL MARKET OF WOOD PRODUCTS (code: 197346)

Original course title	International Wood Products Market	Status	elective
Semester	summer	Course teacher	Assist. Prof. Andreja Pirc Barčič, PhD, Prof. Darko Motik, PhD
ECTS	4	Study level	MSc

Learning outcomes

The aim of the subject is the education of students in order to get all the necessary knowledge and skills from the field of international trade of wood and wood products. The students will be capable of making the right business decisions about export and import of wood and wood products.

Course content

Wood economy. The basic facts of wood processing, furniture manufacture and paper manufacture and recycling. The basic facts of 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 on the international 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 evaluating the wood economy share in the complete economy. The share in industry and gross domestic product. Following the sale trends of certain wood products on the world market. The information about the employment record, the employees' structure, payments, the enterprise income and investments on the international market of wood and wood products.

Language

All teaching activities will be held in English.

Literature

1. Dušak, M., Jelačić, D., Pirc Barčić, A., Novakova, R. (2017): Improvements to the Production Management System of Wood-processing in Small and Medium Enterprises in Southeast Europe. *BioResources*. 12 (2): 3303-3315.
2. Kotler, P; Wong, V; Saunders, J.; Armstrong, G: *Osnove marketinga*, 4. europsko izdanje. Mate, Zagreb.
3. Previšić, Ozretić Došen, Krupka: *Osnove međunarodnog marketinga*, Školska knjiga, Zagreb, 2012.
4. Sertić Basarac, Martina; Pirc Barčić, Andreja; Klarić, Kristina (2018): Economic determinants and analysis of the European Union wood industry SMEs employment. *Boiresources*. 13 (1): 522-534. DOI: 10.15376/biores.13.1.522-534
5. UNECE/FAO (2018): *Forest Products Annual Market Review*
6. UNECE/FAO (2017): *Forest Products Annual Market Review*
7. UNECE/FAO (2016): *Forest Products Annual Market Review*

Forms of teaching

Except regular practice, students have to collect all the available data and information for an assigned practical work, they have to systematize the data and present all the received facts in a form of a project work.

Assessment methods

The evaluation of students' knowledge and achievements is going to be conducted during the classes and by written and oral exams.

MECHANICAL PROCESSING OF WOOD (code: 33949)

Original course title	Osnove mehaničke preradbe drva	Status	elective
Semester	summer	Course teacher	prof. dr. sc. Tomislav Sinković
ECTS	2	Study level	MSc

Learning outcomes

Interdiction of macroscopic, physical and mechanical properties of wood, and comparing technological properties of domestic and foreign commercial wood species.

Course content

Knowledge about mechanical technologies of wood processing. Wood as final product of forestry and properties of wood importante for mechanical technologies of wood processing. The influence of phisycal and mechanical properties of wood on sawmilling. Technologyes of sawmilling. Products of sawmilling. Veneer. Technologyes of veneers productions. . The influence of phisycal and mechanical properties of wood on veneeers productions.

Plywood. . Phisycal and mechanical properties of plywood. Composite boards. Phisycal and mechanical properties composite boards. Hydrothermic wood processing. . The influence of phisycal and mechanical properties of wood on hydrothermic wood processing

Language

Teaching will be conducted in English and forms of instruction are a combination of presentations and exercises. Studying the students' knowledge is done by the tasks they need to do during the classes. The final evaluation of the knowledge is done by interviewing the student.

Literature

1. Brežnjak, M.:Pilanska tehnologija drva I i II dio, Zagreb,1997/2000, str. 1-212/1-215.
2. Horvat, I. i sur.: Osnove nauke o drvu i izrada proizvoda iz masivnog i usitnjenog drva, Zagreb, 1985, str. 1-87.
3. Krpan, J.:Tehnologija furnira i ploča, Zagreb,1970. str. 1-283.
4. Kollmann, F.R., Cote, W.A.Jr.: Solid wood, New York, 1968, str. 1-592.
5. Giordano, G. :Techologia del legno 2.,Le lavorazioni industriali, Torino, 1974, str. 1-1269.
6. Tsoumis, G.: Science and Technology of Wood, New York,1991, str. 1-233.

Formsof teaching

Lectures 1 (h/w)

Assessment methods

oral exams

SPECIAL PRODUCTS OF WOOD (code: 197759)

Original course title	Special Wood Products	Status	elective
Semester	summer	Course teacher	Full Prof. Tomislav Sinković, PhD; Assist. Prof. Tomislav Sedlar, PhD
ECTS	4	Study level	MSc

Learning outcomes

By completing the course, students are expected to master the specific knowledge, theory and skills related to special wood products. They will apply such knowledge to scientific research and production, analyze and select wood species for special wood products. This course will lay good foundation for their follow-up course study and independent work regarding wood properties and wood products.

Course content

Course 'Special wood products' is composed of general theoretical knowledge about different wood species and their implantation in special wood products. Knowledge about manufacturing and wood species used for pencils, matches, wooden molds, shoe heels. Barrels and wood species used in their production. Barrels for alcoholic beverages and soft drinks. Light barrels. Barrels manufactured from plywood. Manufacturing and wood species for wooden packaging, crates and parts of wooden packages. Standards for wooden packaging. Wood densifying by compression (lignostone). Manufacturing of beech and birch lignostone. Structure, density, variation in

moisture content, swelling and shrinkage, compression strength, impact bending strength and usage of lignostone. Wooden briquettes. Wood types used in their production. Houses made of wood. Square timber, sawn timber, particleboards, plywood and sandwich composites. Musical instruments. Acoustical properties of wood. Comparing of acoustical properties of wood species used for musical instruments. Wooden toys making techniques and wood species used in their production. Wooden accessories usage classification. Wood species for production of wood accessories. Wood in shipbuilding. Wood species, selection and their properties. Forest breeding types for shipbuilding. Wooden vessels. Parts of wooden vessels. Shipbuilding technique and construction requirements. Carving and marquetry wood. Wood species and their properties important for carving and inlaid work. Wood for sports equipment and props.

Language

The course is going to be taught in English. All forms of teaching are a combination of presentations and exercises. Students gain the knowledge by performing assigned tasks during the course. Final evaluation of the knowledge is done in the form of interview.

Literature

1. Panshin, A.J.; deZeeuw. C., 1980: Textbook of wood technology, 4th edition. McGraw-Hill series in forest resources. McGraw-Hill book company, New York.
- 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.
- WOOD Magazine. 1993: Classic woodworking; Woods and how to use them. better; Homes and gardens. Meredith Books, Des Moines, IA.
- Jackson, A; Day, D., 1991: Good wood handbook - The woodworker's guide to identifying, selecting and using the right wood. Harper Collins publishers Ltd, London.

Forms of teaching

The course is provided in the forms of lecture attendance (2 h/w), laboratory exercises (2 h/w) and field work (1 day) which follow the course program.

Assessment methods

Oral exam

WOOD FIBRES AND PAPER TECHNOLOGY (code: 197347)

Original course title	Wood Pulp and Paper Technology	Status	elective
Semester	summer	Course teacher	Prof. Vladimir Jambreković, PhD, Assist. Prof. Nikola Španić, PhD
ECTS	4	Study level	MSc

Learning outcomes

The aim of the course is to provide student with knowledge about wood pulp structure, wood pulp technology processes, regeneration and regeneration products, paper manufacturing processes and paper treatment with a view to autonomous monitoring and controlling manufacturing processes in mechanical pulp, semicellulosic, cellulosic and paper industry.

Course content

Wood fibres quality in dependence of wood species. Wood delignification technological processes. Influence of basic and modified delignification methods on wood fiber quality. Thermomechanical and chemithermomechanical defibrillation. Defibrillation procedures and their influence on mechanical fibers quality. Technological processes in semicellulose manufacturing. Neutral sulphite process of wood delignification. Wood delignification with cold alkaline procedure. Technological processes in sulphite cellulose manufacturing. Sulphite and natrone procedures comparison. Discontinues and continues chips cooking methods comparison. Influence of white liquor composition and technological parameters on defibration efficiency. Methods and procedures of fiber bleaching. Wood fibers quality insurance. Influence factors on efficiency of black liquor regeneration. Technological processes in recycled fibers manufacturing. Wet-end and dry-end procedures in technology of paper manufacturing. Paper surface protection and pigment coating methods. Paperboard and cartonboard manufacturing technology. Paperboard and cartonboard 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 improving paper properties and fiber base products.

Language

All teaching activities including the exam will be held in English. All of the teaching materials (lectures, laboratory worksheets and instructions, etc.) will be written in English.

Literature

Selected chapters from following books:

1. PAPERMAKING SCIENCE AND TECHNOLOGY – Book 4. Papermaking Chemistry. Leo Neimo (Ed.), Fapet Oy, Helsinki, Finland, 1999.
2. PAPERMAKING SCIENCE AND TECHNOLOGY – Book 8. Papermaking, Part 1. Stock Preparation and Wet End. Hannu Paulapuro (Ed.), Fapet Oy, Helsinki, Finland, 1999.
3. SPRINGER SERIES IN WOOD SCIENCE – Analytical Methods in Wood Chemistry. Eero Sjöström, Raimo Alén (Eds.), Springer-Verlag, Berlin Heidelberg, Germany, 1999.
4. WOOD AND CELLULOSIC CHEMISTRY – second edition, revised and expanded. David N.-S. Hon, Nobuo Shiraishi (Eds.), Marcel Dekker, Inc. New York, USA, 2001.

Forms of teaching

Course is delivered in the forms of lecture attendance and practical laboratory exercises which follow the program units.

Assessment methods

Written exam. Oral exam.