Course catalogue
UNDERGRADUATE STUDY PROGRAMME

TABLE OF CONTENT

I. SEMESTER

Module name:	**Introduction to Civil Engineering**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21677
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Jelena Bleiziffer
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Seminars: 15
Workload	Lecture hours 30 Self study hours 40 Seminar preparation hours 15 Other contact hours 5
Credit points	3 ECTS
Requirements according to the examination regulations	Regular attendance in lectures, Writing a seminar paper.
Recommended prerequisites	
Module objectives/intended learning outcomes	Thorough knowledge about an extensive and pervasive profession -civil engineering, Learning to distinguish between the different areas of civil engineering, Theoretical knowledge on basic civil engineering terms, Ability to assess specific achievements and evaluate them in the context of the worldwide achievements in the field of civil engineering.
Content	• Lectures: 1. Introduction [2] 2. History of civil engineering [2] 3. Professions in building construction; Structures in nature [2] 4. Bearing systems [1] 5. Materials; Construction methods [3] 6. Structures [2] 7. Traffic infrastructures [2] 8. Hydraulic Engineering Structures; Building from concept to construction [2] 9. Sustainable development; Management of structures [2] 10. Regulations and codes; Ethics in civil engineering [2] 11. World achievements in civil engineering [2] 12. Croatian achievements in civil engineering [2] • Seminars: 1. Technical description of a chosen building, description of the present state of the building [15]

Study and examination requirements and forms of examination	• 2 pre-exams - students who achieve minimum 60% score in each pre-exam, are exempt from the exam. • Seminar 10-20%, • Written exam or pre-exams 80-90%
Media employed	Whiteboard, projector
Reading list	Required literature: 1. J. Radić: Introduction to Civil Engineering, mimeographed notes published on the website: http://www.grad.unizg.hr/predmet/uug Optional literature: 1. Pech, A., Kolbitsch, A., Zach, F., Pauser, A., Zeininger, J.: Tragwerke, Springer-Verlag, Wien, 2007

Module name:	**History of Civil Engineering**
Module level, if applicable	Bachelor's Degree Program
Code, if applicable	21687
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Silvio Bašić, Marinko Sladoljev
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's Degree Program. Compulsory elective. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 hours
Workload	Lecture hours: 30 Other contact hours: 15 Self study hours: 45
Credit points	3 ECTS
Requirements according to the examination regulations	• Course attendance, • 2 pre-exams, minimum 25% score in each, one make up pre-exam.
Recommended prerequisites	Familiarity with specific literature, prior knowledge.
Module objectives/intended learning outcomes	
Content	• Lectures: 1. Introduction –the art of construction and history of building [2] 2. Construction as primary process, constructive elements, history of shaping [2] 3. Construction in Mesopotamia [2] 4. Construction in Egypt [2] 5. Construction in the Aegean area and Greece [2] 6. Construction in Ancient Rome [2] 7. Construction in late Antiquity and early Christianity [2] 8. Construction in the middle Ages: Pre-romanesque, Romanesque and Gothic styles [2] 9. The modern era – Humanism and Renaissance [2] 10. The modern era – Baroque and Classicism [2] 11.The modern era – Foundation of new Architecture [2] 12. The modern era – the present, trends and tendencies [2]
Study and examination requirements and forms of examination	• Pre-exams. • Written exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Basic S.,Senjak I., Vezilić Strmo N.: Internal mimeographed notes Optional literature: 1. Muller W., Vogel G.: Architectural Atlas1&2, Golden marketing, Zagreb, 1999

Module name:	**Mathematics 1**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21678
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Vera Čuljak, Alan Filipin
Lecturer	Nikola Adžaga, Rafael mrđen, Tatjana Slijepčević-Manger, Kristina Ana Škreb
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:60 • Exercises (auditory):60
Workload	Lecture hours 60 Exercises hours 60 Self study hours 150
Credit points	9 ECTS
Requirements according to the examination regulations	Lecture and exercise attendance, 1 mid-term exam - minimum 25% score, a make-up exam.
Recommended prerequisites	Secondary school mathematics, basic knowledge on vectors, sequences and functions.
Module objectives/intended learning outcomes	Knowledge on basic facts and theorems on vectors and analytical geometry in space, Acquiring basic knowledge on matrix calculus, with the emphasis on linear systems of equations and relevant values, Knowledge about the basic facts on sequences and series, Understanding the basics of differential calculus and its applications, Understanding the basics of integral calculus and its applications.
Content	Lectures: 1. Vectors [6] 2. Analytic geometry in space [4] 3. Matrices, linear systems of equations, eigenvalues [10] 4. Sequences and series [4] 5. Real functions of real variable [10] 6. Differential calculus, continuity, limes, derivations, applications [10] 7. Integral calculus with applications [16] Exercises (auditory): 1. Vectors [4] 2. Analytic geometry in space [6] 3. Matrices [10] 4. Sequences and series [4] 5. Functions, introduction [10] 6. Differential calculus [10] 7. Integral calculus [16]

Study and examination requirements and forms of examination	Lecture and exercise attendance, 1 mid-term exam– minimum 25% score, a make-up exam. Students who achieve a 60% score are exempt from the written part of the exam. Written and oral exam.
Media employed	Whiteboard, projector.
Reading list	T. Došlić, N. Sandrić, Matematika I, web-based teaching material S. Kurepa, Uvod u linearnu algebru, ŠK, Zagreb, 1978. S. Kurepa, Matematička analiza 1, TK, Zagreb, 1975. Ž. Pauše, Matematički priručnik ŠK, Zagreb, 2004.

Module name:	**Descriptive Geometry**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21679
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Sonja Gorjanc, Dora Pokaz
Lecturer	Sonja Gorjanc, Iva Kodrnja, Helena Koncul, Dora Pokaz
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semestar I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 45 (auditory – 15, design –30)
Workload	Lecture hours: 30 Hours of laboratories or skills: 45 Other contact hours: 15 Self study hours: 90
Credit points	6 ECTS
Requirements according to the examination regulations	4 term papers and 2 midterms
Recommended prerequisites	Secondary school mathematics.
Module objectives/intended learning outcomes	A student acquires knowledge on modelling curves, surfaces and geometric bodies with emphasis on dimensioned projection and geometric interpretation of its application in design of transportation facilities. The methodology of the course leads a student to develop skills of creative solution of 3D problems and enhance logic mathematical thinking.
Content	Lectures: 1. Plane curves and transformations [4] 2. Monge's method (12) 3. Axonometric projection [2] 4. Computer CAD software [2] 5. Cross sections [2] 6. Intersection of surfaces [2] 7. Projection with elevations – Terrains [6] Exercises (auditory): 1. Plane curves and transformations [2] 2. Monge's method [6] 3. Axonometric projection [1] 4. Computer CAD software [1] 5. Cross sections [1] 6. Intersection of surfaces [1] 7. Projection with elevations – Terrains [3] Exercises (design – drawing room or computer room): 1. Planar curves and transformations [4] 2. Monge's projection method [14] 3. Axiomatic image of an object [2]

	4. Cross sections [2] 5. Intersection of surfaces [2] 6. Projection with elevations – Terrains [6]
Study and examination requirements and forms of examination	A student acquires knowledge on modelling curves, surfaces and geometric bodies with emphasis on dimensioned projection and geometric interpretation of its application in design of transportation facilities. The methodology of the course leads a student to develop skills of creative solution of 3D problems and enhance logic mathematical thinking.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. I. Babić, S. Gorjanc, A. Sliepčević, V. Szirovicza: Nacrtna geometrija – zadaci, HDGG, Zagreb, 2007 2. S. Gorjanc: Predavanja iz Deskriptivne geometrije, (web mimeographed notes) http://www.grad.hr/sgorjanc/Links/deskriptiva/plan.html Optional literature: 1. V. Szirovicza, E. Jurkin: Deskriptivna geometrija, CD-ROM, HDGG i GF, Zagreb, 2005 2. I. Babić, K. Horvat-Baldasar: Nacrtna geometrija, Sand, Zagreb, 1997 3. V. Niče: Deskriptivna geometrija, Školska knjiga, Zagreb, 1997

Module name:	**Basics of Construction Informatics**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	93368
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Davor Delić
Lecturer	Davor Delić
Language	Croatian, English
Relation to curriculum	Bachelor's degree programme. Compulsory. Semestar I.
Type of teaching, contact hours	Lectures: 15 Exercises (auditory): 15 E-learning: 15
Workload	Lecture hours 15 Hours of laboratories or skills 30 Other contact hours 10 Self study hours 35
Credit points	3 ECTS
Requirements according to the examination regulations	75% lecture attendance, 100% exercise attendance, AutoCAD 2D pre-exam pass, 60% score in e-learning pre-exam.
Recommended prerequisites	Familiarity with AutoCAD and MS Office
Module objectives/intended learning outcomes	Mastering the basic use of operational systems, e-mail and the Internet, Developing basic 2D techniques of CAD tools, Learning basic functionalities of office tools, Understanding the role of information and communication technologies in construction industry and their development trends.
Content	Lectures: 1. Introduction [1] 2. Construction informatics – What is it? [1] 3. Engineering software [1] 4. Basics of computer graphics [3] 5. Communication revolution [1] 6. Intro into the Internet [1] 7. Internet security [2] 8. Business and social networking [1] 9. Methods of modeling [1] 10. Building Information Model [1] 11. New forms and architecture of digital age [1] 12. Trends of development and implementation of information and communication technologies in construction industry [1] Exercises (auditory): 1. AutoCAD entrance exam [1] 2. Introduction into AutoCAD [1] 3. AutoCAD 2D [6] 4. AutoCAD colloquium [1]

	5. e-learning entrance pre-exam (all modules) [1] 6. e-learning: Hardware, software, Internet and MS Word [1] 7. e-learning: MS Excel [1] 8. e-learning: MS Powerpoint [1] 9. e-learning: MS Access [1] 10. e-learning pre-exam (all modules) [1]
Study and examination requirements and forms of examination	Students will be able to use AutoCAD 2D and the fundamentals of MS Office tools
Media employed	Full equipped IT Classrooms with e-learning facilities, whiteboard, projector.
Reading list	Required literature: 1. D. Gookin: PC For Dummies, Windows 7 Edition, Willey Publishing Inc., 2010 2. P. Weverka: Office 2010 All-In-One For Dummies, Willey Publishing Inc., 2010 3. B. Fane: AutoCAD 2014 For Dummies, Willey Publishing Inc., 2013 Optional literature: 1. T. Dzambazova, E. Krygiel, G. Demchak: Introducing Revit Architecture 2010: BIM for Beginners, Willey Publishing Inc., 2009 2. G. Freund: Network Security For Dummies, Willey Publishing Inc., 2003

Module name:	**Mathematical Programmes for Engineers**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	93369
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Krešimir Fresl, Petra Gidak
Lecturer	Marija Demšić, Krešimir Fresl, Petra Gidak, Miroslav Klačinski, Iva Kodrnja, Helena Koncul
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester I.
Type of teaching, contact hours	Lectures: 15 Exercises (design): 15
Workload	Lecture hours 15 Exercises hours 15 Self study hours 30
Credit points	2 ECTS
Requirements according to the examination regulations	Regular attendance in lectures and exercises, Two pre-exams – 40% score required in each, One make up pre-exam.
Recommended prerequisites	Secondary school mathematics.
Module objectives/intended learning outcomes	Ability to solve mathematical tasks using computers, Understanding computer programming and ability to write a simple computer program, Ability to apply acquired knowledge and skills in further study.
Content	Lectures: 1. Introduction into computer algebra systems (CAS) [1] 2. Numerical and symbolic calculus using computer software [5] 3. Visualisation of functions and data using computer software [2] 4. Basics of computer programming [7] 4.1 Data types, variables, constants, commands, 4.2 Looping and branching, 4.3 Functions, 4.4 Containers (lists, sequences, dictionaries). Derived types, 4.5 Programming paradigms Exercises (in the computer room): 1. Arithmetic operations, elementary functions [1] 2. Polynomials, functions, graphs [1] 3. Equations, systems of equations, inequalities [2] 4. Vectors and matrices [1] 5. Limits, derivatives and integrals [1] 6. 2D and 3D graphics [2] 7. Data types, variables, commands [2] 8. Looping and branching [2] 9. Functions, containers [2]

Study and examination requirements and forms of examination	Regular attendance in lectures and exercises, Two pre-exams – 40% score required in each, One make up pre-exam.
Media employed	Computers, whiteboard, projector.
Reading list	Required literature: 1. Course materials: http://sage.grad.hr 2. Sage PREP Tutorials, http://sagemath.org/doc/prep/index.html. 3. M. O'Sullivan, R. Rosenbaum, D. Monarres: Sage Tutorial, http://wwwrohan.sdsu.edu/~mosulliv/Courses/sdsu-sage-tutorial/index.html. Optional literature: 1. Sympy Tutorial, http://docs.sympy.org/latest/tutorial/index.html 2. G. van Rossum: The Python Tutorial, http://docs.python.org/2/tutorial/index.html

Module name:	**Geodesy**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	93370
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Đuro Barković, Mladen Zrinjski
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 30 (auditory - 10, design - 10, field - 10)
Workload	Lecture hours 30 Hours of exercise 30 Other contact hours 20 Self study hours 40
Credit points	4 ECTS
Requirements according to the examination regulations	Regular attendance in lectures and exercises, Doing 2 design assignments.
Recommended prerequisites	Knowledge of basic properties of trigonometric functions, Basic knowledge about infinitesimal calculus (derivations and integrals), Basic knowledge about working on computer: text processing, grid computing, basic graphic programs.
Module objectives/intended learning outcomes	Ability to analyse and use geodetic maps: maps and plans of different scales, Understanding the role of the geodetic works in construction in various design phases, Application of acquired knowledge in preparation of project documentation and realization of concrete project tasks, Analysing and recognising the importance of geodetic works in various design tasks and the need to involve geodetic experts, Ability to obtain geodetic documentation necessary for the design and transfer of the project into field, Implementing simple geodetic task in field.
Content	• Lectures: 1. The shape and size of the Earth and its mapping on maps and plans [2] 2. Geodetic instruments. Basic geodetic measurements: length, angles and altitude differences [2] 3. The basic theory of errors and adjustments [2] 4. Coordinate systems in geodesy. National coordinate system [2] 5. Basic geodetic works. Positional geodetic networks [2] 6. Altitude geodetic maps. Methods of height determination [2] 7. Cartography. Scale geodetic plans and maps. Cartometry [2],

	8. Calculating areas and volumes based on measured values and data obtained from surveying: from plans and maps of various scales [2] 9. Land surveying methods; classic, photogrammetric, satellite [2] 10. Spatial databases. Geoinformation systems – GIS [2] 11. Cadastral contents and land registry [2] 12. Surveying in design and construction [2] 13. Surveying in various construction branches [2] 14. Surveying in design and route design of traffic routes [2] 15. Determination of displacements and deformations of objects using different geodetic methods [2] • Exercises (auditory): 1. Coordinate calculus. Calculating direction angles, horizontal angles, lengths, areas and volumes from the coordinates of points. First and second geodetic task [2] 2. Determining the altitude differences by geometric and trigonometric precise levelling, 3. Surveying methods of capturing details. Practical examples [2] 4. The theory of errors and adjustment calculus. Examples of direct and indirect measurements [2] 5. Special databases. Examples of GIS based on geodetic data [2] • Exercises (field): 1. Measuring horizontal and vertical angles and slanting lengths (theodolite, measuring station) intriangle [5] 2. Determining altitude differences using geometric and trigonometric precise levelling. Determining the heights of objects based on measured values [5] • Exercises (design): 1. Calculating angles and lengths in a triangle using trigonometric functions. Calculating area by analytic and trigonometry method. Calculating altitude differences and altitude of points by geometric and trigonometric precise levelling [5] 2. Cartometry: reading the coordinates of four points from a map, scale 1: 5000. Numerical calculations of directional angles, horizontal angles, lengths, areas and volumes from coordinates of points on a map. Creating a longitudinal profile and transverse profiles for a section of a traffic route marked on a map, based on the lengths and heights from the map. Calculating the terrain inclination for route sections [5]
Study and examination requirements and forms of examination	Attendance in lectures and exercises 5%, Two pre-exams (or written exam) 60% Oral exam 35%.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Cigrovski-Detelić, B.: Repozitorij – Geodezija, predavanja: www.grad.unizg.hr, Građevinski fakultet Sveučilišta u Zagrebu, Zagreb, 2012 2. Cigrovski-Detelić, B.: Topografija, mimeographed copy, Geodetski fakultet Sveučilišta u Zagrebu, Zagreb, 2009 3. Kapović, Z.: Geodezija u niskogradnji, Geodetski fakultet Sveučilišta u Zagrebu, Zagreb, 2010 4. Pribičević, B., Medak, D.: Geodezija u građevinarstvu, V.B.Z. d.o.o., Zagreb, 2003

	Optional literature: 1. Benčić, D., Solarić, N.: Mjerni instrumenti i sustavi u geodeziji i geoinformatici, Školska knjiga, Zagreb, 2008 2. Frančula, N.: Kartografske projekcije, skripta, Geodetski fakultet Sveučilišta u Zagrebu, Zagreb, 2000. 3. Roić, M.: Upravljanje zemljišnim informacijama: katastar, Geodetski fakultet Sveučilišta u Zagrebu, Zagreb, 2012.

Module name:	**Sociology of Work and Professional Ethics**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21683
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Miljenko Antić
Lecturer	Miljenko Antić
Language	Croatian, English
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours 30 Self study hours 40 Seminar preparation hours 15 Other contact hours 5
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in lectures, • Pre-exam, • Final exam.
Recommended prerequisites	
Module objectives/intended learning outcomes	Effective leadership abilities and knowledge about business ethics.
Content	• Lectures: 1. Course introduction [2] 2. Basic definitions, subject and methods of investigation [2] 3. History of work [2] 4. Classical theories of work [2] 5. Modern theories of work [2] 6. Selection of employees [2] 7. Work motivation [2] 8. Awards and punishments [2] 9. Work in construction industry [2] 10. Professionalism [2] 11. Professional and business ethics [2] 12. Ethics of studying, scientific ethics, sexual harassment [2] 13. Ethics of civil engineers [2] 14. Business ethics and profit [2] 15. Final lecture [2]
Study and examination requirements and forms of examination	• Discussions in class and class attendance 10 %, • Mid-term exam 20 %, • Final exam 70 %.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Antić, Miljenko, Sociology of work and professional ethics, Textbook, 2012

	Optional literature: 1. Grint, Keith, The Sociology of Work, Polity Press, Cambridge, 2005 2. Jennings, Marianne M.Business Ethics: Case Studies and Selected Readings. Eagan, USA: Thomson West, 2006 3. Dienhart, John W., Business, Institutions and Ethics: A Text with Cases and Readings, Oxford University Press, 2000 4. Vecchio, Robert P., Organizational behaviour: core concepts, Mason, Ohio: Thomson/SouthWestern, 2003 5. Dessler, Gary. Human Resource Management. Upper Saddle River, USA: Pearson Education, 2005 6. Kendall, Dina., Sociology in Our Times: The Essentials. Belmont, USA: Wadsworth, 2002 7. Vecchio, Robert P., 2003, Organizational behavior: core concepts. Mason, Ohio: Thomson/SouthWestern, 2003

Module name:	**Basics of Civil Engineering law**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21674
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I. (Winter)
Person responsible for the module	Davor Rajčić
Lecturer	Davor Rajčić
Language	Croatian
Relation to curriculum	Bachelor's Degree Program. Compulsory elective. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours 30 Other contact hours 30 Self study hours 30
Credit points	3 ECTS
Requirements according to the examination regulations	Regular attendance and pre-exam pass.
Recommended prerequisites	
Module objectives/intended learning outcomes	• Knowledge of and understanding the basics of legal system, • Knowledge of and understanding the basics of property law, • Knowledge of and understanding the basics of obligation law, • Knowledge of and understanding the basics of spatial planning, • Knowledge of and understanding the basics of construction.
Content	• Lectures: 1. Introductory lecture [2] 2. Basic questions related to the structure of law [4] 3. Status issues – natural and legal persons [2] 4. Legal affairs [2] 5. Property law – possession [2] 6. Property law – right of ownership [2] 7. Land registry [2] 8. Property rights on other people's possession [2] 9. Obligation law [2] 10. Obligation law – agreements [2] 11. Cadastre, spatial planning, construction [6]
Study and examination requirements and forms of examination	• Pre-exam. • Written exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Rajčić, D., Nikšić, S.: Uvod u građevinsko pravo, university textbook, HSN, Zagreb, 2008 Optional literature: 1. Relevant regulations.

Module name:	**Business Economics**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21684
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	
Lecturer	Lana Lovrenčić Butković
Language	Croatian
Relation to curriculum	Bachelor's Degree Program. Compulsory elective. Semester I
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • E-learning: 2nd level
Workload	Lecture hours 30 Self study hours 60
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in more than 75% lectures, • Achieving minimum25% score in every pre-exam, • Written paper, • Using Merlin.
Recommended prerequisites	
Module objectives/intended learning outcomes	• Description of the development of economics as a scientific discipline and the list of the most prominent economic theorists throughout history, • Definition of company types, restrictions and principles of business companies and business operations through the process of reproduction and business assets, • Definition of the key elements of production; input & output, working capital; basic assets, capacity, amortization, costs and price calculation; price, purchase price, supply price; • Interpretation of business success measures; cost-effectiveness, productivity, profitability; • Analyses of business environment; concept of earning, indicators of economic development, factors of economic development, technical structure of economy, • Evaluation of the contribution of factors affecting the performance of an enterprise.
Content	• Lectures: 1. History of economics [2] 2. Basics of reproduction process[2] 3. Business assets [2] 3.1. Basic asset 3.2. Working assets 4. Costs, price and price calculation[4] 4.1. Costs (direct/indirect; fixed/variable) 4.2. Price (purchase price/supply price; law of supply and demand; elasticity of demand) 4.3. Price calculations (calculation methods; calculations in construction) 5. Business results[2]

	5.1. Financial reports 5.2. Business success measures (cost-effectiveness, productivity, profitability 6. Company and its environment[2] 6.1. Company types 6.2. Restrictions in company operations 6.3. Principles of company operations 7. Business environment[2] 8. Factors affecting company performance[4]
Study and examination requirements and forms of examination	• Pre-exams 80%, • Paper 15%, • Merlin 5%. • Written exam, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Mariza Katavić,Osnove ekonomike za graditelje, Hrvatska sveučilišna naklada, Zagreb, 2009 2. Lecture notes (hand outs on Merlin)

Module name:	**English Language in Civil Engineering 1**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	93371
Subtitle, if applicable	
Courses, if applicable	Bachelor's's programme: 2 classes Master's's programme 7 classes
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Alemka Kralj Štih
Lecturer	Alemka Kralj Štih
Language	English
Relation to curriculum	Bachelor's Degree Program. Compulsory elective. Semester (I).
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours 30 Other contact hours 10 Self study hours 50
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance 75%, • Taking 3 pre-exams.
Recommended prerequisites	Intermediate or B1 according to the European Language Framework
Module objectives/intended learning outcomes	• Mastering skills and competences involving the key terms in civil engineering, Independent and fluent acquisition of basic vocabulary, • Reinforcement of basic grammar categories used in technical language - passive, tenses, modal verbs, • Gaining fluency in structuring sentences and developing skills of individual presentation and writing technical reports.
Content	1. Civil engineering as a profession [2] 2. What is cool about being an engineer [2] 3. Go where the action s [2] 4. Principal construction materials [2] 5. Environmental engineering [2] 6. The birth of modern structures [2] 7. Up in the air [2] 8. Bridges [2] 9. Skyscrapers [2], 10. Revision of tenses [2], 11. Revision of vocabulary [2] 12. Domes [2] 13. Aswan high dam [4] 14. Term preliminary exam [2]
Study and examination requirements and forms of examination	• The credits earned through all the testing and pre-exams make up the final grade. • Grading is as follows - 50-62% score – sufficient [2], - 63-75% score – good [3], - 76-88% score – very good [4], - 89-100% score – excellent [5].
Media employed	Whiteboard, projector, power point presentations.

Reading list	Required literature: 1. Kralj Štih: English in Civil Engineering, Hrvatska sveučilišna naklada, 2004 Optional literature: 1. D. Bonamy: Technical English 3, Pearson Longman, 2011 2. Vulelija, Ilustrirani rječnik arhitekture i građevinarstva – hrvatsko engleski i englesko hrvatski, Masmedia, Zagreb, 2010 3. Prager, Trojezični građevinski rječnik, Masmedia, Zagreb, 2002 4. Internet pages Building Big, Brantacan, ASCE

Module name:	**German language in Civil Engineering 1**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	
Subtitle, if applicable	
Courses, if applicable	Bachelor's Programme – 1 class, Master's's Programmes 1 class
Semester(s) in which the module is taught	I (Winter)
Person responsible for the module	Alemka Kralj Štih
Lecturer	Alemka Kralj Štih
Language	German
Relation to curriculum	Bachelor's Degree Program. Compulsory elective. Semester I.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours 30 Other contact hours 10 Self study hours 50
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance 75% , • Taking 3 pre-exams.
Recommended prerequisites	Intermediate – B1 level
Module objectives/intended learning outcomes	• Mastering skills and competences involving key terms in civil engineering. Independent and fluent application of basic vocabulary, • Understanding technical vocabulary, • Reinforcement of basic grammar categories used in technical language - passive, tenses, modal verbs.
Content	1. Was ist Bauingenieurwesen? (2) 2. Wie wird man Bauingenieur(in)? (2) 3. Bauingenieure haben ein weites Feld….. (3) 4. Bauingenieure gestalten die Umwelt (2) 5. Wie entstehen Ingenieurbauten – die Arbeitsweise des Bauingenieurs (3) 6. Geschichte der Baustoffe (2) 7. Wie haben Erfindungen das Aussehen von Bautenverändert? (3) 8. Die Baustoffe für Ingenieurbauten (2) 9. Die Entwicklung der ersten Wolkenkratzer (3) 10. Vokabelübungen (Dialogübungen) (2) 11. DieBrücken I (3) 12. DieBrücken –II / 13. Ein Mann der Perfektion – G. Eiffel I (3) 14. Turmbau 15. Kolloquium
Study and examination requirements and forms of examination	• The credits earned through all the testing and pre-exams make up the final grade. • Grading is as follows - 50-62% score – sufficient [2], - 63-75% score – good [3], - 76-88% score – very good [4], - 89-100% score – excellent [5].

Media employed	Whiteboard, projector, power point presentations.
Reading list	Required literature: 1. A. Kralj Štih: Deutsch im Bauingenieurwesen, Hrvatska sveučilišna naklada, 2004 Optional literature: 1. A. Prager: Trojezični građevinski rječnik, Masmedia, Zagreb, 2002 2. www.bau.de www.leo.org

II. SEMESTER

Module name:	**Mathematics 2**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	103980
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	II (Summer)
Person responsible for the module	Tomislav Došlić, Alan Filipin
Lecturer	Nikola Adžaga, Rafael Mrđen, Tatjana Slijepčević-Manger
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester II.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 60 • Exercises (auditory): 45
Workload	Lecture hours 56 Exercises hours 45 Other contact hours 4 Self study hours 135
Credit points	8 ECTS
Requirements according to the examination regulations	• Regular attendance, • Minimum 25% score in pre-exam.
Recommended prerequisites	Basic knowledge of differential and integral calculus and analytic geometry in space.
Module objectives/intended learning outcomes	• Knowing basic facts and theorems about differential equations, recognizing types and understanding methods for their solving, • Recognizing the problems which lead to solving differential equations, • Understanding the basics of differential and integral calculus for the functions of several variables together with applications, • Understanding the basics of line and surface integrals and their applications.
Content	• Lectures: 1. Differential equations, introduction [2] 2. Method of the separation of the variables [2] 3. Linear differential equation of the first order [2] 4. Linear differential equation of the second order [4] 5. Functions of several variables, introduction [2] 6. Continuous functions and limit [2] 7. Differential of functions of several variables, derivations of higher order [4] 8. Taylor's theorem [2] 9. Extreme value of the function of several variables [4] 10. Multiple integrals [6] 11. Method of substitution in multiple integrals [4] 12. Application of multiple integrals [4] 13. Scalar and vector fields, gradient [2]

	14. Divergence and rotation, special fields [4] 15. Curves and line integrals, line integral of the first kind [4] 16. Line integral of the second kind [4] 17. Surfaces, surface integral of the first kind [2] 18. Surface integral of the second kind [2] 19. Divergence theorem, Stokes theorem [2] • Exercises (auditory): 1. Differential equations [7] 2. Function of several variables [11] 3. Multiple integrals, applications [12] 4. Scalar and vector fields [3] 5. Line integrals [6] 6. Surface integrals [6]
Study and examination requirements and forms of examination	• Pre-exam, students with minimum 60% score are exempt from the part of the exam • Written exam 50% • Oral exam 50%
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Došlić, T., Filipin, A.: Internal mimeographed notes Optional literature: 1. I. Brnetić, V. Županović: Višestruki integrali, Element, Zagreb, 2004, 2. N. Elezović: Diferencijalne jednadžbe, Element, Zagreb, 2004, 3. P. Javor: Matematička analiza 2, Element, Zagreb, 2004, 4. L. Korkut, M. Krnić, M. Pašić: Vektorska analiza, Element, Zagreb, 2007

Module name:	**Physics**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	93373
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	II (summer)
Person responsible for the module	Dario Jukić
Lecturer	
Language	Croatian and/or English
Relation to curriculum	Bachelor degree programme.Compulsory. Semester II.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 60 • Exercises: 15 (auditory – 1, laboratory - 14)
Workload	Lecture hours 60 Hours of laboratories 14 Hours of practical exercies 1 Other contact hours 35 Self study hours 70
Credit points	6 ECTS
Requirements according to the examination regulations	• Regular attendance in lectures and exercises, • 3 pre-exams: minimum 35% score; one make-up pre-exam.
Recommended prerequisites	Competence in applying vector, differential, integral and matrix calculus.
Module objectives/intended learning outcomes	• Competence in solving special examples and tasks, in setting physics experiments which verify the solutions of problems, • Skills in recognising a common physics basics for different real life phenomena, • Skills in reducing real life phenomena to physics models, in finding equations for physics models, • Skills in preparation for laboratory work, skill in laboratory team work, data measuring and processing, knowledge about the physical basis of phenomena, measuring and processing measures.
Content	• Lectures: 1. Mechanics of material particles and rigid bodies (with experiments within lectures): dynamics, work, energy, strengths, conservation laws [2]. Oscillation, curvilinear motion, nutation, precession, gravitation, relative systems [4] 2. Mechanics of fluids (with experiments within lectures): Euler's method, statics of fluids [2]. Laminar flows, body motion [4]. Viscosity of fluids, vortices, model testing [4]. Capillarity, surface tension [1] 3. Electro-magnetism (with experiments within lectures): Coulomb's law, energy, potential, voltage, condensers, electric dipole, dielectrics, current [5]. Magnetic field [3]. Alternating current, law of induction, work, power [2]. Transformers, electric resonance, electromagnetic

	waves [1] 4. Optics (with experiments and computer simulations within lectures): Fermat's principle, plane waves, spherical waves, spreading of waves [2]. Spreading of waves through media, ideal and spheric diopter, spherical aberration, colours, photometry, vision [2]. Geometrical optics, physical optics, interference, diffraction, polarisation, lasers [2] 5. Acoustics (with experiments and computer simulations within lectures): longitudinal waves, creation and spreading of waves in media, supersonic wave fronts, hearing [4] 6. Heat (with experiments and computer simulations within lectures): temperature, kineticmolecular theory, work [2]. Heat, thermodynamic properties of bodies, calorimeters, mechanical equivalent of heat [2]. Thermodynamics, 1st and 2nd laws [3]. Thermodynamic cycles, Otto cycle, Diesel cycle, Carnot cycle, heat engine, heat pump [3]. Phases [2]. Conduction, convection and radiation and their combinations, properties of substantances [2]. 7. Atomistics, structure and testing of materials (with tests and computer simulations within lectures): matterwaves, photoelectric effect, line spectra, Franck-Hertz experiment, Bohr's model [3]. The structure of atoms and molecules, structure of materials, properties of materials, properties of chemical bindings [3]. Testing of material properties, X-rays, electron diffraction [2] • Laboratory exercises (all students do not participate in all exercises): 1. Measuring with measuring instruments, 2. Airy's pendulum, 3. Density of solid bodies, 4. Density of alcohol, 5. Spiral spring law, 6. Torsional oscillation, 7. Physical pendulum, 8. Friction, 9. Speed of sound in air and in CO2, 10. Spherical mirror, 11. Bessel method for measuring the focal length, 12. Prism spectrometer, 13. Photometric laws, 14. Determining properties of light source, 15. Young's experiment, 16. Heat of vaporization, 17. Joule's law, 18. Heat pump – heat raiser, 19. Ohm's law, 20. The strength of alternating current. • Auditory exercise: preparation for exam.

Study and examination requirements and forms of examination	Students with a 60% score in pre-exams are exempt from the part of the final exam (final test is compulsory). Final test and final exam (final test is the requirement for the final exam).
Media employed	Whiteboard, projector, experiments integrated with the lecture presentation.
Reading list	Required literature: 1. Kulišić, P.: Mehanika i toplina, Školska knjiga, Zagreb, 1991 2. Henč-Bartolić, V.; Kulišić, P.: Valovi i optika, Školska knjiga, Zagreb, 1989 3. Pavičić, M.: Zbirka riješenih za ataka iz fizike, (2. izdanje), Sveučilište u Zagrebu, Zagreb, 1984 4. Babić, E.; Krsnik, R.; Očko, M.: Zbirka riješenih za ataka iz fizike, Školska knjiga, Zagreb, 1988

Module name:	**Mechanics 1**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	93374
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	II (Summer)
Person responsible for the module	Krešimir Fresl, Mladen Meštrović, Marta Šavor Novak
Lecturer	Marija Demšić, Filip Prekupec, Marta Šavor Novak, Mario Uroš
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semestar II.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory): 30
Workload	Lecture hours 30 Exercise 26 Other contact hours 20 Mid-term exams hours 4 Exam hours 3 Self study hours 67
Credit points	5 ECTS
Requirements according to the examination regulations	• Lecture and exercise attendance, • Solving 2 programs, • 2 pre-exams: 25% score, 1 make-up pre-exam.
Recommended prerequisites	Linear algebra, trigonometry, differential and integral calculus, descriptive geometry and physics.
Module objectives/intended learning outcomes	• Knowledge of vector mechanics, representation of physical quantities by a vector notation. Grasping the meaning of magnitude and direction of a vector, understanding the definition of a unit vector, • Understanding the physical meaning of a force and a moment equilibrium. Mastering the balance of forces and moments to ensure equilibrium for 2D and 3D structures, • Students acquire the skill in drawing a correct and complete free body diagram of forces and moments for a structure, • Understanding the internal forces in structures and learn how to draw the internal forces diagrams for beams, Gerber beams and three-hinged frames, • Students learn the method of joints and the method of sections for the analysis of trusses. They should also be able to identify the zero force members of a truss by inspection, • Understanding the concept of friction on surfaces and calculating friction forces, • Skill in calculing the centroid of lines, areas, volumes and composite bodies, • Understanding the method of virtual work.
Content	• Lectures: 1. Basic concepts and principles. Statics of particles. Forces in plane and space. Resultants. Resolution of a force into components. Unit vectors. Equilibrium of a particle in plane and space [2]

	2. Vector analysis. Rigid bodies: Equivalent systems of forces. Moment of a force about a point and a given axis. Varignon's theorem. Moment of a couple. Reduction of a system of forces in plane and space to one force and one couple. Reduction of a system of forces to a wrench [4] 3. Graphic analysis of forces in the plane [2] 4. Distributed forces: Centroids and centers of gravity [2] 5. Equilibrium of rigid bodies. Free body diagram. Reactions on supports and connections for two and three dimensional structure [2] 6. Analysis of structures. Beams. Internal forces in structural members. Various types of loading and support. Internal forces diagrams. Relations among load and internal forces [7] 7. Gerber beams [1] 8. Plane trusses: Method of joints, Method of Sections [2] 9. The three-hinged frames [2] 10. Method of virtual work [2] 11. Friction [1] 12. Cables [1] • Exercises (auditory): 1. Examples of vector of force in space and in plane. Resultants. Equilibrium of a particle in plane and space [2] 2. Moment of a force about a point, a given axis [2] 3. Reduction of a system of forces in plane and space to one force and one couple [2] 4. Equilibrium of rigid bodies [2] 5. Reactions on supports and connections for two and three dimensional structure [3] 6. Distributed forces: Centroids and centers of gravity [1] 7. Beams [10] 8. Plane trusses: Method of joints, Method of Sections [2] 9. The three-hinged frames [2]
Study and examination requirements and forms of examination	• 2 pre-exams: students who achieve a 60% score in each pre-exam are exempt from the written part of the exam • Programs 10%, • pre-exams or written exam 50-60%, • oral exam 30-40%
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Werner, H.: Mehanika 1 - Statika, HSGI, Zagreb, 2007, 2. Nikolić, Ž.: MehanikaI, SveučilišteuSplitu, Građevinsko-arhitektonskifakultet, Split, 2009, 3. Matejiček, F.; Semenski, D.; Vnučec, Z.: Uvod u statiku sa zbirkom zadataka, Golden marketing, Tehnička knjiga, Zagreb, 2005 Optional literature: 1. Beer, F. P.; Johnston, E. R.: Vector Mechanics for Engineers – Statics, McGraw-Hill, 1988, 2. Kiričenko, A.: Tehnička mehanika - Statika, IGH, Zagreb, 1990, 3. Muftić, O.: Mehanika 1 (Statika), Tehnička knjiga, Zagreb, 1989, 4. Bazjanac, D.: Tehnička mehanika - Statika, Tehnička knjiga, Zagreb, 1963

Module name:	**Building Construction**
Module level, if applicable	Bachelor's Degree Program
Code, if applicable	21688
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	II (Summer)
Person responsible for the module	Silvio Bašić, Nikolina Vezilić Strmo
Lecturer	Marinko Sladoljev, Silvio Bašić, Nikolina Vezilić Strmo
Language	Croatian
Relation to curriculum	Bachelor's Degree Program. Compulsory. Semester II.
Type of teaching, contact hours	Number of hours (in semester): • lectures: 45 hours • exercises: 45 (auditory – 15, design – 30)
Workload	Estimated workload in hours [7 (ECTS) x 30 (hours/ETCS)=]: 90 hours Lecture hours: 70 Other contact hours: 105 Self study hours: 35
Credit points	7 ECTS
Requirements according to the examination regulations	• Regular attendance in lectures and exercises, • Program development, • 2 pre-exams with a minimum 25% score, a make-up pre-exam.
Recommended prerequisites	
Module objectives/intended learning outcomes	• Analysis of the structure of construction, • Description of building structure and its elements, • Identification of functional problem of a primary structure(structural strong hold) and secondary structure(material support/density of support) in buildings, • Ability to present expert analyses associated to structure of construction in buildings, • Applying the acquired knowledge and engineering analyses as well as methodology of work.
Content	• Lectures: 1. Introduction. Foundation. Hydro-insulation [3] 2. Vertical construction [3] 3. Stone walls [3] 4. Concrete slabs [3] 5. Dividing slabs [3] 6. Stucco [3] 7. Ceiling construction [3] 8. Flooring [3] 9. Roof top [3] 10. Roofing materials [3] 11. Staircases [3] • Exercises: 1. Auditory Site Plan M 1:500, Block Plan M 1:200, Floor Plan M 1:100 2. - 4. Constructive

	design - Site Plan M 1:500, Block Plan M 1:200, Floor Plan M 1:100 5. Program completion Site Plan M 1:500, Block Plan M 1:200, Floor Plan M 1:100 6. Auditory Floor Plan M 1:50 7. - 9. Constructive design - Floor Plan M 1:50 10. Program completion Floor Plan M 1:50 11. Auditory Section drawing M 1:50 12.-14. Constructive design - Section drawing M 1:50 15. Program completion Section drawing M 1:50
Study and examination requirements and forms of examination	• Pre-exams, • Programs/ exercises. • Written exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Basic S.,Senjak I., Vezilić Strmo N.: Internal mimeographed notes of lectures Optional literature: 1. Peulić, Đ.: Konstruktivni elementi zgrada I. i II., Tehnička knjiga, Zagreb, 1980, 2. Peulić, Đ.: Konstruktivni elementi zgrada, Croatia knjiga, Zagreb, 2002, 3. Neufert, P.: Elementi arhitektonskog projektiranja, Golden marketing, Zagreb, 2002

Module name:	**Materials Science**
Module level, if applicable	Bachelor's Degree Programs
Code, if applicable	21692
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	II (Summer)
Person responsible for the module	Ivana Banjad Pečur, Nina Štirmer
Lecturer	Marina Bagarić, Ana Baričević, Ivan Gabrijel, Marija Jelčić Rukavina, Bojan Milovanović, Marijana Serdar
Language	Croatian
Relation to curriculum	Bachelor's degree program, Compulsory, Semester II.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory): 15
Workload	Lecture hours 30 Hours of exercises 15 Project 4 Other contact hours 15 Self study hours 56
Credit points	4 ECTS
Requirements according to the examination regulations	• 75 %, attendance in lectures, 100% attendance in exercises, • 2 programs, • 2 pre-exams (min 25 % score in each).
Recommended prerequisites	Basic knowledge of physics and chemistry
Module objectives/intended learning outcomes	• Information, theoretical and factual knowledge about materials. Cognitive skills about basic testing and properties of construction materials. Competences: integration of knowledge in future study and work.
Content	• Lectures: 1. Introduction [2] 2. Physical properties of materials [2] 3. Classification of materials and their properties [2] 4. Surface properties, capillary absorption, surface stress [2] 5. Atom bonding; Physical parameters of materials: thermal, acoustic, optical and electrical properties of materials [3] 6. Chemical properties of materials [3] 7. Development of microstructure: hardening, changes in phases, diagrams of phases [2] 8. Reaction of materials to action of external forces [2] 9. Deformations under short-term and long-term loading [2] 10. Theories of material failure: mechanics of failure [2] 11. Rheology of liquids and solid bodies [2] 12. Fatigue of materials; Durability of materials [2] 13. Regulatory rules [2] • Exercises (auditory): 1. Physical parameters of materials [3] 2. Permeability properties [3] 3. Thermal properties of materials [3]

	4. Optical and electrical properties of materials [3] 5. Mechanical properties of materials [2] 6. Statistical analysis [1]
Study and examination requirements and forms of examination	• Written examination, minimum 50 % score.
Media employed	Whiteboard, projector, laboratory testing equipment
Reading list	Required literature: 1. Bjegović, D., Balabanic, G., Mikulic, D.: Construction materials – solution manual, Faculty of civil engineering, University of Zagreb, 2007 (in Croatian) 2. Ukrainczyk, V.: Introduction to construction materials, Institut građevinarstva Hrvatske, Alcor, Zagreb, 2001 (in Croatian) 3. Young, J.F., Mindess, S.,Gray, R.J., Bentur, A.: The Science and Technology of Civil Engineering Materials; Prentice Hall, 1998, 4. Beslac, J.: Materials in architecture and civil engineering, Školska knjiga, Zagreb, 1989 (in Croatian) Optional literature: 1. Ashby, M. F.; Jones, D. R.: Engineering Materials 1, Butterworth Heinemann 1996, 2. Illston, J. M., Domone, P. L. J. (ed.): Construction materials – their nature and behavior, 4th edition, SPON Press, 2010

III. SEMESTER

Module name:	**Probability and Statistics**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	128881
Subtitle, if applicable	
Courses, if applicable	2 classes for lecture, 10 for auditory groups
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Vera Čuljak, Alan Filipin
Lecturer	Nikola Adžaga, Tatjana Slijepčević-Manger, Kristina Ana Škreb
Language	Croatian
Relation to curriculum	Bachelor's Degree Programmes. Compulsory. Semester III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory): 30
Workload	Lecture hours 30 Hours of exercise 15 Other contact hours 15 Self study hours 60
Credit points	4 ECTS
Requirements according to the examination regulations	• Regular attendance, • Minimum 25% score in mid-term exam.
Recommended prerequisites	• Secondary school mathematics.
Module objectives/intended learning outcomes	• Understanding and availability of the interpretation of descriptive statistical data, • Availability of the presentation of descriptive statistical data, • Understanding random variables, • Knowing basic theoretical facts and fields of the applications of the most common probabilistic distributions, • Understanding relations of statistical variables in the population and model, • Knowledge of and ability to apply elementary methods of inferential statistics – interval estimates, tests.
Content	• Lectures: 1. Descriptive statistics [8] 2. Theory of probability [4] 3. Random variables and their distribution [4] 4. Basic methods of inferential statistics [12] • Exercises (auditory): Same as lectures
Study and examination requirements and forms of examination	Written and oral exam.
Media employed	Whiteboard, projector..
Reading list	Required literature:

	1. Internal mimeographed notes.

Module name:	**Strength of Materials 1**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21740
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Diana Šimić Penava
Lecturer	Janko Košćak, Ivan Duvnjak, Marina Frančić Smrkić
Language	Croatian
Relation to curriculum	Bachelor's Degree Programme. Compulsory. Semestar III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:45 • Exercises: 45 (auditory – 39, laboratory – 6)
Workload	Lecture hours 45 Exercise hours 41 Experimental practice in laboratory hours 4 Other contact hours 25 Self study hours 95
Credit points	7 ECTS
Requirements according to the examination regulations	• Regular attendance in and exercises, • Two pre-exams, in each minimum 25% score; 2 makeup exams.
Recommended prerequisites	• Knowledge of differential and integral calculus (including ordinary differential equations) and linear algebra, • Knowledge of solid body statics. Understanding the concepts of internal forces.
Module objectives/intended learning outcomes	• Applying differential equations of balance and transformation equations to the analysis of stresses and strains, • Using physical equations and Hooke's law to determine the characteristics of deformable solid bodies, • Calculating the stresses of straight rods with torsion, • Distinguishing pure straight bending, bending forces and biaxial bending strength and calculate the base element in bending, • Identifying and calculating the stresses in bending compound and composite girders, • Defining and calculating the stresses in the fastener elements loaded in shear, • Using differential equations elastic line carriers in calculating the deflection and rotation angle girders, • Calculating the stress and deformation of thin walled vessel.
Content	• Lectures: 1. General assumptions and basic design elements. External and internal forces [3] 2. General approach to solving problems in the science of resistance of a material. Stress analysis. Stress tensor. Differential equations of balance and transformation equations [3] 3. Major stresses. Stress ellipsoid. Mohr's stress circle. Octahedral stresses [3]

	4. Strain analysis. Concepts of displacement and strain. Strain tensor. Transformation equations. Major strains [3] 5. Continuity condition. Deformability characteristics of rigid bodies – physical equations[3] 6. Hooke law. Material elasticity constant. Law on superposition, Saint Venant principle [3] 7. Permitted stresses, safety coefficient and recent explanation of structure safety [3] 8. Axial beam loading - extension and pressure. Stress concentration. Structurally indeterminate beam systems. Heat and initial stresses [3] 9. Extension of catenary cable. Stress and strain of thin walled vessel. Shear (cutting force) [3] 10. Design of elements under thrust load. Geometric characteristics of flat beam cross sections – moment of inertia. Torsion of flat beams [3] 11. Prandtl's membrane analogy. Statically indeterminate tasks with torsion [3] 12. Bending of flat beams. Pure bending. Bending under forces. Strength design under bending [3] 13. Bending of compound and composite girders. Skew bending [3] 14. Differential equations of second and fourth order of girders elastic line and solving procedure. 15. Deflections due to transverse force. Influence of temperature on deflection [3] • Auditory exercises: 1. Numerical solving examples. Stress analysis. Strain analysis [6] 2. Hooke law [3] 3. Axial beam loading - extension and pressure [3] 4. Stress and strain of thin walled vessel. Shear (cutting force) [3] 5. Design of elements under thrust load [6] 6. Geometric characteristics of flat beam cross sections – moment of inertia [3], 7. Torsion of flat beams. Prandtl's membrane analogy. Statically indeterminate tasks with torsion. Bending of flat beams [6] 8. Pure bending. Bending of compound and composite girders [6] 9. Skew bending. Differential equations of second and fourth order of girders elastic line and solving procedure [3]
Study and examination requirements and forms of examination	• Pre-exams, written exam 50%, • Oral exam 50%.
Media employed	Whiteboard, projector.
Reading list	Required literature: V. Šimić: Otpornost materijala I, Školska knjiga, Zagreb, 2002 Optional literature: 1. I. Alfirević: Nauka o čvrstoći I, Tehnička knjiga, Zagreb, 1989, 2. D. Bazjanac: Nauka o čvrstoći, Tehnička knjiga, Zagreb, 1973, 3. J. Brnić, G. Turkalj: Nauka o čvrstoći I, Tehnički fakultet Sveučilišta u Rijeci, Rijeka, 2004

Module name:	**Fluid Mechanics**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21720
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Goran Gjetvaj, Goran Lončar
Lecturer	Goran Gjetvaj, Goran Lončar, Hrvoje Mostečak, Kristina Potočki
Language	Croatian
Relation to curriculum	Bachelor's degree programme, Compulsory, Semester III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 45 • Exercises (auditory, design, laboratory): 30
Workload	Lecture hours 45 Hours of laboratories 9 Other contact hours 36 Self study hours and consultation 90
Credit points	6 ECTS
Requirements according to the examination regulations	• Attendance in75% of lectures and 100% of exercises, • Two pre-exams.
Recommended prerequisites	• Knowledge of differential and integral calculus (including ordinary differential equations) and linear algebra, • Knowledge and understanding of the particle mechanics (speed, acceleration, Newton's laws, the change of momentum, energy, force, work, power), • Knowledge and understanding of the substance physical properties (material phases, density, specific volume and the amount of substance), • Understanding of the stress and pressure, transmission of forces through the material, • Knowledge of basic theology principles, velocity of compressible phenomena propagation, the speed of sound, thermal expansion of solids and liquids, phase change, latent heat, specific heat, thermal conductivity, surface tension and capillarity, adsorption and absorption, • Knowledge of the laws of thermodynamics.
Module objectives/intended learning outcomes	• Understanding the basic concepts of fluid(field of physical quantities, the physical properties of liquids, liquid rheological diagram), • Understanding and implementing the procedures of fluid statics calculation (equilibrium equations, pressure forces on surfaces, buoyancy, stability of floating body), • Understanding concepts and procedures used in the calculation of fluid kinematics (the fluid particle motion, streamline, trajectory, stationarity, uniformity, conservatism, total derivative of speed), • Understanding the concepts and applying procedures and calculation sin fluid dynamics (momentum equation, the general law of real fluids (Saint-Venant and the Navier-Stokes equation), kinetic energy budget, Bernoulli's equation for ideal and viscous fluid, laminar flow, turbulent flow, boundary layer, linear and local energy losses, piezometer and energy line, measurements of speed and pressure within the flow field,

	• Application of those finding stopractical hydraulic problems(pipe flow, pump, turbine, spill, overflowing, channel flow, potential flow, groundwater flow, hydrodynamic forces on the immersed body, dynamically stable and unstable forms, physical modelling).
Content	• Lectures: 1. Introduction: basic concepts of fluid and physical quantities fields, the physical properties of liquids, Rheological diagram, forces exerted on fluids [3] 2. Fluid statics: Euler equilibrium equations and its solving, relative motion [3] 3. Fluid statics: Forces acting on the surface, buoyancy and lift force, swimming body stability [3] 2. Fluid kinematics: motion of fluid particles, streamline, trajectory, stationarity, uniformity, conservatism, total derivative of velocity [3] 3. Conservation laws for physical quantities field: law of mass conservation (continuity) [3] 4. Fluid dynamics: momentum equations, general law of real fluid flows (Saint-Venant and Navier-Stokesova equations)[3] 5. Kinetic energy equation, Bernoulli equations for ideal and real fluids, laminar flow, turbulent flow, boundary layer theory [3] 6. Flow resistance, linear and local energy losses, piezometric and energy line, measurement of speed, pressure and discharge within the flow field [3] 7. Application to hydraulic problems: pipe flow including pumps and turbines [3] 8. Application to hydraulic structures: small and large orifice, culverts, overflows [3] 9. Open channel flow: specific energy diagram, flow regimes, uniform flow [3] 10. Open channel flow: non-uniform flow, constriction and elevation of the riverbed, water jump, initiation of sediment transport [3] 11. Potential flow: potential flow equations, boundary condition, source-sink, dipole [3] 12. Groundwater flow: Darcy flow equation, hydrodynamic 3D theory, hydraulic 2D theory, Dupuit assumption, groundwater capture objects [3] 13. Fluid forces on the immersed body, dynamically stable and unstable forms, physical modeling [3] • Exercises: 1. Fluid Statics: The Governing Equations, Pressure Due to Gravity [2] 2. Hydrostatic Pressure in a Compressible Fluid [2] 3. Hydrostatic forces on submerged planar and curved surfaces and bodies, buoyancy [2] 4. “Solid-Body” acceleration of liquids (linear acceleration, solid-body rotation of a fluid), stability of floating objects [2] 5. Law of mass conservation (continuity), potential flow and vortices, uniform andnon-uniform flow, steady and unsteady flow [2] 6. Law of momentum conservation, examples of dynamically stable systems [2] 7. Law of kinetic energy conservation, Bernoulli equation for ideal fluid, piezometric and energy line [2] 8. Bernoulli equation for real fluid, generally approach, determination of local and line energy losses, discharge, speed and pressure measurement [2] 9. Bernoulli equation for real fluid, pipe flow with pumps and turbines [2]

	10. Free discharge (small and large orifice and culverts), sharp crested overflow, Venturi flume, broad crested overflow, specific energy of open channel flow, critical depth and slope, determination of the flow regime according to the bottom slope [2] 11. Open channel flow: application of Chezy equations calculation of hydraulic parameters [2] 12. Non-uniform flow, hydraulic jump and calculation of conjugate depths, stilling basin, influence of flow profile changes on water surface elevation [2] 13. Potential flow in ground water flow analysis, Darcy flow equation, hydrodynamic 3D theory, hydraulic 2D theory, apply of Dupuit assumption in engineering problems of groundwater flow [2] 14. Groundwater flow field, confined and unconfined well, group of wells, calculating the water table depression, open channel flow as boundary condition [2] 15. Fluid forces on the immersed body, Froude and Reynolds partial similarity in physical modeling, dimensional analysis [2]
Study and examination requirements and forms of examination	• According to success achieved in two pre-exams over the course of instruction: 50% -65% - sufficient [2], 66% – 80% - good [3], 81% – 90% - very good [4], 91% – 100% - excellent [5]. • Students with the score under 50% in pre-exams are required to do the written part of the exam and the oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Jović, Osnove hidromehanike, Element, Zagreb, 2005 2. Public domain: (http://www.grad.unizg.hr/predmet/mehtek) 3. Mimeographed notes (pdf, word) 4. Weekly lecture notes (ppt, pdf) 5. Previous exams with a key (pdf, word) Optional literature: 1. Fancev, Mehanika fluida, Tehnička enciklopedija (Technical encyclopedia), vol. 8 2. Agroskin, Hidraulika, Tehnička knjiga, 1969.

Module name:	**Mechanics 2**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	128882
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Mario Uroš, Marija Demšić
Lecturer	Marija Demšić, Ivana Pavleković Gogić, Filip Prekupec,
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semestar III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 23 auditory, 7 design
Workload	Lecture hours 30 Hours of exercise 30 Other contact hours 45 Self study hours 45
Credit points	5 ECTS
Requirements according to the examination regulations	• class attendance (exercises 100%, lectures 75%) • 2 mid-term exam
Recommended prerequisites	• Well knowledge of trigonometry, basics of vector calculus is expected. • Knowledge of the differential and integral calculus as well as the meaning of differentials and integrals is expected. • Well knowledge of basics static lows of particle, rigid bodies and simple systems of rigid bodies, as the understanding of forces transmission to reactions at supports and connections.
Module objectives/intended learning outcomes	• Learn to apply mathematic and informatics knowledge on different problems of particle, rigid bodies and simple systems of bodies motions solving, • To explain kinematics constrains of different supports and connections, • To explain and apply the knowledge of analytical procedure for solving velocities and accelerations problems particle motions depending on various way of setting task, • To explain and apply the knowledge of analytical and graphical procedure for solving velocities and accelerations problems rigid bodies motions depending on various way of setting task, • To explain and apply the knowledge of graphical procedure for determination a displacement and velocities fields of mechanisms, • To explain the motion problem formulation of rigid bodies and systems of bodies due to external force actions, • To identify and explain the motion ways of particle, rigid bodies and simple systems of rigid bodies due to different supports and connections, • To explain a single degree of freedom vibrations problem and apply it to find out a simplified response to some specific loadings in civil engineering.
Content	• Lectures: 1. Kinematics of particles: Introduction to kinematics. Determination of the motion of a particle: position, velocity and acceleration. Coordinate system selection, the relation existing between various systems [1]

	2. Selected methods on determination of the particle motion: vector functions, parametric and natural way. Determination of the kinematics properties of the various motion laws [1] 3. Particular way of the motions, angular velocity, angular acceleration. Analytical and graphical solution methods of rectilinear-motion problems [1] 4. Absolute and relative motion. Composed motion. Coriolis acceleration explanation [1] 5. System of particles motion. General laws application. Motion of a connected particles system [1] 6. Introduction to Kinematics of a rigid body. Translation, rotation, motion in a plane [1] 7. Analysis of a rigid body motion in a plane. Central axis. Selection of the degrees of freedom. The generalized coordinates [1] 8. Analysis of a joined bodies systems. Mechanisms degrees of freedom [1] 9. Constrained plane motion of rigid bodies systems. Kennedy's theorem [1] 10. Fields of velocities and the displacement fields definitions. Graphical methods in solutions [1] 11. Application of the field of velocities and the displacement fields on the theory of structures. Principle of virtual work [1] 12. Introduction to dynamics of particle. Fundamental laws and principles of dynamics overview [1] 13. Motion of a particle under the action of force: Newton's laws. Free and constrained plane motion [1] 14. D'Alembert principle. Theorem of momentum [1] 15. The law of moment of momentum [1] 16. The law of relative motion of a particle. Moment of momentum with respect to a moving reference plane [1] 17. Work of a force. Function of a force, conservative forces and proper laws [1] 18. Potential energy. Kinetic energy of a particle. Principle of work and energy. Conservation of energy [1] 19. Dynamics of a system of particles (free and constrained)..The point of a centre of mass [1] 20. Motion of the center of mass. Theorem of momentum. The moment of momentum. Kinetic energy of a system of particles [1] 21. Systems of particles motion analysis, application of fundamental dynamic laws [1] 22. Impact of two particles. Principle of impulse and momentum. Impact several particles [1] 23. Rigid body dynamics: Mass moments of inertia, major axis, Steiner's item [1] 24. General plane motion of a rigid body. Translation of a rigid body. Equations of a rigid body translation motions [1] 25. Rotation about a fixed axis. Equations defining the rotation of a rigid body about a fixed axis [1] 26. Inertial force. Reactions exerted by the rotation of a rigid body about a fixed axis [1] 27. Plane motion of a rigid body: Equations of motion, D'Alembert's principle, momentum and moment of momentum [1] 28. Application of the principle of momentum and the law of moment of momentum to the analysis of the plane motion of a rigid body [1] 29. Introduction to mechanical vibrations: Free vibrations of particles. Simple harmonic motion without damping. Damped free vibrations [1] 30. Introduction to simple forced mechanical vibrations without damping [1] • Exercises (auditory, design): Follows the lectures

Study and examination requirements and forms of examination	• First part of written exam (problems only) – 55% is necessary to access a second part of exam • Second part of written exam (problems solving and explaining lows of Kinematics and Dynamics) – 50% is necessary to access grade
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. V. Andrejev: Kinematika, dinamika, Tehnička knjiga, Zagreb, 1973. 2. A. Kiričenko: MehanikaII, PBI d.o.o., 1976 3. A. Kiričenko: Mehanika III, PBI d.o.o., 1996 4. V.Raduka: Lectures (on line) 5. V.Raduka: Solved problems, examples for exercises (on line) Optional literature: 1. F.P.Beer, E.R. Johnston: Vector Mechanics for Engineers – Dynamics, 1988

Module name:	**Construction Materials**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	128884
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Ivana Banjad Pečur; Nina Štirmer
Lecturer	Marija Bagarić, Ivan Gabrijel, Bojan Milovanović, Miro matuzić, Zvjezdana Matuzić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semestar III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises : 30 (auditory – 12, laboratory - 18),
Workload	Lecture hours 30 Laboratory and Auditory exercise 30 Project 8 Other contact hours 15 Self study hours 67
Credit points	5 ECTS
Requirements according to the examination regulations	• Minimum 75% attendance in lectures, • 100% attendance in exercises, • 2 programs, • 2 preliminary exams (min 25 % score in each).
Recommended prerequisites	• Basic knowledge of materials science.
Module objectives/intended learning outcomes	• Theoretical and factual knowledge about construction materials, • Cognitive and practical skills in basic testing and properties of construction materials, • Competences: integration of knowledge in future study and work. Students will be able to determine basic physical and mechanical properties of construction materials, make aggregate grading curves and concrete mix design.
Content	• Lectures: 1. Introduction [2] 2. Stone [2] 3. Aggregate [2] 4. Ceramics [2] 5. Inorganic binders [2] 6. Mortar [2] 7. Concrete [2] 8. Organic binders [2] 9. Metals [2] 10. Timber [2] 11. Polymers[2] 12. Glass [2] 13. Adhesives, colours and varnishes, Insulation materials [2] 14. Concrete admixtures [2] 15. Quality control [2]

	• Auditory exercises: 1. Stone [2] 2. Aggregate [2] 3. Ceramics [2] 4. Inorganic binders [2] 5. Mortar [2] 6. Fresh concrete [2] 7. Hardened concrete [2] 8. Strength [2] 9. Non-destructive testing methods [2] • Laboratory exercises: 1. Physical and mechanical properties of stone [2] 2. Physical and mechanical properties of ceramics [2] 3. Aggregate properties for concrete [2] 4. Fresh concrete testing [2] 5. Mechanical properties of construction materials [2] 6. Non-destructive testing methods [2].
Study and examination requirements and forms of examination	• Minimum 60% score in written exam, • Oral exam.
Media employed	Whiteboard, projector, laboratory testing equipment
Reading list	Required literature: 1. Young, J.; Mindess, S.; Gray, R. J., Bentura: The Science and Technology of Civil Engineering Materials, Prentice Hall, 1998, 2. Ukrainczyk, V.: Introduction to construction materials, InstitutgradevinarstvaHrvatske, Alcor, Zagreb, 2001 (in Croatian), 3. Ukrainczyk, V.: Concrete – Structure, Properties and Technology, Alcor, Zagreb, 1994 (in Croatian), 4. Bjegovic, D., Balabanic, G., Mikulic, D.: Construction materials – solution manual,, Faculty of civil engineering, University of Zagreb 2007, (in Croatian), 5. Beslac, J.: Materials in architecture and civil engineering, Skolskaknjiga, Zagreb, 1989 (in Croatian), 6. Durekovic, A.: Cement, cement composites and additives for concrete, Skolskaknjiga, Zagreb, 1996 (in Croatian), Optional literature: 1. Ashby, M. F.; Jones, D. R.: Engineering Materials 1, Butterworth Heinemann 1996, 2. Illston, J. M., Domone, P. L. J. (ed.): Construction materials – their nature and behavior, 4th edition, SPON Press, 2010, 3. Taylor, G. D.: Materials in Construction, second edition, Longman Group UK Limited, 1994

Module name:	**Basics of Concrete Technology**
Module level, if applicable	Bachelor's Degree Programs
Code, if applicable	128885
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Marijan Skazlić, Ivan Gabrijel
Lecturer	Ana Baričević, Marija Jelčić Rukavina
Language	Croatian
Relation to curriculum	Bachelor's degree programme, Compulsory elective. Semestar III.
Type of teaching, contact hours	Number of hours (in semester): 60 • Lectures: 30 • Exercises: 30 (auditory – 15, laboratory - 15), • E-learning: optional
Workload	Lecture hours 30 Hours of laboratories 18 Hours of auditory exercises 12 Other contact hours 10 Preparation of two students' programs 10 Self study hours 70
Credit points	5 ECTS
Requirements according to the examination regulations	• Minimum 75% attendance in lectures, • 100% attendance in auditory exercises, • 100% attendance in laboratory exercises, • Concrete mix design paper, 2 preliminary exams (min 25 % score in each)
Recommended prerequisites	• Basic knowledge of physics, chemistry and materials science.
Module objectives/intended learning outcomes	• Basic knowledge about concrete properties in fresh and hardened state and concrete mix design, • Knowledge about the properties of concrete components(cement, aggregates, additives) and their influence on concrete design and properties, • Practical skills in the application of certain concrete technology depending on the type of structure, • Theoretical and factual knowledge of concrete degradation processes and concrete durability in different environmental conditions, • Understanding the process of concrete quality control in concrete production plant and on-site by using laboratory and field test methods, • Knowledge about special concrete types and special concrete technology • Integration of knowledge in future study and work.
Content	• Lectures: 1. Introduction [2] 2. Cement [2] 3. Aggregate, Water, Admixtures [2] 4. Fresh Concrete and Concrete Mix Design [2] 5. Strengths of Concrete [2] 6. Concrete Deformation Properties [2] 7. Durability of Concrete [2] 8. Concrete Production [2]

	9. Basics of Concrete Technology, Concrete in Extreme Conditions [2] 10. Special Concrete types [4] 11. Special Concrete types II [2] 12. Advanced Concrete Technology [2], 13. Concrete Testing Methods and Quality Control [2] 14. Technical Regulations for Concrete Structures [2] • Auditory exercises: 1. Physical Parameters of Construction Materials, Cement [2] 2. Aggregate [2] 3. Concrete Mix Design [2] 4. Concrete properties in hardened state [2] 5. Concrete deformations [2] • Laboratory exercises: 1. Physical Parameters of Construction Materials [2] 2. Cement [2] 3. Aggregate [2] 4. Fresh Concrete and Concrete Mix Design [2] 5. Hardened concrete [2]
Study and examination requirements and forms of examination	Written examination (minimum 60 % score) and oral examination
Media employed	Whiteboard, projector, laboratory testing equipment
Reading list	Required literature: 1. Bjegovic, D., Balabanic, G., Mikulic, D.: Construction materials – solution manual,, Faculty of civil engineering, University of Zagreb 2007 (in Croatian) 2. Ukrainczyk, V.: Concrete: structure, properties and technology, Institut gradevinarstva Hrvatske, Alcor, Zagreb, 2001 (in Croatian) 3. Young, J.F.; Mindess, S.;Gray, R.J.; Bentur, A.: The Science and Technology of Civil Engineering Materials; Prentice Hall, 1998, 4. Beslac, J.: Materials in architecture and civil engineering, Skolska knjiga, Zagreb, 1989 (in Croatian) 5. Krstulović, P., Properties and technology of concrete, ISBN 953-6116-20-0, Faculty of civil engineering, University of Split. (in Croatian) Optional literature: 1. Mehta P.K., Concrete, Structure, Properties and materials, New Yersey: Prentice Hall, Inc., Englewood Cliffs,1986. 2. Neville, A.M., Properties of concrete, fourth edition. Essex: Longman Group Limited,1995, 3. Žarnić, R., Osnove lasnosti gradiv, Ljubljana: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo, Katedra za preskušanje materialov in konstrukcij, 1999, 4. Muravljov, M. Basics of concrete theory and technology. 3 edition. Građevinska knjiga, Beograd, 2005, 5. Zoran Grdić, Concrete technology, GAF, Niš, 2011

Module name:	**Hydrology**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	128883
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	III (Winter)
Person responsible for the module	Damir Bekić
Lecturer	Kristina Potočki
Language	Croatian, English
Relation to curriculum	Bachelor's degree programme, Compulsory, Semester III.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory): 15
Workload	Lecture: 30 hours Other contact hours 30 Self study hours 30
Credit points	3 ECTS
Requirements according to the examination regulations	• 75 %, attendance in lectures, 100% attendance in exercises, • 2 programs, • 2 pre-exams (min 25 % score in each).
Recommended prerequisites	Basic knowledge of physics and chemistry.
Module objectives/intended learning outcomes	Information, theoretical and factual knowledge about materials. Cognitive skills about basic testing and properties of construction materials. Competences: integration of knowledge in future study and work.
Content	• Lectures: 1. Introduction [2] 2. Physical properties of materials [2] 3. Classification of materials and their properties [2] 4. Surface properties, capillary absorption, surface stress [2] 5. Atom bonding; Physical parameters of materials: thermal, acoustic, optical and electrical properties of materials [3] 6. Chemical properties of materials [3] 7. Development of microstructure: hardening, changes in phases, diagrams of phases [2] 8. Reaction of materials to action of external forces [2] 9. Deformations under short-term and long-term loading [2] 10. Theories of material failure: mechanics of failure [2] 11. Rheology of liquids and solid bodies [2] 12. Fatigue of materials; Durability of materials [2] 13. Regulatory rules [2] • Exercises (auditory): 1. Physical parameters of materials [3] 2. Permeability properties [3] 3. Thermal properties of materials [3] 4. Optical and electrical properties of materials [3] 5. Mechanical properties of materials [2]

	6. Statistical analysis [1]
Study and examination requirements and forms of examination	• Written examination 100 %, • Preliminary exams 70%, • Programs 30%.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Bjegović, D., Balabanic, G., Mikulic, D.: Construction materials – solution manual, Faculty of civil engineering, University of Zagreb, 2007 (in Croatian) 2. Ukrainczyk, V.: Introduction to construction materials, Institut građevinarstva Hrvatske, Alcor, Zagreb, 2001 (in Croatian) 3. Young, J.F., Mindess, S.,Gray, R.J., Bentur, A.: The Science and Technology of Civil Engineering Materials; Prentice Hall, 1998, 4. Beslac, J.: Materials in architecture and civil engineering, Školska knjiga, Zagreb, 1989 (in Croatian) Optional literature: 1. Ashby, M. F.; Jones, D. R.: Engineering Materials 1, Butterworth Heinemann 1996, 2. Illston, J. M., Domone, P. L. J. (ed.): Construction materials – their nature and behavior, 4th edition, SPON Press, 2010

IV. SEMESTER

Module name:	**Applied Geology**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21752
Subtitle, if applicable	
Courses, if applicable	1. Applied Geology, 2. Hydrogeology and Engineering Geology
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Meho-Saša Kovačević
Lecturer	
Language	Croatian, English
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semestar IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:30
Workload	Lecture hours 30 Other contact hours 10 Self study hours 50
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in 75% lectures, • Minimum 25% score in the pre-exam.
Recommended prerequisites	Kowledge of basic chemical elements and compounds.
Module objectives/intended learning outcomes	• Ability to distinguish between igneous, metamorphic and sedimentary rocks, • Ability to identify layers, faults and overthrust, • Knowledge about the process of the formation of karst and various karst formations and learning about the problems which constructors encounter during construction of tunnels in karst, • The ability to use geological maps – recognition of geological symbols, determination of the geological age of rocks, their composition and other important geological phenomena of a terrain, • Knowledge of basic engineering-geological rock mass classification.
Content	• Lectures: 1. Introduction [2] 2. General information about the geosciences, Geology general, stratigraphic; Constitution of Earth; Geoid; Mineralogy; Mineral; Crystal [2] 3. Isotropic and anisotropic minerals; pyrogenic, pneumatogenic, hydrothermal, hydatogenic; Axis, center plane of symmetry; crystal systems; properties of crystals, crystal connection; tetrahedral coordination, coordination number; Polymorphism; Isomorphism [2] 4. The properties of minerals, Mineral groups; oxides and hydroxides, carbonates, sulfates, silicates [2] 5. Introduction to Petrology; Rock phenocrysts, Monomineral; igneous rocks; types of igneous rocks, structure and texture of igneous rocks; Acidity of magma; Bowen series of crystallization; Table of igneous rocks [2]

	6. Sedimentary rocks, sediment transport, mineral composition of sedimentary rocks , structures and textures of sedimentary rocks; General overview of sedimentary rocks, metamorphic rocks, metamorphic zones; types of metamorphic rocks [2] 7. Tectonics, rock exposures, outcrops, thickness of layers, anticlines and synclines, faults, over thrust, types of cracks [2] 8. Pre-exam [2] 9. Egzodynamic processes; insolation, hydrogeology, water, the hydrologic cycle, porosity, permeability, laminar and turbulent flow; types of aquifers; Ghyben Herzberg law; Ice and Snow, Wind, organisms [2] 10. Pre-exam [2] 11. Karst; external karst formations; interior karst formations [2] 12. Types of caves, speleothems, groundwater [2] 13. Landslides; Endodynamics; orogeny, epirogensis [2] 14. Volcanoes, Earthquakes; Earthquake scales, seismicity [2] 15. Geological maps, RMR and Q classification of rocks in the construction domain; determining the age of rocks [2]
Study and examination requirements and forms of examination	Written and oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Herak, M., Geology, 1990 2. Šestanović, S., Basics of Geology and Petrology, 2001 Optional literature: 1. West, T.,Geology Applied to Engineering, 1994 2. Monroe, J. & Wicander, R., Physical geology, 2006 3. Plummer,C., McGeary,D. & Carlson, C., Physical Geology, 2010

Module name:	**Environmental Protection**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21769
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Živko Vuković
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semestar IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours 30 Consultation hours 30 Self study hours 30
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Two pre-exams.
Recommended prerequisites	Basic knowledge in physics, biology, chemistry and civil engineering.
Module objectives/intended learning outcomes	• Understanding basic ecological processes, • Recognising and explaining basic ecological principles, • Explaining basic technological procedures of wastewater treatment, • Understanding waste management, • Understanding the concept of "sustainable development".
Content	• Lectures: 1. Introduction [2] 2. Basic ecological concepts (ecology, biotop, biocenose, ecosystem, biodiversity) [3] 3. Global changes in biosphere –changes in atmosphere [2] 4. Pedosphere pollution [2] 5. Hydrosphere pollution [3] 6. The impact of cities [3] 7. The impact of landfills [3] 8. Impact of hydraulic structures [3] 9. Transportation facilities impact [3] 10. Environmental sustainability and sustainable development [3] 11. Measures and environmental protection procedure (political and sociological approach, legal measures, environment planning, economic and financial measures, scientific approach and technological measures, institutional measures [3]
Study and examination requirements and forms of examination	Students with minimum 60 % score in each pre-exam are exempt from the final exam. Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Vuković, Ž.: Environment Protection, Manuscript, 2014, Zagreb (in Croatian).

	Optional literature: 1. Raven, P. H., Berg, L. R., Hassenzahl, D. M.: Environment, 7th Edition, Wiley, 2010. 2. Miller, G. T.: Living in the Environment: Principles, Connections, and Solutions, 15th Edition,Thomson Books, 2007.

Module name:	**Strength of Materials 2**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	128886
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Joško Krolo
Lecturer	Janko Košćak, Marko Bartolac, Ivan Dokoza, Marina Frančić Smrkić, Katarina Holek, Ana Skender
Language	Croatian
Relation to curriculum	Bachelor's Degree Programme. Compulsory. Semestar IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 45 • Exercises: 30 (auditory – 28, laboratory - 2)
Workload	Lecture hours 45 Exercise hours 28 Experimental practice in laboratory hours 2 Other contact hours 10 Self study hours 80
Credit points	5,5 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Attendance in laboratory exercises, • 2 pre-exams: in each pre-exam students are required to do a minimum25% score, 2 make up tests.
Recommended prerequisites	• Knowledge about differential and integral calculus, • Knowledge about mechanics (statics and kinematics), stress and strain analysis and calculation of stresses and strains of flat beams caused by individual internal forces(longitudinal and transversal forces, torsion and bending moments).
Module objectives/intended learning outcomes	• Recognizing static indetermination and solving simple statically indeterminate systems, • Solving simple cases of girders on an elastic base, • Using the basic theories of strength that dimensioning of structural elements loaded with multiaxial stress state, • Analyzing complex stress-loaded beams, determining the cross section core and applying it in biaxial bending and eccentric load, • Determining and understanding the importance of the shear center in thin-walled cross-sections, • Calculating the stress and strain in curved beams and perceiving the difference between the flat beams, • Explaining and applying the principle of minimum potential energy of deformation, • Explaining the problem of stability loss(buckling) of flat beams and dimension beams loaded to buckling, • Calculating simple statically determined and statically indeterminate structures using theory of plasticity.
Content	• Lectures: 1. Simple statically indeterminate systems [3]

	2. Girder on an elastic base [3] 3. Equivalent stress according to strength theories. Comparison and application of strength theories. [4] 4. Complex loading of flat beams. Bending and axial load. Bending and torsion. [3] 5. Eccentric loading of the short beams. Cross section core. [3] 6. Application of cross section core. Stresses in cross section with exclusion of tension zone. Bending and axial loading of composite beams. [3] 7. Thin-walled cross-sections. Shear center. [3] 8. Curved beams theory. Stress and strain due to longitudinal and transversal forces. Bending. The general case of bending. Rational shapes of curved beam cross section under bending. [3] 9. Potential energy of deformation. Theorem of reciprocity effect of work and displacements, Castigliani's theorems , Crotti - Engesser's theorem. [4] 10. Principle of strain minimum potential energy. Principle on stationary condition of potential energy system. [3] 11. Buckling, elastic stability loss. Beam buckling in the elastic area. Euler's critical force [3] 12. Beam buckling in the plastic area (extension of Euler's expression for the critical force by introducing a tangent module). Slender beam under the action of longitudinal and transverse loads. Dimensioning of beams under buckling load stability condition [4] 13. Design of structures according to plasticity theory. The model of ideal elastoplastic material. The condition of plasticity. Plastic torsion and plastic bending of a flat beam. Influence of load release, residual stresses[3] • Exercises (auditory, laboratory): 1. Simple statically indeterminate systems[2] 2. Beam on an elastic base[2] 3. Comparison and application of theories of strength[3] 4. Cross-section core [2] 5. Application of the cross-section core to biaxial bending and eccentric load[2] 6. Shear center[2] 7. Curved beams [2] 8. Application of Castiglian's theorems and the principle of minimal potential energy of strain in solving static systems[3] 9. Beam buckling in the elastic area[3] 10. Design of structures according to plasticity theory[3] 11. Laboratory exercise[2] • Pre-exams: 1. Statically indeterminate beams. Beam on an elastic base. Cross-section core. Shear center. Strength theories. 2. Curved beams. Potential energy. Buckling. Design of structures according to the theory of plasticity.
Study and examination requirements and forms of examination	• Written part of the exam: to pass students are required to achieve minimum 50% score, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Šimić, V.: Strength of Materials II, Školska knjiga, Zagreb, 2002 2. Bazjanac, D.: Science of Strength, Tehnička knjiga, Zagreb, 1967

	Optional literature: 1. Alfirević, I.: Science of Strength II, Golden marketing, Zagreb, 1999 2. Timošenko, S.: Strength of Materials I i II, Građevinska knjiga, Beograd, 1965 3. Brnić, J.; Turkalj, G.: Science of Strength II, Zigo, Rijeka, 2006

Module name:	**Structural Analysis 1**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	128894
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Mladen Meštrović, Krešimir Fresl, Josip Atalić
Lecturer	Maja Baniček, Petra Gidak, Elizabeta Šamec
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. IV Semestar.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 60 • Exercises (auditory): 45
Workload	Lecture hours 60 Exercises 45 Other contact hours 30 Self study hours 90
Credit points	7,5 ECTS
Requirements according to the examination regulations	• Regular attendance in lectures and exercises, • Doing 3 programs and the discussion with an assistant lecturer, • 2 pre-exams: each requires a 25% score, one make up pre-exam.
Recommended prerequisites	• Knowledge of differential and integral calculus (including ordinary differential equations), and linear algebra, • Knowledge of the statics of particles, particle systems, rigid bodies and connected systems, • Understanding the concept of stress and strain and internal forces.
Module objectives/intended learning outcomes	• Recognising geometric invariability and statical determinacy or indeterminacy of rod structures, • Interpreting conditions of equilibrium in the plane and in the space and applying them when calculating external and internal forces, • Explaining and applying analytical and graphical methods in calculating statically determinate planar and spatial structures, • Explaining the concept of virtual work and comparing it with the equlibrium conditions and kinematic conditions, • Explaining variational theorems and comparing them with the equilibrium conditions and kinematic conditions, • Explaining and applying analytical procedures in calculating statically indeterminate structures, • Explaining and applying analytical and graphic procedures in determining displacement and deflection lines, • Applying influence function in calculating the influence of moving load.
Content	• Lectures: 1. The scope, objectives and methods of structural analysis. Model of structure. Basic assumptions and principles [1] 2. Differential and integral equations of equilibrium. Simple beams [2] 3. Multi-span statically determinate beams: analytical and graphical methods [3]

	4. Trusses: statical determination and geometric invariance; analytical and graphical methods [3] 5. Three-hinged and similar beams 5.1 Graphical methods [4] 5.2 Analytical methods [3] 5.3 Methods based on superposition[4] 6. Elastic systems. Displacements and deflection lines [4] 7. Work. Virtual displacements. Virtual work for elastic bodies. Application [6] 8. Variational methods [3] 9. Statically indeterminate structures. Methods of analysis [3] 10. Force method: 10.1 Transformation into determinate structures [2] 10.2 Equations of the force method. Flexibility matrix [6] 10.3 Forced displacement and the influence of heat. Calculation of displacement [4] 11. Introduction to deflection method. Equilibrium equations. Matrix formulation [6] 12. Introduction to the finite element method [3] 13. Influence functions and influence lines – application [2] 14. Spatial stastically determinate systems [2] • Exercises (auditory): 1. Multi-span statically determinate beams and trusses [6] 2. Three-hinged and similar girders [12] 3. Elastic lines [4] 4. Application of the virtual forces theorem [4] 5. Force method [14] • Pre-exams: 1. Covers parts 1. and 2. in exercises 2. Covers parts 4. and 5. In exercises
Study and examination requirements and forms of examination	• Written exam: 50 % score, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. V. Simović: Građevna statika , Građevinski institut, Zagreb, 1988. 2. M. Anđelić: Građevna statika 2, Građevinski fakultet, Zagreb, 2005. 3. K. Fresl: GS – Bilješke i skice s predavanja, http://master.grad.hr/nastava/gs Optional literature: 1. M. Sekulić: Teorija linijskih nosača, Građevinska knjiga, Beograd, 2005. 2. L. P. Felton, R. B. Nelson: Matrix Structural Analysis, Wiley, New York, 1997.

Module name:	**Introduction to Strucutral Engineering**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	128895
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (summer)
Person responsible for the module	Ivica Džeba, Vlatka Rajčić
Lecturer	Jure Barbalić, Ivan Čurković, Mislav Stepinac
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. IV Semestar.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 27 • E-learning: 3
Workload	Lecture hours 30 Other contact hours 15 Self study hours 15
Credit points	2 ECTS
Requirements according to the examination regulations	• Attendance in lectures, • 2 pre-exams : minimum 25% score in each; makeup pre-exam for students who did not achieve minimum 25% score in one or both pre-exams for students who want to improve the score achieved in regular pre-exam.
Recommended prerequisites	• Knowledge of statics of rigid body and connected systems, • Understanding and ability to apply equilibrium conditions in plane and space, • The ability of structure spatial perception, • Knowledge about building construction basic elements.
Module objectives/intended learning outcomes	• Ability to make layout solutions of simpler structures made of various materials – concrete, steel and timber, • Adentifying key factors related to structural reliability, • Ability to determine actions on structures and their design situations for various limit states, • Ability to use European structural standards for actions.
Content	• Lectures: 1. Basic structural elements and ways of transferring forces [4] 2. Fundamentals on creating building layout solutions [4] 3. Typical building disposition solutions for different building materials [6] 4. Modes of action transfer [2] 5. Fundamentals of structural reliability [6] 6. Reliability concept built into European standards Eurocode [2] 7. Methods of action determination [2] 8. Design situations for various limit states [4]
Study and examination requirements and forms of examination	Written exam: minimum 60% score.
Media employed	Whiteboard, projector.
Reading list	Required literature:

	1. Schultz, Sobek, Habermann: Steel structures atlas, Građevinska knjiga, 2010.(In Croatian) 2. Bjelanović, Rajčić: Timber structures according to European standars, GF Zagreb, 2005. (In Croatian) 3. Milčić, Peroš: Introduction to reliability of structures, Građevinski fakultet Split, 2003. (In Croatian) 4. Radić: Concrete structures, Hrvatska sveučilišna naklada, Zagreb, 2006. (In Croatian) 5. Džeba et al.: WEB materials Optional literature: 1. Eurocode EN 1990, EN 1991

Module name:	**Soil Mechanics**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	128896
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Meho-Saša Kovačević, Lovorka Librić
Lecturer	Gordana Ivoš, Stjepan Matić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:45 • Exercises (design):30
Workload	Lecture hours 45 Numerical exercises hours 28 Midterm written examination hours 2 Self study hours 73 Final written examination hours 2
Credit points	5 ECTS
Requirements according to the examination regulations	• Attendance in lectures (3points), • Attendance in exercises (2points), • Two homework assignments (10points), • Pre-exam (30points), • Final exam (60 points).
Recommended prerequisites	Subject matter of Mechanics 1, Strength of materials 1 and Fluid mechanics
Module objectives/intended learning outcomes	• Understanding the classification of soils into groups of similar properties; basic elements of seepage in soil and can interpret flow nets; basic elements about soil stiffness and strength; essential features and use of laboratory and field testing equipment in geotechnical engineering. • Ability to classify soils related to basic engineering properties; to calculate bearing capacity and settlement of shallow foundations; estimating safety of simple slopes in soils; to calculate lateral pressures on simple retaining structures. • Ability to integrate the acquired knowledge about general mechanical behavior of solids and fluids with particular aspects of mechanical properties of soils; application of acquired knowledge in solving typical problems in design of simple geotechnical structures.
Content	• Lectures: 1. Introduction to soil mechanics [3] 2. Basic soil properties and phase relationships, granulometric composition of the soil, border consistency of fine grained soil [3] 3. Capillarity, soil classification, soil compaction [3] 4. Seepage in soils [3] 5. Strain and stress, effective stress, stiffness of the soil, potential flows in calm water [3] 6. The flow of water through the soil [3] 7. Drained and und rained condition, soil consolidation [3]

	8. Shear strength of soil [3] 9. Application of the plasticity method and the method of limit equilibrium [3] 10. Immediate and time dependent settlement of shallow foundations [3] 11. Eurocode 7 [3] 12. Slope stability [3] 13. Shallow foundations [3] 14. Supporting structures [3] 15. Geotechnical field investigations [3] • Exercises (design): 1. Images of geotechnics, field work, laboratory [2] 2. Phase relationships and grain size distribution [2] 3. Soil classification [2] 4. Effective stress, stiffness of the soil [2] 5. The flow of water through the soil [2] 6. Soil consolidation [2] 7. Shear strength of soil, bearing capacity of shallow foundations [2] 8. Settlement of shallow foundations [2] 9. Applications of Eurocode 7 [2] 10. Infinite slope [2] 11. Slope stability [2] 12. Shallow foundations [2] 13. Supporting structures [2]
Study and examination requirements and forms of examination	• Students should earn minimum 55points (including the final examination) for a pass.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Roje-Bonacci, Tanja: Mehanika tla, Građevinski fakultet Sveučilišta u Splitu, (in Croatian). Optional literature: 1. Craig, R. F. (1997).Soil Mechanics, Sixth Edition. E & FN Spon, London.

Module name:	**Water Supply and Sewerage 1**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21764
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Ivan Halkijević
Lecturer	Ivan Halkijević, Marin Kuspilić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semester IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:30 • Exercises (auditory):15
Workload	Lecture hours 30 Exercise hours 15 Consultation hours 30 Self study hours 45
Credit points	4 ECTS
Requirements according to the examination regulations	• Attending lectures and exercises, • Two pre-exams.
Recommended prerequisites	Prior knowledge in Fluid mechanics.
Module objectives/intended learning outcomes	• Planning, design, construction and operation of water supply and sewerage systems facilities: water intakes, pumping station, water conditioning plants, water tanks, water supply networks, sewerage networks, sewerage facilities, waste water treatment plants, outlets, house water supply and sewerage networks.
Content	• Lectures: 1. Water supply – introduction, water supply systems [2] 2. Water consumption [2] 3. Springs, water intakes [2] 4. Pumping stations, water intakes [3] 5. Water conditioning [3] 6. Water tanks, water supply networks [2] 7. Water supply networks – calculation [2] 8. Waste disposal facilities – introduction, waste disposal facilities systems [2] 9. Design waste water quantities [2] 10. Sewerage networks [2] 11. Sewerage networks– calculus [2] 12. Sewerage facilities [3] 13. Waste water treatment and drainage [3] • Exercises (auditory): 1. Numerical examples of water consumption [1] 2. Dimensioning water intake facilities [1] 3. Dimensioning pumping stations [1] 4. Dimensioning water conditioning facilities [1] 5. Dimensioning water tanks [1]

	6. Hydraulic calculus of water supply networks [3] 7. Determining the hydrostatic and hydrodynamic force pressure within water supply networks [1] 8. Determining the quantities of waste water [1] 9. Hydraulic calculus of sewerage networks [3] 10. Dimensioning facilities in a sewerage network [1] 11. Determining parameters for dimensioning the facilities for waste water treatment [1]
Study and examination requirements and forms of examination	Written and oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Vuković, Ž.: Water Supply and Sewerage 1, Manuscript, 2014, Zagreb (in Croatian). Optional literature: 1. Ratnayaka, D. D., Brandt, M. J., Johnson, K. M.: Tworts Water Supply, 6th Edition, Elsevier, 2009 2. Trifunović, N.: Introduction to Urban Water Distribution, Taylor & Francis Group, London, 2008 3. Margeta, J.: Vodoopskrba naselja: planiranje, projektiranje, upravljanje, obrada vode, AG fakultet, Split, 2010

Module name:	**Water Protection**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21765
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	
Lecturer	Dražen Vouk, Marin Kuspilić
Language	Croatian
Relation to curriculum	Bachelor's degree programme, Compulsory elective. Semestar IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory, design, laboratory): 15
Workload	Lecture hours 30 Hours of laboratories or skills 15 Other contact hours 10 Self study hours 65
Credit points	4 ECTS
Requirements according to the examination regulations	• Regular attendance in lectures and exercises, • Exercise attendance 100% • Lecture attendance 75%
Recommended prerequisites	General knowledge from secondary school, the basics of mathematical modeling.
Module objectives/intended learning outcomes	• Acquiring basic knowledge about natural and wastewater properties, anthropogenic impacts on water quality, • Legal measures on water protection, water quality modeling and wastewater treatment.
Content	• Lectures: 1. Basic ecological principles: biotic and abiotic factors, biotopes, biocenosis, ecosystems. Water properties: structure, physical, chemical, biological [3] 2. Water quality: physical, chemical and biological indicators. Changes in water quality: pollution sources, wastewater types, water auto-purification [1] 3. Water quality models: empirical models, numerical models, QUALL, WASP [2] 4. Aquatic systems degradation: eutrophication, chronic and acute pollution ([2], 5. Water quality management: political and sociological issues, legal measures, physical planning, financial and economic measures, scientific and technological measures, institutional measures, water protection plans and programs [2] 6. Wastewater treatment: general principles, mechanical treatment, physico-chemical treatment [2] 7. Wastewater treatment: biological – conventional treatment with active sludge [2] 8. Wastewater treatment: biological – extended aeration, SBR [2] 9. Wastewater treatment: biological – nitrogen and phosphorus removal [2]

	10. Wastewater treatment: sludge treatment [2] 11. Wastewater treatment: alternative wastewater treatment [2] 12. Wastewater treatment: alternative procedures [2] 13. Mixing models in lakes and seas: (VISUAL PLUMES, CORMIX) [2] 14. Best management practices in runoff treatment [2] 15. Non point pollution control: phenomenon, sources, control techniques [2] • Exercises (auditory: 1. Waste water analyses: physical, chemical, biological [1] 2. Streeter-Phelps oxygen sag curve calculation [1] 3. River water quality modeling (QUAL, WASP) [1] 4. River water quality modeling (QUAL, WASP) [1] 5. River water quality modeling (QUAL, WASP) [1] 6. Dynamics of wastewater generation and inflow [1] 7. Mechanical treatment dimensioning [1] 8. Kinetics equations of biological treatment [1] 9. Conventional biological treatment dimensioning [1] 10. Attached microorganisms systems dimensioning [1] 11. Primary and secondary settling dimensioning [1] 12. Facilities for sludge treatment dimensioning [1] 13. Alternative WWTP dimensioning [1] 14. Long sea outfalls dimensioning [1] 15. Mathematical modeling of pollution transport and dilution (VISUAL PLUMES, CORMIX) [1]
Study and examination requirements and forms of examination	• 2 pre-exams, each maximum 100 points • 1 additional pre-exam, for students who achieved less than 25% score in one or both pre-exams.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Mimeographed notes of lectures 2. Tedeschi, S.: Zaštita voda, Zagreb university textbook, 1997 Optional literature: 1. Metcalf & Eddy: Wastewater Engineering, Treatment, Disposal and Reuse, McGraw-Hill International Editions, 2003

Module name:	**Law in Construction**
Module level, if applicable	Bachelor's degree program
Code, if applicable	21733
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	IV (Summer)
Person responsible for the module	Anita Cerić, Maja-Marija Nahod
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree program. Compulsory. Semester IV.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • E-learning: teaching hours ar not limited during semester
Workload	Estimated workload in hours [3 (ECTS) x 30 (hours/ETCS)=]: 90 hours Lecture hours: 30 Other contact hours: 15 Self study hours: 45
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in lectures, • Minimum 3 written papers (a critical review and a personal reflection on the lectures).
Recommended prerequisites	
Module objectives/intended learning outcomes	Understanding the role and the provisions of the law as well as the applicable regulations which determine the concept, design and realization of construction projects in the area of the rights and obligations of their main parties.
Content	• Lectures: 1. Legal elements, basic terminology, legal norms, legal system, origin of law & subjects of law, legal relationships and procedures [2] 2. Basic contents of Building Act, multidisciplinary elements in a construction project, control systems [2] 3. Direct and indirect factors in construction projects [2] 4. The role of construction law in construction projects, Building Act, professional norms, lifecycle of construction projects, feasibility studies [2] 5. Urban planning, types of urban documents, drawings and projects. Location permit, building site preparation. Regulation models and key activities in construction projects, preparation for the project and the project documentation. Conceptual design, project design, detailed design. Internal and external control of project documentation [2] 6. Construction tendering, constructing. Complete final account. Building operation and maintenance [2] 7. Demolition of buildings, project of building demolition [2] 8. The participants in construction project and their legal obligations. Investor, designer, reviewer, building contractor, supervisor [2] 9. Tender documents, bill of quantities, drawings. Technical conditions Obligatory site documentation. All types of legal solutions for building activities. The building permit, the building diary book. Design details. The

	bill of quantity. Certificates about the quality of performed works, and products [2] 10. Basic legal documents. Purposes, ways and methods of obtaining a building permit [2] 11. Plan extract. The building pre-permit. The general building permit. The building permit for the part of the building, or for the whole building [2] 12. Use permits, permit for building demolition and evacuation. Government inspections [2] 13. Professional associations. Croatian chamber of architects and engineers in construction. FIDIC. Basic goals, documents, manner of operation [2] 14. Basics of commercial law, the corporation. Types of safety and their uses [2] 15. Contracts in: construction, concession, selling and leasing, patents, investments, transport, deposit, guarantees [2]
Study and examination requirements and forms of examination	• Students with minimum 60% score in their reports and pre-exams are exempt from the written and oral exams, • Students who have achieved less than 60% score in 2 pre-exams are obliged to take the written and/or oral examination upon the completion of the course, regardless of the pre-exam scores.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Radujković, J.; Izetbegović, J.; Nahod, M. M.: Osnove građevinske regulative, GF Sveučilišta u Zagrebu, Zagreb, 2008 2. Izetbegović, J., Predavanja (E-learning) na sustavu Merlin u SRCU: Dostupni su studentima s osobnom lozinkom 3. Gorenc, V.: Trgovačka poduzeća, ŠK, Zagreb, 1992 4. Gorenc, V.: Trgački ugovori, ŠK, Zagreb, 1993 5. Zakon o prostornom uređenju (Spatial planning act) ((published by NN in 2013) 6. Zakon o gradnji (Building Act)(published by NN in 2013) 7. Zakon o građevinskoj inspekciji (Law on building inspection) (published by NN in 2013) 8. Important web-links: a. http://www.nn.hr (Narodne novine; National Gazette) b. http://www.mzopu.hr (Ministarstvo zaštite okoliša, prostornog uređenja i gradnje) c. http://www.iusinfo.hr (Pravni informacijski sustav IUS-INFO) d. http://www.cadial.hr (Tražilica na hrvatskom ili engleskom jeziku) Optional literature: 1. Bienenfeld, J., Blažević-Perušić, J., Rajčić, D.; Sudarević, N.: Prikaz Zakona o izmjenama i dopunama Zakona o prostornom uređenju i gradnji i Zakona o postupanju sa nezakonito izgrađenim zgradama, Građevinski fakultet Sveučilišta u Zagrebu, 2011. 2. Loboja, A.; Bačurin, N.; Flam, D.; Pandžić, Z.; Pranjić, I.; Rajčić, D.: Novi propisi o javnoj nabavi, Građevinski fakultet Sveučilišta u Zagrebu, 2012. 3. Zakon o prostornom uređenju i gradnji (Publshed in 2007)

V. SEMESTER

Module name:	**Concrete and Masonry Structures 1**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	146797
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Tomislav Kišiček
Lecturer	Jure Barbalić, Martina Carić, Tvrtko Renić, Mislav Stepinac
Language	Croatian, English,
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 60 • Exercises: 45 (auditory – 15, design - 30)
Workload	Lecture hours 60 Hours of laboratories or skills Exercise 45 Other contact hours 30 Self study hours 60
Credit points	6,5 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Making an independent exercise assignment, • Passing both pre-exams (minimum 25 % score).
Recommended prerequisites	• Theoretical and practical knowledge acquired in the course Structural analysis 1 (behavior of structures under applied loading and determining of internal forces for that structures), • Theoretical and practical knowledge acquired in the courses Strength of materials 1 and 2 and Materials science, • Knowledge about basic structural elements.
Module objectives/intended learning outcomes	• Students will acquire basic knowledge and skills needed for designing basic structural systems of reinforced concrete and masonry structures and they will know basic principles of conceptual designing, • Students will gain basic knowledge about basic bearing reinforced concrete and masonry structural elements, • Students will have knowledge and skills needed to analyse behavior and to design basic bearing system of reinforced concrete and masonry structures according to ultimate limit states using modern methods and European norms criteria, • Students will be able to make design plans for simple reinforced concrete structures and their elements, • Students will have necessary knowledge for designing simple masonry building in areas where no stronger seismic activities are expected.
Content	• Lectures: 1. General information about concrete and masonry structures – the meaning and usage, history and development, advantages and isadvantages. CONCRETE STRUCTURES - Codes, literature. Physical and mechanical properties of concrete and steel reinforcement [4]

	2. Bending of reinforcement. Concrete cover. Reinforcement bar spacing. Tables of reinforcement. Design spans. Bond-slip behavior of reinforcement, anchoring, lap-splicing of reinforcement. Durability and concrete cover. Basic assumptions for reinforced concrete structures design according to ultimate limit states. Global and partial safety factors [4] 3. Actions on structures. Singly reinforced cross sections [4] 4. Minimum reinforcement. Double-reinforced cross sections. One way slabs [4] 5. Staircases. Two way slabs. Minimum and maximum reinforcement [4] 6. Beams – rectangular and T- cross section – design [4] 7. MIDTERM EXAM no. 1 – Design of reinforced concrete one-way slabs [4] 8. MASONRY STRUCTURES – history. Introduction [4] 9. Masonry structures materials. Masonry elements. Mortar. Concrete infill [4] 10. Material characteristics: masonry units, mortar, masonry, reinforcement [4] 11. Unreinforced masonry. Stability and behavior of structures [4] 12. MIDTERM EXAM no. 1 – Design of vertically loaded unreinforced masonry wall according to European norm EN 1996-1-1 [4] 13. Walls subjected to concentrated load. Confined masonry. Laterally loaded masonry. Reinforced masonry walls. CONCRETE STRUCTURES – Principles and methods of centrically and eccentrically loaded reinforce concrete structural elements (columns and walls) [4] 14. Design of reinforced concrete short columns according to method by Ehlers and interaction diagrams [4] 15. Reinforced concrete foundations. Revision of the course content [4] • Exercises (auditory, design): 1. Introduction (auditory) [3] 2. Layout and dimensions of elements (auditory) [2], (design) [1] 3. Design of slabs position numbers from 100 and up (auditory) [2], (design) [1] 4. Reinforcement layout for slabs position numbers from 100 and up (auditory) [2], (design) [1] 5. (design) [3] 6. Beam 207-208-207 (auditory) [2] , (design) [1] 7. Reinforcement plan for beam 207-208-207 (auditory) [2], (design) [1] 8. (design) [3] 9. Frame system – structural analysis (auditory) [1] , (design) [2] 10. (design) [3] 11. Frame columns (auditory) [1], (design) [2] 12. (design) [3] 13. (design) [3] 14. (design) [3] 15. (design) [3]
Study and examination requirements and forms of examination	Written exam -minimum 55 % score, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Sorić, Z., Kišiček, T.: Betonske konstrukcije 1, University textbook, Zagreb, 2014. ISBN 978-953-6272-75-4 2. Sorić, Z.: Zidane konstrukcije, University textbook, Zagreb 2016.

	3. Sorić, Z., Pičulin, S., Zamolo, M., Kišiček, T., (Jure Radić i suradnici.): Osnove proračuna, paragraph 5, book Betonske konstrukcije, University textbook, Zagreb, 2006., ISBN 953-169-pp. 126-6. Pp. 399-663, Editor: Čandrlić, V., 4. Sorić, Z., Kišiček, T., Galić J., (Jure Radić and associates): paragraph from the book Betonske konstrukcije, riješeni primjeri, III. Konstrukcijski elementi, pp. 139-390, university textbook, Zagreb, 2006, Hrvatska sveučilišna naklada, Sveučilište u Zagrebu - Građevinski fakultet, SECON HDGK, ANDRIS. Editor: Čandrlić, V., 5. Tomičić, I.: Betonske konstrukcije, Društvo Hrvatskih građevinskih konstruktora, Zagreb, 1996, 6. Tomičić, I.: Priručnik za proračun armiranobetonskih konstrukcija, Društvo Hrvatskih građevinskih konstruktora, Zagreb, 1996, 7. Lectures and exercises

Module name:	**Rock Mechanics**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	146799
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (winter)
Person responsible for the module	Meho-Saša Kovačević, Lovorka Librić
Lecturer	Gordana Ivoš, Lovorka Librić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:45 • Exercises (auditory):30
Workload	Lecture hours 30 Hours of laboratories 30 Other contact hours 30 Self study hours 90
Credit points	6,0 ECTS
Requirements according to the examination regulations	• 75% attendance in lectures, • 100% attendance in exercises, • 25% score in a pre exam.
Recommended prerequisites	• Understanding and ability to apply the conditions of equilibrium in the plane, • Understanding the concepts of stress, strain, stress-strain curve, stiffness and strength, • Knowledge about Mohr stress circle theory.
Module objectives/intended learning outcomes	• Understanding the primary and secondary stress state, as well as the methods of their determination, • Gained knowledge in laboratory and field testing of rocks, and the methods of determining parameters of the intact rock (laboratory tests) and the rock mass (field tests), • Gained knowledge about the classification of rock masses, • Understanding the concepts of strength and stiffness of the rock mass, as well as the strength of discontinuities, • Ability to solve simple problems in the domain of rock mechanics: foundations on rock, rock slope stability, the stability of rock falls, the interaction between the rock mass and tunnel support.
Content	• Lectures: 1. Introduction to rock mechanics and rock engineering [3] 2. State of stress and strain in the rock [3] 3. Laboratory testing methods ([3] 4. Field testing methods [3] 5. Classification of the rock mass [3] 6. The strength of the rock mass [3] 7. The strength of the discontinuities [3] 8. The stiffness of the rock mass [3] 9. Foundations on the rock [3] 10. The stability of rock slopes [3]

	11. The stability of rock falls [3], 12. Reinforcing of rock mass with rock bolts [3] 13. Tunnelling [3] 14. Rheology of rock material [3] 15. Make up pre-exam [3] • Exercises (auditory): 1. Introduction to rock mechanics and rock engineering [3] 2. State of stress and strain in the rock [3] 3. State of stress and strain in the rock [3] 4. Laboratory testing methods (carbonate content, ultrasound, PLT) [3] 5. Laboratory testing methods (uniaxial compressive strength, correlation between uniaxial compressive strength and PLT) [3] 6. Classification of the rock mass [3] 7. The stiffness and the strength of the rock mass [3] 8. Foundations on the rock [3] 9. The stability of rock slopes (planar failure) [3] 10. The stability of rock slopes (wedge failure) [3] 11. Pre-exam(Midterm examination) [3] 12. The stability of rock slopes (rotational failure)[3] 13. The stability of rock falls [3] 14. Underground structures [3] 15. Underground structures [3].
Study and examination requirements and forms of examination	• Written (theory - 70%, assignments, solving of problem - 30%), • Oral exam.
Media employed	Whiteboard, projector, DVDs
Reading list	Required literature: 1. Meho Sasa Kovacevic and Danijela Marcic lecture notes and tables for exercise – power point presentation - available on the web) Optional literature: 1. Goodman, R.E., Introduction to Rock Mechanics, Second Edition, 1989, 2. Hudson, J.A., Harrison, J.P., Engineering Rock Mechanics, An Introduction to the Principles, 1997

Module name:	**Roads**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	21738
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Vesna Dragčević
Lecturer	Saša Ahac, Šime Bezina, Josipa Domitrović, Tamara Džambas, Željko Stepan
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semestar V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 45 • Exercises (auditory, design, laboratory):30
Workload	Lecture hours 45 Exercise hours 30 Contact hours and self study hours 105
Credit points	6 ECTS
Requirements according to the examination regulations	• Lecture and exercise attendance, • Program design.
Recommended prerequisites	Knowledge of computer programs for technical drawing.
Module objectives/intended learning outcomes	• Understanding the basic principles of traffic, safety, levels of service and capacity, • Understanding the basic transportation dynamic rules for determining horizontal, vertical and crosssection elements of roads, • Ability to use the design documents in road construction, • Ability to search through scientific papers and collect information and data to solve practical problems in everyday engineering practice, • Basic knowledge needed for the construction of road beds, slope protection and drainage system, • Basic knowledge needed for the construction of pavement structure.
Content	• Lectures: 1. Introduction. Road vehicles [3] 2. Motion of vehicles [3] 3. Horizontal alignment [6] 4. Vertical alignment [3] 5. Space alignment. Traffic [3] 6. Road cross-section [3] (1st pre-exam) 7. Geometry tread [3] 8. Drainage. Materials. Lower structure [3] 9. Road junctions [3] (2nd pre-exam) 10. Traffic areas. Road equipment [3] 11. Pavement structures [6] • Exercises (auditory, design, laboratory): 1. Situation [12]

	2. Longitudinal profile [6] 3. Normal cross-section profile [4] 4. Characteristic cross-section profiles [4] 5. Technical description [4]
Study and examination requirements and forms of examination	Written exam: 40% score for a pass, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Korlaet, Ž.: Uvod u projektiranje i građenje cesta, Udžbenik Sveučilišta u Zagrebu, 1995, p. 208 2. Dragčević, V.; Korlaet, Ž.: Osnove projektiranja cesta, Udžbenik Sveučilišta u Zagrebu, 2003, p. 93 3. Drugi sadržaji: http://www.grad.unizg.hr/predmet/ceste (web page for Roads - Ceste)

Module name:	**Building technology**
Module level, if applicable	Bachelor's Degree Program
Code, if applicable	21734
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Ivica Završki
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree program. Compulsory elective. Semester V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30
Workload	Lecture hours: 30 Other contact hours: 10 Self study hours: 50
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • 2 pre-exams: 25% score in each pre-exam, make up pre-exam.
Recommended prerequisites	Knowledge and skills in previous modules, particularly in construction materials and concrete technology.
Module objectives/intended learning outcomes	• Recognising the technology and producing the workflow for specific construction process, • Selecting the scaffold for specific construction and understanding the erection process, • Selecting the ormwork for specific construction and understanding the phases of work with it, • Selecting the type and capacity of machinery for earthworks, • Selecting the type and capacity of concrete plant, • Defining the capacity of transportation system and estimating the duration of concrete. Pouring.
Content	• Lectures: 1. Introductory lecture [2] 2. Workflow charts [2] 3. Building machinery [4] 4. Foundation pit securing [2] 5. Concrete plant [2] 6. Transport and pouring of concrete [2] 7. Concrete steel production plant and rebar works [2] 8. Scaffolds in building [4] 9. Formworks in building [6] 10. Boring, cutting and demolition of buildings [2]
Study and examination requirements and forms of examination	Written and oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Mimeographed lecture notes on the faculty website,

	2. Zdravko Linarić: Leksikon osnovne građevinske mehanizacije (Lexicon of elementary construction machinery), faculty website Optional literature: 1. Zdravko Linarić: Učinak građevinskih strojeva (Performance of construction machines), faculty website, 2. Gorazd Bučar: Tesarski,armiračkii betonskiradovi na gradilištu (Carpenter, rebar and concrete works on construction site), Civil Engineering Faculty Osijek, Osijek, 1997

Module name:	**Technology of Heavy Construction**
Module level, if applicable	Bachelor's Degree Program
Code, if applicable	21735
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Ivana Burcar Dunović
Lecturer	
Language	Croatian
Relation to curriculum	Bachelor's degree program. Compulsory elective. Semester V.
Type of teaching, contact hours	Number of hours (in semester): 30 • Lectures:30 • E-learning: 100% of lectures and examination is supported by e-learning but it is not normalized.
Workload	Estimated workload in hours [3 (ECTS) x 30 (hours/ETCS)=]: 90 hours Lecture hours: 30 Other contact hours: 15 Self study hours: 45
Credit points	3 ECTS
Requirements according to the examination regulations	• Attendance in minimum 75% lectures, • Achieving a 255 score in pre-exam.
Recommended prerequisites	Familiarity with specific literature, prior knowledge, skills or participation in preparatory modules of Bachelor's's degree program (area of: Materials).
Module objectives/intended learning outcomes	• Theoretical or factual knowledge about construction or building technique and technology, specially the technology for heavy construction, • Cognitive and practical skills which make use of the knowledge about planning of heavy construction technology, • Productivity of earthworks equipment and transportation, • Scaffoldings and formworks in heavy construction, • Competences: integration of knowledge, skills and social and methodological liabilities in work ands study situations in heavy construction or building.
Content	• Lectures: 1. Introduction lecture [2] 2. Technology of heavy construction– Construction and building works. Construction technique and technology [2] 3. Construction equipment. Features of modern construction equipment [2] 4. Technique and technology of surface (crust) earthworks [2] 5. Earthworks. Surface excavation in soil and rock. Dozers, scrapers, excavators. Work tools and arrangement for excavators. Trenchers. Rock scraping [2] 6. Transportation of earth material. Loaders and rubber tyred haulage. Embankment works. Graders and rollers [2] 7. Planning the methods and technology for earthworks [2] 8. Productivity of equipment and transportation for earthworks [2] 9. Methods and technology of concrete works (transported concrete) [2]

	10. Concrete works (concrete building). Transportation of concrete. Preparation (mixing) of concrete, concrete- mixing plant [2] 11. Scaffoldings and formworks in heavy construction. Modern systems of formworks. Scaffoldings system [2] 12. Transportation of concrete. Tower cranes, concrete building, horizontal concrete building structures [2] 13. Scaffoldings and formworks systems for bridge construction [2] 14. Prefabricated building practices for bridges. Auto-and heavy (track, crawler) cranes [2] 15. Asphalt structures and construction works. Roller compacted asphalt concrete works. Mastic asphalt works. Asphalt macadam works [2]
Study and examination requirements and forms of examination	• Written exam, • Or minimum 60% score in pre-exams and oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Course materials available on e-learning system 2. Linarić, Z, Leksikon osnovne građevinske mehanizacije, 3. Linarić, Z ,Učinak građevinskih strojeva, 4. Linarić, Z ,Postrojenja za proizvodnju gradiva, I.dio, Drobilane,Tvornice betona (betonare), Asfaltne baze (asfaltna postrojenja), 5. Linarić, Z, Izbor strojeva i planiranje strojnog rada u građenju. Optional literature: 6. Linarić, Z, Tehnologija građenja I, Zemljani radovi, 7. Linarić, Z ,Sustavi građevinskih strojeva, 8. Lončarić Rudolf: Organizacija graditeljskih projekata, Sveučilište u Zagrebu, 1995, 9. Eduard Slunjski: Strojevi u građevinarstvu

Module name:	**Structural Analysis 2**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	146800
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Krešimir Fresl, Petra Gidak
Lecturer	Maja Baniček, Elizabeta Šamec
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semestar V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises : 30 (auditory – 24, computer room – 6)
Workload	Lecture hours 30 Exercises 30 Other contact hours 15 Self study hours 60
Credit points	4,5 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Making 3 programs and discussing them, • 1 pre-exam: minimum25% score, one make up pre-exam.
Recommended prerequisites	• Understanding and ability to apply equilibrium equations, • Knowledge about the basic theoretical methods of linear static analysis for determination of reactions, internal forces and displacements on statically determinate and indeterminate structures, • Understanding the principle of virtual work and basics of variational calculus.
Module objectives/intended learning outcomes	• Application analytical and relaxation methods in calculating statically indeterminate structures, • Interpretation of theoretical foundations of numerical procedures in calculations, • Application of computer programmes in calculating structures and assessment of possibilities of application of various programmes, • Explanation and implementation of the procedures of defining influence functions and drawing influence lines.
Content	• Lectures: 1. Displacement method: a. Slope–deflection method [6] b. Static and kinematic condensation [3] c. Application of symmetry and anti-symmetry in force and displacement methods [3] 2. Relaxation methods: a. Cross method [4] b. Werner and Csonka's method [4] 3. Influential functions and lines: a. Statically determinate systems [4] b. Statically indeterminate systems [4] 4. Spatial systems [2]

	• Auditory exercises: 1. Displacement method [8] 2. Relaxation procedures [8] 3. Influential functions [6] • Computer room exercises: 1. Application of computer software [6]
Study and examination requirements and forms of examination	nd of semester grading: • 50% score in written exam required for a pass, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. V. Simović: Građevna statika , Građevinski institut, Zagreb, 1988, 2. M. Anđelić: Građevna statika 2, Građevinski fakultet, Zagreb, 2005, 3. K. Fresl: GS – Bilješke i skice s predavanja, http://master.grad.hr/nastava/gs Optional literature: 1. M. Sekulić: Teorija linijskih nosača, Građevinska knjiga, Beograd, 2005, 2. L. P. Felton, R. B. Nelson: Matrix Structural Analysis, Wiley, New York, 1997, 3. W. Wunderlich, W. D. Pilkey: Mechanics of Structures. Variational and Computational Methods, CRC Press, Boca Raton, 2003.

Module name:	**Numerical Modeling of Structures**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	146801
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Mladen Meštrović
Lecturer	Josip Atalić, Marta Šavor Novak, Mario Uroš
Language	Croatian
Relation to curriculum	Bachelor's degree programme .Compulsory elective. Semestar V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 30 (auditory – 8, laboratory – 22)
Workload	Lecture hours 30 Exercises 30 Other contact hours 30 Self study hours 45
Credit points	4,5 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Solving 4 problems, • 2 written pre-exams during semester.
Recommended prerequisites	• Understanding and ability to apply equilibrium equations in 2D and 3D, • Knowledge about the basic theoretical methods of linear static analysis for determination of reactions, internal forces and displacements on statically determinate and indeterminate structures, • Understanding the principle of virtual work and basics of variational calculus, • Basic mathematical knowledge of differential equations.
Module objectives/intended learning outcomes	• Lectures: 1. Diplacement Method [2] 2. Iterative methods [4] 3. Influence lines [2] 4. Discretization, Mathematical model of structure [4] 5. Strong and weak formulation of problem [2] 6. Ritz Method [2] 7. Finite difference method [4] 8. Introduction to FEM [4] 9. Structures in 3D [2] 10. Introduction to wall and plate structures [4] • Exercises (auditory, design, laboratory): 1. Displacement method [2] 2. Iterative methods [4] 3. Influence lines [2] 4. Introduction to software package (SAP) [4] 5. Modeling of beam structures (8) 6. Modeling of gird structures (10) 7. Introduction to modeling of wall and plate structures [4] 8. Presentations of students' work [4]

Content	• Lectures: 1. Diplacement Method [2] 2. Iterative methods [4] 3. Influence lines [2] 4. Discretization, Mathematical model of structure [4] 5. Strong and weak formulation of problem [2] 6. Ritz Method [2] 7. Finite difference method [4] 8. Introduction to FEM [4] 9. Structures in 3D [2] 10. Introduction to wall and plate structures [4] • Exercises (auditory, design, laboratory): 1. Displacement method [2] 2. Iterative methods [4] 3. Influence lines [2] 4. Introduction to software package (SAP) [4] 5. Modeling of beam structures (8) 6. Modeling of gird structures (10) 7. Introduction to modeling of wall and plate structures [4] 8. Presentations of students' work [4]
Study and examination requirements and forms of examination	• Final seminar paper, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. M. Anđelić: Građevna statika 2, Građevinski fakultet, Zagreb, 2005. 2. M. Meštrović: NMK – mimeographed notes, http://www.grad.hr/predmeti/nmk

Module name:	**Railways**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	146802
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	V (Winter)
Person responsible for the module	Stjepan Lakušić
Lecturer	Viktorija Grgić, Ivo Haladin, Katarina Vranešić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester V.
Type of teaching, contact hours	Number of hours (in semester): • Lectures:30 • Exercises (auditory, design): 15
Workload	Lecture hours 28 Other contact hours 15 Mid-term exams hours 2 Exam hours 2 Self study hours 43
Credit points	3 ECTS
Requirements according to the examination regulations	• Lecture and exercise attendance, • Program design, • 2 pre-exams (minimum 25% score in each pre-exam, 1 additional make up pre-exam.)
Recommended prerequisites	Knowledge of materials mechanical properties.
Module objectives/intended learning outcomes	• Understanding the basic principles of railway traffic, • Analyzing the basic thesis related to load influence on track, • Basic knowledge on track design geometry, • Basic knowledge on track superstructure and permanent way elements, • Basic knowledge on rail welding procedures and continuous welded rail (CWR), • Basic knowledge on railway maintenance procedures.
Content	• Lectures: 1. Introduction to railways. Historical development and classification [1] 2. Clearances. Wheel sets [2] 3. Rail vehicles. Railway lines categorization [2] 4. Selection of route and design elements [2] 5. Railway stations [2] 6. Horizontal and vertical alignment elements [2] 7. Track load. Basic calculations [3] 8. Track superstructure elements. Rails. Sleepers [3] 9. Track superstructure elements. Fastening systems. Ballast [2] (1st pre-exam) 10. Permanent way elements. Turnouts. Turntables. Travelling platforms [4] 11. Basic requirements for a track arrangement. Straight track. Track in curve [2] 12. Rail welding [2] 13. Track quality control. Track maintenance [2] (2nd pre-exam)

	14. Special railways [1] • Exercises (auditory, design): 1. Calculation of rail stresses depending on superstructure elements and load [5] 2. Calculation and reconstruction of existing horizontal curve [5] 3. Calculation of continuously welded track stability [5]
Study and examination requirements and forms of examination	• Written exam: 50% score for a pass, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Prister, G.; Pollak, B.: Gornji ustroj i specijalne željeznice, Građevinski institut, Zagreb, 1988, 2. Lakušić, S.: Željeznice, lectures for the 3rd year students at the Faculty of Civil Engineering. Optional literature: 1. Esveld, C.: Modern Railway Track, Second Edition, MRT Productions, Zaltbommel, 2001.

VI. SEMESTER

Module name:	**Construction management**
Module level, if applicable	Bachelor's Programme
Code, if applicable	146820
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Mladen Vukomanović
Lecturer	Kristijan Robert Prebanić, Sonja Kolarić
Language	Croatian
Relation to curriculum	Bachelor's degree programme, Compulsory. Semester VI.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 45 • Exercises: 42 (auditory – 25, design – 17) • Seminars: 3 • E-learning: 120
Workload	Lecture hours 45 + 45 Other contact hours and self study hours 105
Credit points	6,5 ECTS
Requirements according to the examination regulations	• 80 % attendance in lectures and exercises, • Completed work assignment, • Presentation of the seminar paper.
Recommended prerequisites	• Basic principles of building technology, • Basic principles of the technology of heavy construction.
Module objectives/intended learning outcomes	• Theoretical and practical knowledge about the construction management processes in civil engineering, e.g.: cost management, time/schedule management, site management, safety at work, bill of quantities, basics in project management, performance measurement, etc…
Content	• Lectures: 1. Introduction [1] 2. System vs Project [4] 3. Construction project management plan [4] 4. Organization of construction processes [4] 5. Site management [4] 6. Scheduling, monitoring and control in construction projects [6] 7. Cost and expense calculation in construction projects [6] 8. Business and stakeholder management [4] 9. Basics in project management [4] 10. Construction legislative [4] 11. Safety at Work [4] • Exercises (auditory, design, laboratory): 1. Bill of quantities [4] 2. Technology alternatives [4]

	3. Technology flowcharts [6] 4. Organization of the work processes [6] 5. Scheduling [6] 6. Construction site planning [4] 7. Cost estimate [6] 8. Project management concept [6] • Seminars: 1. Current trends in project management
Study and examination requirements and forms of examination	• Three pre- exams, • A work assignment and 1 presented seminar paper, • Or the final exam at the end of the semester (writing assignment + oral examination).
Media employed	Whiteboard, projector, on line module materials (in part)
Reading list	Required literature: 1. Radujković, M.: Construction management I, lectures – hard copy of PPT slides, University of Zagreb, 2008, 2. Marušić , J.: Construction management, University of Zagreb, 1994, 3. Lončarić, R.: Organization of execution construction projects, HDGI, Zagreb, 1995, 4. Radujković M., Burcar I., Vukomanović M.: Solved assignment examples from Construction mangement I and Scheduling methods, University of Zagreb, FCE, 2008, 5. Radujković M., Izetbegović J., Nahod M..M., Construction law regulation, University of Zagreb, 2008. Optional literature: 1. Radujković, M et. al: Planning and control of project, University of Zagreb, 2012, 2. Vukomanović, M. and Radujković, M: Business excellence in construction industry, University of Zagreb, 2011.

Module name:	**Metal Structures**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Ivica Džeba
Lecturer	Ivan Čurković, Ivan Lukačević, Davor Skejić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester VI.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises (auditory, design, laboratory): 15
Workload	Lecture hours 30 Excersizes hours 13 Consultations hours 4 Mid-term exams hours 2 Exam hours 3 Self study hours 68
Credit points	4 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Completed, submitted and positively graded individual project task and discussed with the assistant lecture to demonstrate understanding, • 2 pre-exams to verify the level of acquired theoretical knowledge: earning minimum 25% score in each; make up pre-exam for students who did not achieve minimum 25% score in one or both preexams or for students who want to improve the score achieved in regular pre-exam.
Recommended prerequisites	• Knowledge about the statics of rigid body and connected systems, • Understanding and ability to apply equilibrium conditions to plane and space, • Knowledge of and ability to determine reactions and internal forces as well as deflections on statically determinate structures.
Module objectives/intended learning outcomes	• Ability to link knowledge about the behavior of steel as a material and the impact of that behaviour on the resistance of steel structural elements, • Ability to make the layout solutions of simpler structures such as, for example, one story industrial buildings without crane rails, • Identifying the key factors for determination of the basic actions on structures, • Ability to determine the action effects at structural elements level for statically determinate systems, • Ability to determine design resistances of simpler steel structural elements and connections for ultimate limit state and serviceability limit state.
Content	• Lectures: 1. Introduction. Terminology and defining the contents of the course [3] 2. Types of constructional steel, production and properties [3] 3. Properties of steel as an engineering material [2] 4. Reliability concept of steel structures [2] 5. Action on structures [2]

	6. Classification of cross-sections [2] 7. Resistance of cross-sections [2] 8. Buckling resistance of members without lateral-torsional buckling phenomena [2] 9. Constructional details [2] 10. Connecting devices [2] 11. Corrosion and fire protection [2] 12. Design assisted by testing [2] 13. Fabrication and execution [2] 14. Aluminium structures [2] • Exercises (auditory, design, laboratory): Design of very simple steel structure.
Study and examination requirements and forms of examination	• Written exam in two parts: a theoretical part (students may be exempt from taking this part of the exam) and a practical part – design of structural elements (mandatory for all students), • For a passing grade students must achieve minimum 60% score in each part of the exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Androić, B.; Dujmović, D.; Džeba, I.: Metal Structures 1, IGH, Zagreb, 1994 (In Croatian) 2. Androić, B.; Dujmović, D.; Džeba, I.: Steel Structures 2, I. A.Projektiranje, Zagreb, 2007 (In Croatian) 3. Džeba, I.: Resistance of cross-sections and resistance of members in steel structures - Design, Sveučilište u Zagrebu, Građevinski fakultet, 2007, (In Croatian) 4. Džeba, I: Design of Aluminium Structures, Sveučilište u Zagrebu, Građevinskifakultet, 2007, (In Croatian) 5. Džeba, I.; Skeić, D.: Print- lectures for exercises, Sveučilište u Zagrebu, Građevinskifakultet, 2007 (In Croatian) Optional literature: 1. HRN EN 1993-1-1:2004 Eurocode 3: Design of Steel Structures – Part 1-1:General rules and rules for building

Module name:	**Bridges**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21728
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Anđelko Vlašić
Lecturer	Jelena Bleiziffer, Gordana Hrelja Kovačević, Marija Kušter Marić, Dominik Skokandić
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory. Semester VI.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 15 (auditory – 7, design – 8)
Workload	Lecture hours 30 Exercise hours 15 Self study hours 50 Hours of skills 20 Other contact hours 5
Credit points	4 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Exercise program execution, • Passing two pre-exams (minimum 25% score in each pre-exam).
Recommended prerequisites	• Theoretical knowledge on the behavior of structures under loads and modes of transmission of forces, • Practical knowledge about the linear calculation methods of statically determinate and indeterminate bar structure models, • Basic knowledge about the composition, types and classification of soils and rocks, and the specifics of the mechanical behaviour of soils.
Module objectives/intended learning outcomes	• Acquiring basic knowledge and skills needed to design the bearing system of a bridge and the application of the basic principles of conceptual design, • Acquiring knowledge and skills necessary to analyse the behaviour of the bearing system and the bridge design according to the ultimate limit state and the serviceability limit state using modern methods and European codes, • Knowledge about and ability to select the appropriate bearing system of a bridge, depending on the geometry and boundary conditions in accordance with modern methods and criteria of European codes, • Basic knowledge about all bearing systems and ability to design a reinforced concrete bridge up to span of 20 m in accordance with the modern methods and the criteria of European norms.
Content	• Lectures: 1. Introduction and basic terms [2] 2. Types of bridges, basic requirements for bridges and traffic conditions [4] 3. Loadings on bridge [2] 4. Factors of bridge reliability; elements of bridge disposition [2] 5. Bearing systems of bridges – 1st part [2]

	6. Bearing systems of bridges – 2nd part [4] 7. Substructure and bridge equipment [4] 8. Aesthetics of bridges [2] 9. Construction of bridges [2] 10. Maintaining of bridges and bridges in extraordinary circumstances [2] 11. Overview of history of bridge building [2] 12. Contemporary achievements in bridge engineering [2] • Exercises (auditory, design, laboratory): 1. Introduction to the program , dispositions and cross-sections of bridges – auditory [1] 2. Substructure – auditory [1] 3. Bridge equipment and details – auditory [1] 4. Disposition - drawing and review – design [1] 5. Disposition - drawing and review – design [1] 6. Submission of disposition – design [1] 7. Loads on bridges, transverse distribution, prepares for structural - auditory [1] 8. Computer modeling, basics of Sofistik, Structural analysis of bridge using SOFISTIK – auditory [1] 9. Structural analysis of bridge using SOFISTIK – design [1] 10. Structural analysis of the computer - SOFISTIK – design [1] 11. Dimensioning and reinforcement drafting – auditory [1] 12. Dimensioning and reinforcement drafting, structural analysis review – design [1] 13. Technical description, amount of reinforcement, program accessories, reinforcement drafting review - auditory + design [1] 14. Completing and review of the entire program – design [1] 15. Overview and delivery of the entire program –design [1]
Study and examination requirements and forms of examination	• Written exam: 60% score, • Oral exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Radić, J.: Introduction to bridge engineering (Uvod u mostarstvo),Hrvatska sveučilišna naklada, Jadring, Sveučilište u Zagrebu-Građevinskifakultet, Zagreb 2009 (in Croatian) 2. Radić, J, Mandić, A., Puž, G.: Design of bridges (Konstruiranje mostova), Jadring, Zagreb 2005 (in Croatian) 3. Notes from exercises. Optional literature: 1. Radić J. et al: Concrete structures – Handbook, Andris, Zagreb 2006 (in Croatian) 2. Radić J. et al: Concrete structures – Practical Examples, Andris, Zagreb 2006 (in Croatian)

Module name:	**Timber structures**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21729
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Vlatka Rajčić
Lecturer	Jure Barbalić, Nikola Perković, Mislav Stepinac
Language	Croatian
Relation to curriculum	Bachelor's degree programme. Compulsory elective. Semester VI.
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 30 • Exercises: 15 (auditory – 9, design – 6)
Workload	Lecture hours 30 Hours of auditoria and constructive exercises (face-to-face) 15 Hours of only constructive exercises (face-to-face) 15 Independent study 60 hours
Credit points	4 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises. Making project task. Two pre-exams with minimum 25% score in each.
Recommended prerequisites	• Theoretical knowledge about the behavior of structures under load and other actions on structures and force transfer in structures. Understanding stress and strain concepts and terms related to internal forces. Practical knowledge about the calculation methods for statically determinate and statically indeterminate structures.
Module objectives/intended learning outcomes	• Theoretical and applied knowledge of timber as a building material, basic design of timber structures, design of the basic details in timber structures and the structural stabilization of timber structures.
Content	• Lectures: 1. General overview of timber structures: a historical development, systems, methodological approach [2] 2. Wood as a material: properties of wood, laminated timber and wood based products. Classification of timber in structural engineering [4] 3. Protection methods and durability of timber structures. Fire safety design [2] 4. Procedures in design of timber structures: Eurocode 5. The basis of structural analysis (ultimate limit states and serviceability states) [6] 5. Metal fasteners: nails, bolts, dowels, screws, timber screws, patented fasteners and toothed plate connectors. Design of fasteners according to Eurocode 5 [6] 6. Traditional timber carpentry joints. Principles of the design of elements and details [2] 7. Secondary timber structures: design and detailing [2] 8. Truss structures: design of elements and joints in timber trusses [2] 9. Frame systems: design and detailing. Spatial stability and bracing systems [4] • Exercises (auditory):

	1. Introduction to timber engineering. Problem description [1] 2. Design plan (drawing) of timber truss system [1] 3. Actions on structures [1] 4. Structural analysis and design of secondary timber structures according to EC5 [1] 5. Structural analysis of timber truss. Introduction to structural analysis and design software [1] 6. Design of main timber truss elements according to EC5 [1] 7. Structural stabilization of timber structures [1] 8. Details in timber structures [1] 9. Executive and detailed design plan. Specifications of project structure [1] • Exercises (design): 1. Design plan (drawing) of structure determinate by task [1] 2. Structural analysis and design of secondary timber structure according to EC [1] 3. Structural analysis of primary timber structure (timber truss) [1] 4. Design of main timber truss elements according to Eurocodes [1] 5. Design of structural stabilization. Design of details in timber structures according to Eurocodes [1] 6. Executive and detailed design plan. Specifications of project structure [1]
Study and examination requirements and forms of examination	Practical and theoretical exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Bjelanović, A., Rajčić, V.: Drvene konstrukcije prema europskim normama, Hrvatska sveučilišna naklada, Zagreb, 2005, (Second edition, 2007.) 2. Rajčić, V., Čizmar, D., Stepinac, M.: Riješeni primjeri iz drvenih konstrukcija, Građevinski fakultet Sveučilišta u Zagrebu, Zagreb, 2014 3. E-learning materials available on the Merlin e-learning system Optional literature: 1. Žagar, Z.: Drvene konstrukcije 1 & 2, Pretei, Zagreb, 2003, 2. Magerle, M.: Svojstva drva, IGH, Zagreb, 1996, 3. EUROCODE 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings, CEN, 2004

Module name:	**Lightweight structures**
Module level, if applicable	Bachelor's Degree Programme
Code, if applicable	21730
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Vlatka Rajčić
Lecturer	Jure Barbalić, Nikola Perković, Mislav Stepinac
Language	Croatian
Relation to curriculum	Bachelor's degree programme.Compulsory elective. Semester VI.
Type of teaching, contact hours	Number of hours (in semester): 45 • Lectures: 30 • Exercises: 15 (auditory – 9,design – 6)
Workload	Lecture hours 30 Hours of auditoria and constructive exercises (face-to-face) 15 Hours of only constructive exercises (face-to-face) 15 Independent study 60 hours
Credit points	4 ECTS
Requirements according to the examination regulations	• Attendance in lectures and exercises, • Preparation of the project, • Minimum 25% score in each pre-exam.
Recommended prerequisites	• Theoretical knowledge about the behavior of structures under load and other actions on structures, • Uunderstanding the concepts of stress and strain and internal forces, Practical knowledge about the calculation methods for statically determinate and statically indeterminate structures.
Module objectives/intended learning outcomes	• Theoretical and applied knowledge about timber, aluminium and glass as building materials. • Basic design of timber, aluminium and glass structures. Details on timber, aluminium and glass structures. Structural stabilization of simple structures.
Content	• Lectures: 1. General overview of timber structures: a historical development, systems, methodological approach [2] 2. Wood as a material: properties of wood, laminated timber and wood based products. Classification of timber in structural engineering. Fire design of timber structures [2] 3. The current design standards and Eurocode 5. Basis of structural analysis (ultimate limit state and serviceability state) [5] 4. Metal fasteners: nails, bolts, dowels, screws, timber screws, patented fasteners and toothed plate connectors. Design of fasteners [4] 5. Traditional timber carpentry joints [2] 6. Truss structures. Design of elements and joints in timber trusses [3] 7. Aluminium as a building material. Basics of Eurocode 9 [5] 8. Structural glass. Design of glass panels. Design of glass columns [5] 9. Design of aluminium-glass facades [2] • Exercises (auditory): 1. Problem description. Introduction to timber engineering [1]

	2. Design plan (drawing) for timber truss system [1] 3. Actions on structures [1] 4. Design according to Eurocode 5 standards. Structural analysis and design of secondary timber structures [1] 5. Timber truss – structural analyses [1] 6. Design of main timber truss elements. Structural stabilization [1] 7. Details in timber structures [1] 8. Design of glass panes and columns [1] 9. Design of aluminium columns. Technical description of the project [1] • Exercises (design): 1. Design plan (drawing) [1] 2. Structural analysis and design of secondary timber structures [1] 3. Timber truss – structural analyses [1] 4. Design of main timber truss elements. Structural stabilization [1] 5. Details in timber structures [1] 6. Design of glass panes and columns. Design of aluminium columns [1]
Study and examination requirements and forms of examination	Practical and theoretical exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Rajčić, V., Bjelanović, A.: Drvene konstrukcije prema europskim normama, 2007, ZAGREB 2. Rajčić, V., Čizmar, D.: Priručnik iz predmeta Lagane konstrukcije, Zagreb, 2008 3. Rajčić, V., Čizmar, D., Stepinac, M.: Riješeni primjeri iz drvenih konstrukcija, Zagreb, 2014 4. E-learning materials available at the Merlin e-learning system Optional literature: 1. Žagar, Zvonimir: Drvene konstrukcije II, Pretei, 1999, Zagreb. 2. Loughran, P.: Falling Glass – Problems and Solutions in Contemporary Architecture, New York, 2003, 3. EN 1999: Design of aluminium structures, CEN, Brisel, 2007

Module name:	**Hydraulic Engineering Structures**
Module level, if applicable	Bachelor's Degree Programmes
Code, if applicable	146821
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Neven Kuspilić, Eva Ocvirk
Lecturer	Gordon Gilja, Kristina Potočki
Language	Croatian
Relation to curriculum	Bachelor degree programme, Compulsory, Semestar VI
Type of teaching, contact hours	Number of hours (in semester): • Lectures: 45
Workload	Lecture hours 45 Other contact hours 10 Self study hours 50
Credit points	3,5 ECTS
Requirements according to the examination regulations	• Attendance in lectures, three pre-exams.
Recommended prerequisites	• Knowledge and understanding of basic hydrological processes, • Knowledge and understanding of basic fluid mechanics principles, • Knowledge and understanding of soil and rock characteristics with basic foundation principles, • Knowledge of concrete structures design.
Module objectives/intended learning outcomes	• Identifying problems related to the hydraulic structures, • Participating in design and construction of the hydraulic structures, • Participating in water management projects.
Content	• Lectures: 1. Introduction: the significance and the role of water in human society development; hydraulic engineering and hydraulic structures in water management;hydraulicstructures– purpose, definition, division. Fundamentals of hydraulic structures design [3] 2. Calculation types and hydraulic structures load and budget types, functionality [3] 3. Mechanical resistance; stability [3] 4. Water and surroundings load determination; load schemes for concrete and foundation work [3] 5. River flood protection structures. Structures for river course training [3] 6. Canals and canal structures [3] 7. Road culvert sand structures for road drainage. Aqueducts, syphons, plugs, culverts [3] 8. Pipelines and accompanying devices [3] 9. Pipelines under pressure and with free surface [3] 10. Hydro-engineering tunnels and accompanying devices; pressure tunnels and free-flow tunnels [3] 11. Dams and weirs [3] 12. Reservoirs and accompanying devices. Hydro power-plants [3] 13. Maritime structures [3] 14. Sea motion, sea waves, sea levels, port structures [3]

	15. Drainages, locks [3]
Study and examination requirements and forms of examination	• According to results achieved in two pre-exams over the course of instruction. • Students with 60% score in partial exams are exempt from written exam.
Media employed	Whiteboard, projector.
Reading list	Required literature: 1. Mimeographed notes of lectures (pdf), Weekly notes of classes (ppt, pdf). Optional literature: 1. Stojić, P: Hidrotehničke građe ine I, II, III, GF Split, 1997, 1998 and 1999, 2. Stojić, P.: Hidroenergetika, Građevinski fakultet, Split, 1995, 3. Nonveiller, E.: Nasute brane, Školska knjiga, Zagreb, 1983, 4. Design of Small Dams, US Department of the Interior, Bureau of Reclamation, 1977, 5. Pršić, M., Tadejević, Z.: Unutarnji plovni putevi, mimeographed notes, 1988

Module name:	**Education on Construction Site**
Module level, if applicable	Bachelor's Degree Program
Code, if applicable	21737
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	VI (Summer)
Person responsible for the module	Ivica Završki
Lecturer	Matej Mihić, Zvonko Sigmund
Language	Croatian
Relation to curriculum	Bachelor's degree program. Compulsory.Semester VI.
Type of teaching, contact hours	Number of hours (in semester): • Exercises (on site): 45
Workload	Lecture hours: 9 Other contact hours: 36 Self study hours: 45
Credit points	3 ECTS
Requirements according to the examination regulations	• Tuition attendance, • Writing a paper.
Recommended prerequisites	
Module objectives/intended learning outcomes	• Recognition of technology, techniques, organisation and work processes at construction sites
Content	• Exercises (on site): 1. Construction pits excavation [3] 2. Excavation in query – aggregate crushers [3] 3. Excavations in water, aggregate separators [3] 4. Production and transport of concrete [3] 5. Foundation pit support [6] 6. Reinforced concrete works below ground surface [3] 7. Reinforced concrete works on the ground surface [3] 8. Reinforced concrete – scaffolds and formworks (9) 9. Assembling of precast structures [3] 10. Performance of asphalt works [3] 11. Water supply and drainage works [3] 12. Building of bridges [3]
Study and examination requirements and forms of examination	Writing a paper.
Media employed	Whiteboard, projector.
Reading list	presents picture in real situation on building site