UNIVERSITY OF JOSIP JURAJ STROSSMAYER IN OSIJEK
FACULTY OF CIVIL ENGINEERING IN OSIJEK

GRADUATE UNIVERSITY STUDIES OF CIVIL ENGINEERING

STUDY PROGRAMME

Osijek, March 2005

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CONTENTS

1 INTRODUCTORY PART

1.1 University of Josip Juraj Strossmayer in Osijek, Faculty of Civil Engineering in Osijek

1.1.1 Brief History of the Faculty

University education of civil engineers in the region of East Croatia reaches back into the year 1967, when the department of the Technical College Zagreb was established in Osijek. This department has been active in the region up to 1976 when, as a part of the Educational Centre for Civil Engineers, the Civil Engineering College Osijek was established. The Civil Engineering College was separated from the Civil Engineering School in 1982 and in **1983** it was merged with the Department for Materials and Constructions Osijek into the **Faculty of Civil Engineering Sciences of the Osijek University.** Since than the Faculty has been active within the Civil Engineering Institute Zagreb and after its transformation during the Homeland War in 1991, the four independent units in Zagreb, Split, Rijeka and Osijek were formed. With the separation of the Business centre Osijek of the Civil Engineering Institute of Croatia, the independent **Faculty of Civil Engineering Osijek** was founded **February 7, 1992**.

1.1.2 Past Experiences in the Implementation of University Educational Programmes

Faculty of Civil Engineering Osijek, with its 29 years of experience in educating civil engineers in Slavonia, is today one of the prominent faculties of Josip Juraj Strossmayer University, and of Slavonia, Croatia and Europe. This fact has become evident in the increased interest of students for the studies at the Faculty of Civil Engineering in Osijek and in the tendency of shortening the time of the studying. According to the present situation at the Faculty, the quality of curricula of the undergraduate and postgraduate studies, the success of the scientific and teaching workers, co-workers and other faculty members in all fields of their work, and the successful managing with the revenues, the Faculty has proved its seriousness and high position in university education and science in Croatia.
During the last 29 years of the Faculty, over **1100** students have become **civil engineers**, almost **300** of them have become **Bachelors of Science in civil engineering**, and **4** candidates have acquired their **doctoral degrees in technical sciences (Ph.D.)**. In 2003 the Faculty established the **dislocated study of civil engineering for the Vukovar-Srijem county** in Vinkovci. The concept of the new study programmes of the Civil Engineering Faculty of Josip Juraj Strossmayer in Osijek follows the tradition of high-quality university education of civil engineers in our region and coordinates them with the modern European (the Bologna Declaration) and world trends.

1.1.3 Taking Part in the Community Life

The Faculty staff has been active in the community life by taking part in those kinds of engineering work that demand specific knowledge and experience: reviews, environmental protection studies, geodetic and geotechnical measurements, and measurements of the seismic response, structure testing, architectural recording of protected structures and engineering objects and innovations in the production of engineering structural elements. The revenue coming from the scientific-research work in the economy makes more than 20 % of all the Faculty revenues which approximately corresponds the trends at other university institutions in the world.

1.1.4 International Cooperation

Many Faculty members were staying as visiting lecturers and co-workers on the projects of two European (3 members) and two US universities (3 members). Some Faculty members were awarded scholarships at some prominent European (ETH, Vienna, Utrecht, Stuttgart, Hagen) and US universities (Pen State, Berkley, Purdue, Illinois). The Faculty also sends a representative of Osijek University in the European University Association, and cooperates with the Pecs University in Hungary with which it has preliminary agreed to organize joint postgraduate studies of civil engineering (official language – English).
Our students participate in the IAESTE programme of students' exchange and during the last 5 years more than 30 students were exchanged and at the same time our faculty hosted 5 foreign students. 3 students took part in the international CEEPUS programme.

1.2 Reasons for Initiating the Studies

1.2.1 Needs of the Labour Market

There are several basic reasons for initiating the studies, the most important one is based on the needs analyses of the labour market. According to the Regional Employment Office in Osijek of the Croatian Employment Bureau, there were **no unemployed civil engineers in the region of Slavonija-Baranya county in December 2004.** Reputable civil engineering firms which employ many workers are often limited with the lack of qualified workers, so that some public (Croatian Waters) and private (APZ Zagreb) firms give scholarships to third- and forth-year students. From time to time they also do «head hunting» among best students offering them jobs. The labour market offers civil engineers great employment possibilities: in manufacturing firms (concrete batching plants, cement plants, in the production of bricks, tiles, carpentry, locksmith's products...) in firms that build roads, bridges, residential, public and industrial buildings, in firms that deal with rehabilitation and wrecking, in public firms, in management and state administration, in schools and universities.
For the purpose of better communication, in 2001 AMCA-FA-Mursae, the association of former students of Civil Engineering Faculty was founded. According to AMCA-FA-Mursae more than 90% of our former students work in the region of Slavonia. They work as junior researchers, teachers in secondary schools, civil engineering firms, design offices, Civil Engineering Institute of Croatia, public companies, in management and abroad.

1.2.2 Connection with Modern Scientific Concepts

The new study programmes are based on the long-time and diverse scientific work of our employees in Croatia, as well as on the cooperation with European scientific and educational institutions. Currently nine scientific-research projects financed by the Ministry of Science, Education and Sports are being carried out at our Faculty. There are also three international projects which involve American, German and Slovenian partners. The projects deal with very diverse topics and comprise the problems of earthquake engineering, timber and concrete constructions, soil mechanics, as well as different economical aspects of civil engineering. Scientists of the Faculty of Civil Engineering in Osijek take part in the three **TEMPUS** projects: the first one dealing with the coordination of civil engineering education in Croatia with the Bologna Declaration, the second one with the application of the Bologna Declaration at the Osijek University. The Faculty is a partner in **CARDS** inter-border cooperation projects of the sustainable development of Baranya family farms, with the accent on the preservation of the landscape of Baranya villages.

1.2.3 Comparison with Foreign University Study Programmes

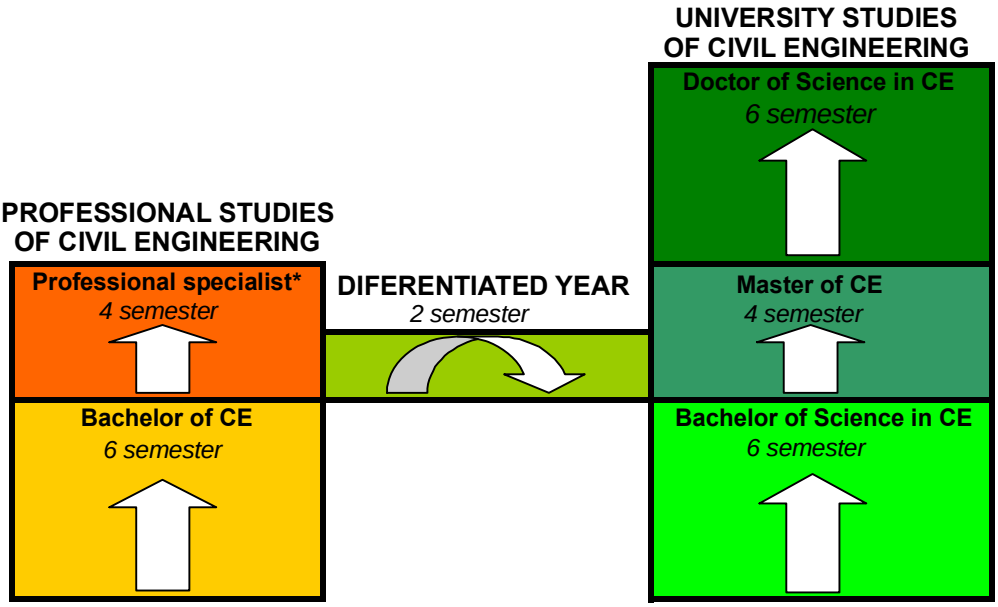
During the making of the study programmes we took part in shaping the **TEMPUS** project **«Restructuring and Updating of Civil Engineering Curriculum, TEMPUS JEP NO. 17062-2002»** on which all four civil engineering faculties in Croatia are engaged together with the international consortium of 10 European faculties. This cooperation, as well as the active participation in the adaptation of study programmes of engineering studies in Croatia organized by the Ministry of Science, Education and Sports, led to the coordination of all the suggested programmes of civil engineering faculties in Croatia (November 2004). The differences in the undergraduate study programmes were less than 10%.
During the making of the programmes we consulted the contents of study programmes of many European and American civil engineering faculties, and used the guidelines of professional organisations which, in some countries, define engineering competencies. We mostly followed the instructions of **EUCEET (European Civil Engineering Education and Training)** which embraces 136 scientific institutions of which more than 100 civil engineering faculties in Europe (EUCEET projects «Harmonising Engineering Education Across Europe» 2004). We also coordinated the programmes with the guidelines of **SEFI (European Society for Engineering Education** project: »Enhancing Engineering Education in Europe, Innovative Curricula in Engineering Education 2003), with the standards of the German institution for accreditation of university programmes in civil engineering **ASBau (Akkreditierung und Qualitatssicherung zeitgemasser Studiengange des Bauingenieurwesens an deutschen Hochschulen)** from 2003, and with the criteria for accreditation of engineering programmes in USA **(Engineering Accreditation Comission, Accreditation Board for Engineering and Technology (ABET)** from 2003 and 2004.
The compilation of **the Bologna Declaration**, the recommendation of the **ASCE Body of Knowledge** committee and the results of EUCEET study on the basic content of the civil engineering studies, gave us a good criterion needed for defining professional knowledge necessary to any civil engineer. The table shows the ECTS credits for particular courses in the first three years of the studies on the chosen European universities in comparison with the suggested undergraduate study programme of the Faculty. Despite certain differences, undergraduate curriculum of our faculty fits into the frame of ECTS credits in all courses and it is most similar to the study programmes of 100 European universities **(EUCET).**

1.3 Potential Partners Outside the Institutions of Higher Education

Outside the higher education system there is an interest for study programmes, particularly in the form of the continuous engineering education.

1.4 Openness of the Studies towards the Mobility of Students

In 1993 the Civil engineering studies, with its first autonomous programme, has already been declared as an «international programme». Today it continues to aim toward the openness of the studies and mobility of students. As a result of these aspirations several dozen foreign students have graduated at our faculty. Moreover, the mobility of students is ensured by the agreement on coordination and mutual acknowledgment of curricula at all civil engineering faculties in Croatia and harmonisation of programmes with European standards (see the table 1) enables mobility on the European level. Besides, this mobility is also enabled by the possibility of conducting some lectures in English language (see the study programme). Also a part of scientific and educational employees is involved in teaching at other faculties of University of Josip Juraj Strossmayer in Osijek, Faculty of Agriculture and Art Academy.



Students' mobility at the Faculty of Civil Engineering in Osijek

2 GENERAL PART

2.1 Title of Studies

Faculty of Civil Engineering at the University of Josip Juraj Strossmayer in Osijek offers a study programme called **Graduate University Studies of Civil Engineering**. Study programme is organised within three fields of specialization:

2.1.1 Supporting Structures
2.1.2 Construction Management and Technology
2.1.3 Hydraulic Engineering

2.2 Coordinator of Studies

The **Faculty of Civil Engineering of Josip Juraj Strossmayer University** is in charge of university studies.

2.3 Duration of Studies

The duration of Graduate University Studies of Civil Engineering is **two years**.

2.4 Admission Policy

Enrolment in the Graduate University Studies of Civil Engineering study programme is open to:

- Bachelors of Science in Civil Engineering
- Bachelors of Civil Engineering after completing a differentiated year study programme

2.5 Competencies

Competence /skills of ***Master of Civil Engineering***
- ability of designing and dimensioning in particular field of specialization
- understanding of legal and professional practice connected with construction industry
- understanding of construction processes, conveying of knowledge, methods, materials, systems, machines, planning, safety, analysis and expenses control
- understanding fundamentals of economy, business, law, statistics, professional ethics, management, optimization, process analysis, engineering economy and developing of decision making skills
- understanding of general phenomena and problems in civil engineering context along with knowledge of boundary conditions and through interaction with other areas of science
- design, realisation and maintenance of civil engineering structures and systems in terms of bearing capacity, stability, safety, environmental protection and prices

After graduating and on-the-job training one will be able to assume responsibility in the field he/she graduated in. He/she will use acquired knowledge and develop abilities in problem formulation and problem solving and to gain an ability to apply such skills to solve real problems and to find an optimal solution. He/she is qualified to obtain new knowledge in the development and methods of scientific and applied-scientific research.

Master of Civil Engineering *is trained for:*

- project design and design of necessary technical documents for construction and reconstruction of buildings and civil engineering works of all kinds
- independent management of a building site...
- design of structures, design of stability of structures, dimensioning of elements…
- design of water supply, land reclamation, sewers and other hydraulic engineering structures
- design of roads, railways, airports, ports, maritime and river waterways and other similar structures
- coordination of complex technical documentation for civil engineering projects, construction management and technology, environmental protection…
- production and management of various geotechnical projects, including the planning and control of geotechnical investigation works
- design, testing and control of the quality of civil engineering works and materials
- preparation of feasibility study; investments in construction of buildings
- scientific – research work in civil engineering
- education of civil engineers

Undergraduate studies in Republic of Croatia which are necessary for the enrolment:

- undergraduate studies of civil engineering faculties in Zagreb, Split, Rijeka and Osijek
- professional studies of civil engineering under condition of taking differentiated exams (differentiated year)

2.6 University Degree Acquired after Finishing the Studies

The Faculty provides a study programme leading to the **master's degree (Master of Civil Engineering).**

3. DESCRIPTION OF STUDY PROGRAMME

3.1. Study programme

3.1.1. Field of specialization Supporting Structures:

I SEMESTER

Compulsory courses	Course	Lecturer	Hours a week Lectures+practice		Exam	ECTS credits
1.05-105	Probability Theory and Statistics	Asc.Prof. RADOSLAV GALIĆ	2,00	2,00	yes	4,00
2.05-204	Structural Dynamics	Ass.Prof. IVICA GULJAŠ	2,00	2,00	yes	4,00
2.05-205	Bridges I	Asc.Prof. ZVONIMIR MARIĆ	3,00	2,00	yes	6,50
2.05-206	Concrete Structures II	Prof. DRAGAN MORIĆ	2,00	2,00	yes	4,00
2.05-304	Hydraulic Engineering Systems	Ass.Prof. LIDIJA TADIĆ	3,00	2,00	yes	6,50
2.05-207	Structure Testing	Prof.VLADIMIR SIGMUND	2,00	2,00	yes	5,00
total of all courses			14,00	12,00		**30,00**

II SEMESTER

In the II semester a student chooses three optional courses; one of them has to be from their field of specialization. Optional courses for all fields of specialization are specified at the end of the study programme.

Compulsory courses	Course	Lecturer	Hours a week *Lectures+practice*		Exam	ECTS credits
2.05-208	Structural Stability	Ass.Prof. IVICA GULJAŠ	2,00	2,00	yes	4,50
2.05-209	Earthquake Engineering	Prof. DRAGAN MORIĆ	2,00	2,00	yes	4,50
2.05-210	Plate and Shell Theory	Prof.VLADIMIR SIGMUND	3,00	2,00	yes	6,00
optional	at least 1 from the field of specialization					15,00
total of obligatory courses			**7,00**	**6,00**		**15,00**
total of optional courses						**15,00**
total of all courses						**30,00**

III SEMESTER

In the III semester a student chooses three optional courses; one of them has to be from their field of specialization. Optional courses for all fields of specialization are specified at the end of the study programme.

Compulsory courses	Course	Lecturer	Hours a week *Lectures+practice*		Exam	ECTS credits
2.05-211	Pre-stressed Concrete	Asc.Prof. ZVONIMIR MARIĆ	2,00	2,00	yes	5,00
2.05-212	Metal Structures II	Ass. Prof. DAMIR MARKULAK	2,00	2,00	yes	5,00
2.05-213	Timber Structures II	Prof.STJEPAN TAKAČ	2,00	2,00	yes	5,00
optional	one from their field of specialization					5,00
	two from the other fields of specialization					10,0
total of obligatory courses			**6,00**	**6,00**		**15,00**
total of optional courses						**15,00**
total of all courses						**30,00**

IV SEMESTER

	Course	Lecturer	Hours a week		Exam	ECTS credits
5-101	Essentials of Scientific Work	Prof. KSENIJA ČULO	1,00	0,00		0,00
2.05-DR	**Master's thesis**					30,00
total of all courses						**30,00**

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
1.05-105	**PROBABILITY THEORY AND STATISTICS**	**2 + 2**	**COMPULSORY**	**I**	**4,00**
Lecturer:	**Asc.Prof. RADOSLAV GALIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

Descriptive statistics:Types of data, Collection of data, Description of data: Graphs and tables.
Probability:Probability- classical approach, combinatorics, Probability- definition, Some rules of probability, Probability- statistical definition, Conditional probability.
Random variables:Discrete random variables, numerical characteristics and their meaning, Independent Bernoulli trials and binomial random variable, meaning of parameters, normal aproximation, Continuous random variable, some parametric families (uniform, exponential, normal ,χ-square).
Sampling distribution.
Inference based on a single sample:Estimation for a population proportion, Large-sample confidence interval for a population proportion, Estimation for a population mean, Large-sample confidence interval for a population mean, Tests of hypotesis about a population proportion and a population mean (large- sample)
Inference based on two samples:Comparing two population means, Comparing two population proportions, Comparing two population distributions.
Two-dimensional random vector:Definition, Conditional distributions. Independence, Analyzing contingency tables , The coefficient of correlation, Simple linear regression.

1.4 Competence

1.5 Obligatory sources

1. I. Pavlić, Statistička teorija i primjena, Tehnička knjiga, Zagreb, 1988.

1.6 Additional sources

1. G.R. Iversen, M. Gergen, Statistics, the Conceptual Approach, Springer, Berlin, 1997
2. S. Lipschutz, J. Schiller, Introduction To Probability And Statistics, Schaum's Outline Series, McGraw-Hill, New York-Toronto, 1998
3. J.T. McClave, P.G. Benson, T. Sincich, Statistics for Bussiness and Economics, Prentice Hall, London, 2001
4. G. McPherson, Applying and Interpreting Statistics, Springer, Berlin, 2001
5. Ž. Pauše, Vjerojatnost, informacija, stohastički procesi, Školska knjiga, Zagreb, 1974.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: no
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-204	**STRUCTURAL DYNAMICS**	**2 + 2**	**COMPULSORY**	**I**	**4,00**
Lecturer:	**Ass.Prof. IVICA GULJAS**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Analysis of structures subjected to dynamic loads: environmental, machine, vehicular and blast sources.
Discrete and continuos mechanical models.
Single degree of freedom system – free and forced vibrations with or without damping. Dynamic response to periodic and arbitrary dynamic excitation. Response spectrum.
Approximate and numerical methods. Frequency domain analysis.
Multy degree of fredom system. General property matrices for vibrating systems. Numerical solution methods. Analysis of dynamic response by mode superposition and by direct integration.
Vibrations of continuous systems.

1.4 Competence

Understanding of the dynamic response of structures and of the common analysis techniques employed to evaluate these responses to earthquake excitation, blast loading, wave forces on structures and wave propaga
The course emphasizes numerical solution techniques for a range of applications in structural dynamics.

1.5 Obligatory sources

1. Čaušević, M.: Dinamika konstrukcija, Udžbenici Sveučilišta u Rijeci, Školska knjiga, Zagreb, 2005.
2. Mihanović, A.: Dinamika konstrukcija, Građevinski fakultet Sveučilišta u Splitu, Split, 1995.
3. Kiričenko, A.: Tehnička mehanika: III. dio – DINAMIKA, Znanstveno stručna biblioteka, Zagreb, 1996.

1.6 Additional sources

1. Chopra, A.K.: Dynamics of Structures, Theory and Applications to Earthquake Engineering, Prentice Hall, New Jersey, USA, 2001.
2. Tedesco, J.W; McDougal, W.G; Ross, C.A.: Structural Dynamics, Theory and Applications, Addison-Wesley Longman, California, USA, 1999.
3. Paz, M.: Structural Dynamics, Theory and Computation, Van Nostrand Reinhold, New York, USA, 1980.
4. Cheung, Y.K.; Leung, A.Y.T.: Finite Element Methods in Dynamics, Kluver Academic Publishers, London, UK, 1992.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: yes
Pre/Corequisites: Mathematics, Statics, Strenght of materials		

1.8 Quality control

Assessment of knowledge is carried out in the semester, during the process of teaching, practical work, seminars and colloquia according to the teaching plan. The final evaluation mark is determined during the written examination (2 or 3 problems have to be solved within two hours), complemented in doubtful case by an oral examination.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-205	**BRIDGES I**	**3 + 2**	**COMPULSORY**	**I**	**6,50**

Lecturer:	**Collaborators:**
Asc.Prof. ZVONIMIR MARIC	**Ph.D. DAMIR VAREVAC**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Introduction. Basic definitions. Types of bridges. Naming and parts of the bridges. Materials for bearing structures. Designing of bridges. Loads on bridges. Bearing systems and shapes. Girder bridges. Frame bridges. Arch bridges. Cable stayed bridges. Suspension bridges. Construction of bridges. Execution of foundations, abutments and columns. Execution of supers-structures. Slab structures. Ribbed structures. Box girders. Support of super-structures. Types of supports and bearings. Abutments. Columns. Pylons. Forces in supports and methods of supporting. Bearing of bridges. Finishing works. Isolations and pavement structure. Expansion joints. Road drainage. Lightning.

1.4 Competence

Since, the road construction (especially, highway construction) is the most represented part of construction industry in Croatia, and bridges are great part on it, it is necessary that each construction engineer overcome basic knowledge of this course. Exercises qualify each student that after short work experience beside an experienced expert can independently design simple bridges.

1.5 Obligatory literature

1. Radić, J.: Mostovi, Zagreb, 2003.
2. Tomičić, I.: Betonske konstrukcije, Zagreb, 1997.
3. Aničić, D.: Prednapeti beton, Osijek, 2003. (skripta za studente Građevinskog fakulteta)
4. Leonhardt, F.: Vorlesungen über Massivbau, Sechster Teil. Springer Verlag, Berlin – München, 1990.

1.6 Additional literature

1. Marić, Z., Sesar, P.: Riješeni primjer proračuna prednapetog betonskog nosača. Zagreb, 1987. (interno izdanje).
2. Puž, G. i dr.: Skripta za održavanje vježbi iz predmeta Mostovi i Masivni mostovi. Zagreb, 2001. (interno izdanje).

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

Seminar

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-206	**CONCRETE STRUCTURES II**	**2 + 2**	**COMPULSORY**	**I**	**4,00**

Lecturer:	**Collaborators:**
Prof. DRAGAN MORIĆ	**Ph.D.DAMIR VAREVAC**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

Basic concept of structural engineering. Project phases. Codes for design and construction works for RC structures. Essential and special requirements for RC structures. Safety requirement for Rc structures. Basic variables. Two values of essential variables principies. Durability requirement.
Bearing and servicebility limit states. Limit states concept. Engineering analysis phases. Calculation approach. Idealisation of structures. Classification of loads. Definitions of calculation values of initial structural forces and cross section bearing capacity.
Excentric compression. Wuchovsky method. Interactive diagrams. Excentric compression of slender columns. Excentric tensile force.
Design concept. Engineering aproximations. Webers diagrams of interactions.
Types of torsions. Radial torsion and elastic state. Torsion in craced cross section. Calculation model for structural element. Participate fatness of cross section. Longitudinal and transversal reinforcment. Torsion in interactivity with bending moment and transversal force.Recommendations accoding Model CODE 90 (CEB, FIP).
Shear stresses in I and II stadiums. Critical area and critical penetration cross section. Slabs with change in dimensions (capitels). Reinforcements details.
RC slabs and plates, RC walls, RC hight girded walls, RC beams, RC columns, RC rigid conection zones.
Preferences and faults of RC prefabricated structures, Calculation approach and design concept, Vertical structural elements (columns and walls), Horisontal structural elements (beams, TT and T slabs, slabs with openings) Vertical conections, Horisontal conections.
Global informations of deflections and cracks limit states for some RC structural elements.

1.4 Competence

Knowing of rules for design, calculations and construction of RC structures for various combinations of loads, t of structures and structural elements in projecting phases.

1.5 Obligatory sources

1. I. Tomičić, Reinforced concrete structures (In Croat) DHGK, Zagreb, 1996.

1.6 Additional sources

1. I. Tomičić, Reinforced concrete structures, Chosen chapters (In Croat) DHGK, Zagreb, 1999

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: no
Pre/Corequisites: Reinforced concrete structures I		

1.8 Quality control

Two colloquial exams during course lecture

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-304	**HYDRAULIC ENGINEERING SYSTEMS**	**3 + 2**	**COMPULSORY**	**I**	**6,50**
Lecturer:	**Ass. Prof. LIDIJA TADIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Structures as basis of hydrotechnical systems – review and role of hydrotechnical structures; Inquisitorial works – environment, soil, water, development; Engineering foundation, grouting, anchorage, diaphragms (cat-off walls); Building site protection from water impacts – weirs, diversions; Dams – purpose, types, specific impacts, loads; Concrete dams – calculations, subtypes (massive, unload, buttress, arch, gated dams); Backfill dams (earthfill, rockfill dams) and embankments; Functional elements of dams – spillways and outlets; Hydrotechnical canals, tunnels and penstocks – discharge-intake structures, surge chambers; Structures of waterways and ports – docks, breakwaters, navigation locks; Power houses, water reservoirs, water gates, pumping-stations, aqueducts, siphons;

1.4 Competence

Introduction to specificities of building and utilisation of structures in presence water conditions; Reference to concepts and calculations diverse water influences; Introduction of appropriate techniques and technologies of building; Development of engineering approach to realisation complex hydrotecnical structures.

1.5 Obligatory sources

1. Stojić, P., Hidrotehničke građevine, knjiga I, II, III, Građevinski fakultet Sveučilšta u Splitu, Split, 1997.(I), 1998.(II,III);
2. Nonveiller, E.: Nasute brane, Školska knjiga, Zagreb, 1983.

1.6 Additional sources

1. Tehničar – građevinski priručnik – 6, Građevinska knjiga, Beograd, 1989.
2. Blind, H.: Waserbauten aus Beton, Berlin, Ernst und Sohn, 1987.
3. Mosony, E.: Water Power Develompent. Vol. 1, 2 (A, B), Third Ed., Akademiai Kiado, Budapest, 1987.

1.7 Exam

Exam:	Oral: Written:	Seminar:
Pre/Corequisites:		

1.8 Quality control

Analyses: seminary works, case study of some hydrotechnical structure and questionnaire for field education realisation.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-207	**STRUCTURE TESTING**	**2 + 2**	**COMPULSORY-K**	**I**	**5,00**
Lecturer: **Prof. VLADIMIR SIGMUND**		**Collaborators:** **Ass.Prof. IVICA GULJAŠ**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Theory, methods, and techniques for experimental studies of structural members and systems. Measurements fundamentals; transducers for measuring strain, displacements, force and torque, pressure, and temperature. Physical modeling principles: similitude, materials and their properties, and loading systems for application to studies of elastic and inelastic models. Case studies. Individual project required of each student.

1.4 Competence

Experimental stress-strain analysis, understanding the importance and methods of experimental measurement

1.5 Obligatory sources

1. D.Aničić, Ispitivanje konstrukcija, Građevinski fakultet Osijek, 2002.
2. A.Kiričenko, Mjerenja deformacija i analiza naprezanja u konstrukcijama, DIT Zagreb, 1982

1.6 Additional sources

1. Christof Rohrbach, Handbuch fuer Experimentelle Soannungsanalyse, VDI-Verlag GmbH, 1989.

1.7 Exam

Exam: yes	Oral: yes Written: no	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

Experimental exercises and seminar work.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-208	**STRUCTURAL STABILITY**	**2 + 2**	**COMPULSORY-K**	**II**	**4,50**
Lecturer:	**Ass. Prof.IVICA GULJAŠ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Basic principles of stability: stable and unstable equilibrium, bifurcation buckling, energy methods.
Stability of columns and beam-columns: different support conditions, buckling of eccentrically loaded and imperfect columns, buckling of elastically supported columns, inelastic buckling, buckling of special columns. Effective length factors, columns curves and interactive equations.
Stability of rigid and semi-rigid frames, plastic collapse loads. Buckling of beams.
Buckling of arches. Plates and shells stability.
Stability under seismic loading. Energy and numerical methods for stability analysis.
Some aspects of inelastic stability. Damage theory and fracture mechanics.

1.4 Competence

Introduction into structural stability and second order theory.
Numerical solution of practical problems.

1.5 Obligatory sources

1. Čaušević, M.: Statika i stabilnost konstrukcija, Udžbenici Sveučilišta u Rijeci, Školska knjiga, Zagreb, 2003.
2. Mihanović, A.: Stabilnost konstrukcija, Hrvatsko društvo građevinskih konstruktora, Zagreb, 1993.
3. Ranković, S.: Metode rješavanja zadataka stabilnosti, Beograd, Građevinski fakultet, 1994.

1.6 Additional sources

1. Chen, W.F; Lui, E.M.: Structural Stability, Theory and Implementation, Elsevier Science Publishing Co., Inc. New York, USA, 1987.
2. Bažant, Z.P; Cedolin, L.: Stability of Structures, Elastic, Inelastic, Fracture and Damage Theories, Dover Publications, Inc., Mineola, New York, USA, 2003.
3. Galambos, T.V.: Giude to Stability Design Criteria for Metal Structures, A Wiley-Interscience Publication, New York, USA, 1988.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: yes
Pre/Corequisites: Mathematics, Statics, Strenght of Materials		

1.8 Quality control

Assessment of knowledge is carried out in the semester, during the process of teaching, practical work, seminars and colloquia according to the teaching plan. The final evaluation mark is determined during the written examination (2 or 3 problems have to be solved within two hours), complemented in doubtful case by an oral examination.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-209	**EARTHQUAKE ENGINEERING**	**2 + 2**	**COMPULSORY-K**	**II**	**4,50**
Lecturer:	**Prof.DRAGAN MORIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

Basic terms, Rise, Discontinuites, Eartquake waves, Quantifications, Magnitude, Ertquake energy, Intensites, Isoseistic lines, Return period, Eartquake registration, Eartquake spectrum, Parametars of location, Seismology map, Social aseismic protection aspect.
Masses distribution, Stiffnesses distribution, Regularity in plans, Dilatations, Stiffnesses of floor structures, Regularity along height,
Ortogonal axeses, soft storey, short columns, Frames, Bearing walls, Mixed systems, Infeel panels
Bearing system, Floor structures, Failure mechanism, Vertical and horisontal RC beams, Openings in walls and its dispositions
Concrete in cyclic load, Steel in cycle load, Reinforcedconcrete elements in cycle load (beams, colomns, walls, rigid zones, short columns), Masonry in cyclic load (bending, shear, slip, unreinforced and reinforced masonry) Ground in cyclic loads (basic rock, sand, liqufaction)
Approach, Capacitay and ductility, Modelling (structure, eartquake) Spectrum analysis, Modal analysis, Time history analysis, Demand and capacity principies, Examples, based on ENV 1998.

1.4 Competence

The aim of the course is to give students knowledge about aseismic design of structures, behaviour of materia methods of calculations as well as modern regulations and codes in the area of earthquake engineering.

1.5 Obligatory sources

1. Petrović B., Earthquake engineering, (in Croat) Građevinska knjiga, Beograd, 1989. (II. edition)
2. Aničić D., Fajfar P., Petrović B., Szavits-Nossan, A., Tomažević M., Earthquake engineering - Buildings, (in Croat) Građevinska knjiga, Beograd, 1990.

1.6 Additional sources

1. Fajfar, P., Basic of earthquake engineering,(in Slovenian) FAGG, Ljubljana, 1990.
2. Earthquake Resistant Design for Civil Engineering Structures in Japan, The Japan Society of Civil Engineers, Tokyo, 1992.
3. Tomažević, M., Earthquake-Resistant Design of Masonry Buildings, Imperial College Press, 1999.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: no
Pre/Corequisites:		

1.8 Quality control

Two colloquial exams during course lecture

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-210	**PLATE AND SHELL THEORY**	**3 + 2**	**COMPULSORY-K**	**II**	**6,00**
Lecturer: **Prof. VLADIMIR SIGMUND**		**Collaborators:** **Ass.Prof. IVICA GULJAŠ**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Basic concepts, elements of plate-bending theory, plates under combined lateral and in-plane loads, membrane stresses in shells, bending stresses in shells, applications, folded structures, dynamical and stability problems by plates and shells, numerical methods.

1.4 Competence

Understanding of the classical and numerical analysis methods for walls, plates and shells. Interpretation and control of the numerical results.

1.5 Obligatory sources

1. A.S.Ugural, "Stresses in plates and shells", second edition, McGraw-Hill, 1999.
2. I. Alfirević, Linearna analiza konstrukcija, FSB Zagreb, 1999.

1.6 Additional sources

1. K Girkman: Površinski sistemi nosača, Gradevinska knjiga, Beograd, 1965
2. K.J.Bathe, Finite elements procedures in engineering analysis, Prentice-Hall, New Jersey, 1988.

1.7 Exam

Exam: yes	Oral: yes Written: no	Seminar: yes
Pre/Corequisites: Courses in continuum mechanics		

1.8 Quality control

Seminar

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-211	**PRESTRESSED CONCRETE**	**2 + 2**	**COMPULSORY-K**	**III**	**5,00**

Lecturer:	**Collaborators:**
Asc.Prof.ZVONIMIR MARIĆ	**IVANKA NETINGER, B.Sc.in Civil Engineering**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Definition. Why should the steel be of a high strength. Material properties. Implementation of prestressing. Necessity of an excentric position of a tendon. Respons of a concrete section to an increase of outer loading. Acting of a tendon upon a concrete girder. Theorema of elementary statics used in mechanics of prestressed concrete. The necessary cross-section geometry. The necessary prestressing force. Tendon axis layout. Losses of prestressing force. Load bearing capacity of a prestressed concrete cross-section at bending. Action of a shear force. Spliting forces at the introduction zone of prestressing force. Prestressing steels and systems. Hyperstatic systems (HS). Methods of determining section forces in HS. Load bearing capacity of HS. The concept of a plastic hinge. The degrees of prestressing – partial prestressing. Outstanding prestressed concrete structures in Croatia and abroad. Design example.

1.4 Competence

Prestressed concrete is the material of XX century. It moved the span limit to manyfold of that attained by reinforced concrete structures. In the field of bridge construction it made possible reaching such span-lengths that could not be thought of earlier. Also in the field of other structures (tanks, stadia, halls, TV towers, chimneys) it pushed the steel out in many cases. Teaching this subject enables, beside widening the perspectives, repeating of summary of essential knowledges of nearly all the mechanic disciplines and of reinforced concrete.

1.5 Obligatory sources

1. Aničić, D.: Prednapeti beton, Osijek, 2003. (course materials)

1.6 Additional sources

1. Marić, Z., Sesar, P.:Design example of prestressed concrete girder, Zagreb, 1987. (internal)
2. Leonhardt, F.: Prednapregnuti beton u praksi, Beograd, Građevinska knjiga, 1965.

1.7 Exam

Exam: yes	Oral: yes Written: yes	Seminar: yes
Pre/Corequisites: Mechanic I, II and Concrete stuctures I, II		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-212	**METAL STRUCTURES II**	**2 + 2**	**COMPULSORY-K**	**III**	**5,00**

Lecturer:	**Collaborators:**
Ass.Prof.DAMIR MARKULAK	**TIHOMIR ŠTEFIĆ, B.Sc. in Civil Engineering**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Built-up compression members – classification, design procedure, constructional details. Space truss structures – application, typical structural forms, design procedure and connections. Cold formed thin members and profiled sheets – typical forms of sections, properties of materials, basis of design, connecting devices. Fatigue of steel members – definitions, fatigue assessment procedures. Introduction to composite steel and concrete structures – special terms, properties of material, types of composite members, basis of design of composite beams. Planar plated structures without transverse loading – resistance to plate buckling, plate girder with transverse stiffeners (calculation procedure). Introduction to EC 3 fire engineering design of steel structures – properties of steel at high temperatures, section classification, critical temperature, simple Eurocode design of steel members. Aluminium structures – material properties, typical types of aluminium alloy sections, basis of design according to EC 9. Tall buildings – specific aspects of design. Industrial building with cranes – typical aspects of design.

1.4 Competence

This course extends the basic informations about steel structures. Students will learn about specific topics in st engineering – space truss members, cold formed thin members, planar plated structures, composite structures introduction to fire engineering design e.t.c.

1.5 Obligatory sources

1. Androić, B., Dujmović, D., Džeba, I.: Metalne konstrukcije 1, IGH, Zagreb, 1994
2. Androić, B., Dujmović, D., Džeba, I.: Metalne konstrukcije 2, IAP, Zagreb, 1995
3. Markulak, D.: Čelične konstrukcije, dio I, Interna skripta, GF Osijek, Osijek 2004.
4. Markulak, D.: Čelične konstrukcije, dio II, Interna skripta, GF Osijek, Osijek 2004.

1.6 Additional sources

1. EN1993-1-1 (EC3): Design of steel structures, General rules and rules for buildings
2. Stahl im Hochbau, 14. Auflage, Band I, Teil II, Band II, Teil I
3. Thiele/Lohse: Stahlbau 1, B.G. Teubner, Stuttgart, 1993
4. Hunersen, Fritzshe: Stahlbau in Beispielen, Werner-verlag GmbH, Dusseldorf, 1993
5. Petersen, C: Sathlbau, Wieweg and Sohn, Wiesbaden, 1994

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar: Yes
Pre/Corequisites: Attendance to lectures and exercise, positive Semestral project, positive exam in Steel Strucures I		

1.8 Quality control

Semestral project is divided into different phases, and students need to work on project continually during semester. Attendance to lectures and exercise will be also monitoring.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-213	**TIMBER STRUCTURES II**	**2 + 2**	**COMPULSORY-K**	**III**	**5,00**
Lecturer: **STJEPAN TAKAČ, Ph.D. in Architecture**		**Collaborators:** **TIHOMIR ŠTEFIĆ, B.Sc.in Civ. Eng.**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Contemporary timber structures and research work overview
Special timber structures:halls (span over 30 m), closed baths, sports halls
Historical buildings; bearing capacity and serviceability analysis; rehabilitation procedures
Timber bridges
Fire resistance of timber structures
Durability of timber structures
Test loads and in-situ testings of load bearing timber structures

1.4 Competence

To achieve the knowledge (according to the educational level of the students) about timber as a perfect ecolog construction material – material of the future (the objective of the developed western countries: "By 2010 wood have become a leading constructiom material!")

1.5 Obligatory sources

1. Takač, S: "Novi koncept sigurnosti drvenih konstrukcija", Sveučilišni udžbenik Sveučilišta J. J. Strossmayera u Osijeku, Osijek 1997. ISBN 953_96691-1-1
2. Holzbauwerke-Bemessung und Baustoffe STEP1, 2, 3 nach EUROCODE 5. Informationdienst Holz, 1995 Fachverlag Holz, Düsseldorf.

1.6 Additional sources

1. CIB W80/RILEM 71-PSL: Prediction of service life of building materials and components. CIB-piblication 96. 1987.
2. Martensson, A., Thelandersson, S.: Control of deflections in timber structures with reference to EUROCODE 5. Proc. of the CIB W18 Meeting, Ahus; Schweden, Paper 25-102-2. 1992.
3. Larsen, H. J:, Gustafsson, P. J., Traberg, S.: Glass fibre reinforcement perpendicular to grain. In: Proc. of the Pacific Timber Eng. Conf. Australija. 1994.

1.7 Exam

Exam:	Oral: yes Written:	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
5-101	**ESSENTIALS OF SCIENTIFIC WORK**	**1 + 0**	**COMPULSORY**	**IV**	**0,00**
Lecturer:	**Prof. KSENIJA ČULO**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**NO**	**NO**	**NO**

1.3 Course curricula

About scientific/research work.
Scientific methods.
Reseach methods in construction.
Planning of the scientific/research work.
Scientific and technological information , information resources.
Researching.
Kinds of scientific/research and professional papers.
Structure of the scientific paper and scientific documentation.
Writting papers – technics.
Defense of paper.

1.4 Competence

The target of the course is introduce students to scientific research, to every formal and neformal specific quali scientific work. Aim of the course is stimulating creativity by using correct methodology.

1.5 Obligatory sources

1. Žugaj, M., Dumičić, K., Dušak, V.: Scientific/research work - bases, FOI, Varaždin, 1999.
2. Low on scientific/research work NN 123/03

1.6 Additional sources

1.7 Exam

Exam:	Oral: No Written: No	Seminar: No
Pre/Corequisites:		

1.8 Quality control

Exam is on consultant level during students work on diploma paper.

3.1.4. LIST OF OPTIONAL COURSES

All optional courses earn **5 ECTS** credits. Optional courses from the following fields of specialization:
O – general optional courses
K – Supporting Structures
OTM - Construction Management and Technology
H - Hydraulic Engineering

Optional	**Course**	**Lecturer**	**Hours** of active classes	**Field of speciali-zation**	**Semester**
2.09-103	Information Systems and Data Bases	Ass.Prof. NIKOLA KLEM	4,00	O	winter
1.05-106	Applied Numerical Methods	Ass.Prof. NINOSLAV TRUHAR	4,00	O	summer
2.01-107	Reconstruction of Heritage	Ass.Prof. SANJA LONČAR-VICKOVIĆ	4,00	O	winter
2.01-108	Architecture of Industrial Buildings	Ass.Prof. SANJA LONČAR-VICKOVIĆ	4,00	O	summer
2.05-402	Transportation Engineering	Ph.D. MATE SRŠEN	4,00	O	winter
2.05-403	Road Construction and Maintenance	Ph.D. MATE SRŠEN	4,00	O	summer
2.05-214	Bridges II	Asc.Prof. ZVONIMIR MARIĆ	4,00	K	summer
2.05-215	Masonry Structures II	Prof. STJEPAN TAKAČ	4,00	K	winter
2.05-216	Composite Structures	Ass.Prof. DAMIR MARKULAK	4,00	K	winter
2.05-217	Structure Modelling	Prof. DRAGAN MORIĆ	4,00	K	summer
2.05-218	Analysis of Structure Stress and Bearing Capacity	Prof. VLADIMIR SIGMUND	4,00	K	winter
2.05-219	Rock Mechanics	Prof. MENSUR MULABDIĆ	4,00	K	summer
5.01-103	Marketing	Asc.Prof. ZLATKO LACKOVIĆ	4,00	OTM	winter
2.15-116	Industrialized Construction	Prof. PETAR BRANA	4,00	OTM	winter
5.01-104	Financial Management	Prof. BARBARA MEDANIĆ	4,00	OTM	summer
2.15-117	TQM – Total Quality Management	Prof. KSENIJA ČULO	4,00	OTM	winter
2.15-118	Maintenance of Structures	Ass. Prof. SAŠA MARENJAK	4,00	OTM	summer
2.05-312	Water Conditioning	Ass.Prof. LIDIJA TADIĆ	4,00	H	summer
2.05-313	Hydrology II	Asc.Prof. VLADIMIR PATRČEVIĆ	4,00	H	summer
2.05-314	Torrent Control	Asc.Prof. VLADIMIR PATRČEVIĆ	4,00	H	summer
2.05-315	Hydrotechnical Modelling	Ass.Prof. LIDIJA TADIĆ	4,00	H	winter

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.09-103	**INFORMATION SYSTEMS AND DATA BASES**	**2 + 2**	**OPTIONAL -O**	**winter**	**5,00**
Lecturer:	**Ass.Prof. NIKOLA KLEM**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	NO

1.3 Course curricula

Information technology
Computers, software, data, communications.
Information systems
Introduction. Basic concepts. Categories of IS. Characteristics of IS components. Management of IS. Methodology of building of IS. Decomposition diagrams. Methodology of development of programming systems. Management of IS development. Role of IS in Civil Engineering.
Databases
Basic concepts. Data models (basic general methods for data modeling, entities, attributes, keys, relations, ER model, relational model, structure of relational model, relational algebra, normalization, normal forms). Models of processes (structural analysis of system, diagram of functional decomposition, rules for forming diagrams, translation from logical to physical model). Hierarchical and network databases. SQL. Relational databases. Database management systems. Programming tools. Distributed databases. Expert systems. Basic elements of the MS-Access.

1.4 Competence

Introducing students into basic concepts of information systems and databases and prepare them for designing and creating of smaller databases.

1.5 Obligatory sources

1. Mile Pavlić: Razvoj informacijskih sustava (Development of Information Systems), Znak, Zagreb, 1996

1.6 Additional sources

1. Vjeran Strahonja, Mladen Varga, Mile Pavlić: Projektiranje informacijskih sustava (Design of Information Systems), Zavod za informatičku djelatnost Hrvatske i INA-INFO, Zagreb, 1992.
2. Velimir Srića, Mario Spremić: Informacijskom tehnologijom do poslovnog uspjeha (Business Success with Information Technology), Sinergija, Zagreb, 2000.

1.7 Exam

Exam:	Oral: Written: Yes	Seminar: Yes
Pre/Corequisites: positive evaluation of more than 75% exercises		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
1.05-106	**APPLIED NUMERICAL METHODS**	**2 + 2**	**OPTIONAL -O**	**SUMMER**	**5,00**
Lecturer:	**Ass.Prof. NINOSLAV TRUHAR**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**NO**	**YES**	**NO**

1.3 Course curricula

Introduction
Modelling of physical processes. Numerical models and approximate solutions. Sources of errors and uncertainty in numerical computation.
Numerical methods
Solution of one nonlinear equation (interval and point methods). Solution of systems of linear equations (direct methods, iterative methods). Computation of inverse matrix. Solution of large and sparse, symmetric positive definite systems of equations (the band method, the envelope method, methods of symbolic factorization, methods of implicit factorization, IFPCG method). Computation of eigenvalues and eigenvectors. Solution of systems of nonlinear equations. Numerical integration. Numerical solution of ordinary differential equations and systems of ordinary differential equations. Higher-order systems. Partial differential equations as physical models. Interpolation. Splines. Regression. Mesh generation.

1.4 Competence

To introduce students to numerical solution of problems, advantages and disadvantages of usage of computer

1.5 Obligatory sources

1. John. R. Rice: Numerical Methods, Software and Analysis, McGraw-Hill Book Company

1.6 Additional sources

1.7 Exam

Exam:	Oral: Yes Written:	Seminar: Yes
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.01-107	**RECONSTRUCTION OF HERITAGE**	**2 + 2**	**OPTIONAL -O**	**WINTER**	**5,00**
Lecturer: Ass.Prof. SANJA LONČAR-VICKOVIĆ, Architect					

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Lectures:
The origin and definition of architectural heritage. The role of heritage in cultural and national identity. Law on Protection of cultural goods. Levels of protection. A review of protected architectural entities in Croatia; Dubrovnik, Trogir, Tvrđa. Architectural heritage protection in Europe and the world; case studies. Documenting heritage; methods, standards, information technologies, examples, case studies. Typology of revival; faximil, adaptation, revitalization, restauration, reconstruction, interpolation. Cultural and architectural landscape. Rural heritage; growth and transformation og villages, rural heritage protection, case studies in Croatia and in Osijek's surroundings. Urban heritage; history of cities, urban typology, fortifications and fortified towns, examples. Managing and maintaining urban heritage in the world and in Croatia. Osijek and Tvrđa; origins, history, today's status, UNESCO list, documentation, heritage protection review, management.
Practical exercises: completing architectural documentation for a building (elements of a building) in Tvrđa.

1.4 Competence

Understanding the role of heritage in national and cultural identity, knowledge of methods of documenting and protecting architectural heritage around us.

1.5 Obligatory sources

1. Maroević, I. Sadašnjost baštine, Društvo povjesničara umjetnosti Hrvatske, Zagreb 1986.

1.6 Additional sources

1. Kastner, R.. Altbauten – Beurteilen, Bewerten, Frauenhofer IRB Verlag, Stuttgart 2000.
2. Mažuran, I. Srednjovjekovni i turski Osijek, HAZU, Zavod za Znanstveni rad u Osijeku, Osijek 1994.
3. Plan obnove i revitalizacije, Agencija za obnovu osječke Tvrđe, Osijek 2001.
4. Zbornik radova, 5th International Congress on Restoration of Architectural Heritage, Firenza 2000.
5. Zbornik radova, 2nd International Congress on Studies in Ancient Structures, Istanbul 2001.

1.7 Exam

Exam:	Oral: none	Written: none	Seminar: yes
Pre/Corequisites: none			

1.8 Quality control

During the semester students complete a research paper where they use text and graphics to present a chosen protected building in Osijek or its surroundings, implementing knowledge acquired in class and using regional approach. At the end of each lecture another student prepares short presentation of his/her paper for other students.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.01-108	**ARCHITECTURE OF INDUSTRIAL BUILDIGS**	**2 + 2**	**OPTIONAL -O**	**SUMMER**	**5,00**
Lecturer: Ass.Prof. SANJA LONČAR-VICKOVIĆ, Architect					

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Lectures:
History of industrial architecture. Industrial revolution; materials, typology, structures. Formal dictionary of industrial architecture. Workplace; definition, types, dimensions. Location of industrial zones nad buildings. External and internal traffic organization.
Types of industrial buildings. Factories; textile ad leather industry, metal production, chemical industry, food industry, construction industry, other industry types, warehouses. Buildings for road, railroad and air traffic; bus and train stations and terminals, tank stations, airports. Agricultural buildings; farms, warehouses, factories, wine cellars. Buildings for production of energy.
Practical exercises: completing a design of an industrial building

1.4 Competence

Learning basic principles of designing industrial architecture, including understanding of town planning, typolog structures and materials.

1.5 Obligatory sources

1. Neufert, E.: Elementi arhitektonskog projektiranja, Golden marketing, Zagreb 2002.

1.6 Additional sources

1. Damjanović, V.: Industrijski kompleksi i zgrade, Građevinska knjiga, Beograd 1990.

1.7 Exam

Exam:	Oral: none	Written: none	Seminar: yes
Pre/Corequisites: none			

1.8 Quality control

During the semester students complete a research paper where they use text and graphics to present a chosen type of industrial buildings, implementing knowledge acquired in class and using regional approach. At the end of each lecture another student prepares short presentation of his/her paper for other students.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-402	**TRANSPORTATION ENGINEERING**	**2 + 2**	**OPTIONAL -O**	**WINTER**	**5,00**
Lecturer: **MATE SRŠEN, Ph.D.Civ.Eng. Professor – permanent vocation**					

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Development and division of traffic. Traffic analysis and forecast. Designing criteria.
Roads: history, classification, cross-section and basic road elements, systems of modern pavement structures (types, construction materials, construction, maintenance, management), drainage.
Urban roads: introduction, vehicle types, public and individual traffic, categorisation of urban roads, design elements, free and traffic profiles, pavement structures, drainage, lightening, equipment, signalisation
Traffic at rest: urban-traffic propositions, types of parking areas and structures, characteristics and methods of areas placement and shaping, pavement structures, drainage, lightening, equipment, signalisation, parking areas for special purposes
Airports: history, types and categories of airports, airport areas, classification of airplanes and pavements, pavement surface loading, pavement structures
Railways: history, general characteristics of railways, railway track elements, upper and lower railway track structure, alignment designing, construction and maintenance, railway stations

1.4 Competence

Acquiring the knowledge of types and ways of progress of traffic, basic characteristics and details of different r types, as well as designing criteria that define them. After successfully passing the exam the students will be trained for competent designing, construction and maintenance of the above-mentioned transport infrastructure a technically correct and economically feasible way.

1.5 Obligatory sources

1. Božičević, J., Legac, I.: Roads, Zagreb, 2001
2. Sršen, M.: Road Maintenance (orig. in Croatian), Građevni godišnjak, HSGI, Zagreb, 2000
3. Babić, B., Horvat, Z.: Construction and maintenance of pavement structures, lecture notes, Zagreb, 1984
4. Horvat, Z.: Airports I (orig. in Croatian), Građevinski institut Zagreb, 1990.
5. Marušić, D.: Railway tracks, basics of design and construction (in Croatian), Sveučilište u Zagrebu, 1995.
6. Lozić, I.: Basic elements of urban roads planning and designing (orig. in Croatian), Split, 1979.

1.6 Additional sources

1. Babić, B.: Designing of pavement structures (orig. in Croatian), Zagreb, 1984.
2. Korlaet, Ž.: Introduction in road design and construction, textbook, Zagreb, 1994.
3. Sršen, M: Introduction of Modern Equipment for Assessment of Road Condition – Croatian and International Experiences (orig. in Croatian), Građevni godišnjak, HSGI, Zagreb, 1999
4. Croney, D. and P. Croney: The Design and Performance of Road Pavements, Third Edition, McGraw – Hill, New York, USA, 1998

1.7 Exam

Exam:	Oral: YES Written: YES	Seminar:
Pre/Corequisites: Passing the written exam is a precondition for taking the oral exam.		

1.8 Quality control

Via preliminary exams and seminar paper.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-403	**ROAD CONSTRUCTION AND MAINTENANCE**	**2 + 2**	**OPTIONAL -O**	**SUMMER**	**5,00**
Lecturer: **MATE SRŠEN, Ph.D.Civ.Eng.Professor – permanent vocation**					

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Introduction. Impact of construction and maintenance on the structural designing of pavement structures. Construction materials and their mixtures. Foundation soil. Selection of a road pavement construction method. Types of pavement structures: flexible, composite, rigid structure. Pavement designing catalogues. Pavement performance and damaging. Frost resistance. Road maintenance. Regular and periodical maintenance. Maintenance and repair of roads with asphalt and concrete surfacing. Pavement rehabilitation. Recycling. Street and sidewalk pavement opening and restoration rules.

1.4 Competence

The students will acquire the knowledge of construction and maintenance of roads, as well as of details on materials used for different types of pavement structures. After attending classes and passing the exam, the students will be able to analyse competently the impacts of construction and maintenance that are crucial for pavement performance under traffic.

1.5 Obligatory sources

1. Roberts, F.L., Kandhal, P.S., Brown, E.R., Lee, D-Y and Kennedy, T.W.: Hot Mix Asphalt Materials, Mixture Design, and Construction (translation from English), HSGI i IGH, Zagreb, 2003
2. Sršen, M.: Introduction of Modern Equipment for Assessment of Road Condition – Croatian and International Experiences (orig. in Croatian), Građevni godišnjak, HSGI, Zagreb, 1999
3. Sršen, M.: Road Maintenance (orig. in Croatian), Građevni godišnjak, HSGI, Zagreb, 2000

1.6 Additional sources

1. Straube, E. und H. Beckedahl: Strassenbau und Strassenerhaltung, 4. neubearbeitete Auflage, Berlin, 1997
2. Schweizer Norm, Beilage, SN 640 925: Schadenkatalog, Zürich, 1991
3. Babić, B. i Z. Horvat: Construction and Maintenance of Pavement Structures (orig. in Croatian), Faculty of Civil Engineering of Zagreb University, 1984

1.7 Exam

Exam:	Oral: YES Written: YES	Seminar: elaborated
Pre/Corequisites: Passing the written exam is a precondition for taking the oral exam.		

1.8 Quality control

Via preliminary exams and seminar paper.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-214	**BRIDGES II**	**2 + 2**	**OPTIONAL -K**	**SUMMER**	**4,00**

Lecturer:	**Collaborators:**
Prof. ZVONIMIR MARIC	**Ph.D. DAMIR VAREVAC**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Interaction of building procedure and bearing system of the bridge. Bridges inclined in plan view and curved bridges. Optimum shape of the bridge arch axis. Measure of the optimum flatness at the concrete fixed arch. Building procedures of the concrete arch bridges. Parallel building of the arch and pavement system. Bridges building procedures without fixed scaffoldings. Making a structure composites of the prefabricated parts and parts made in situ at the pavement system. Static system changes during building process. Bridges forming in demanding environment. Bridges in the areas of strong seismic activity. Durability of bridges. Bridges management-maintenance and repairs. Application of high permormance concrete in bridges building and repairs. Application of external prestressing in bridges building and repairs. Design and building guidelines for concrete bridges.

1.4 Competence

This course gives a wider and deeper insight into material which is necesary to overview this area of structural activity, so that after a short participation in design projects students will be able to indenpendently design bridges of medium comlexity.

1.5 Obligatory literature

1. Radić, J. Mostovi, Zagreb, 2003.
2. Radić, J. Pontifex maximus. Zagreb, 2003.
3. Tonković, K.: Mostovi, Zagreb, 1983.
4. Tonković, K. Masivni mostovi, Zagreb, 1985.
5. Tonković, K.: Oblikovanje mostova, Zagreb, 1987.
6. Leonhardt, F.: Vorlesungen über Massivbau, Sechster Teil, Springer Verlag, München, 1990.
7. Leonhardt, F.: Brücken - Ästhetik und Gestaltung. Deutsche Verlags-Anstalt, Stuttgart, 1984.

1.6 Additional literature

1. Aničić, D.: Prednapeti beton.Skripta za studente Građevinskog fakulteta u Osijeku, Osijek, 2003. (interno)
2. Leonhardt, F.: Prednapregnuti beton u praksi. Građevinska knjiga, Beograd, 1965.

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

Quality analisys in making and presenting of seminars.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-215	**MASONRY STRUCTURES II**	**2 + 2**	**OPTIONAL -K**	**WINTER**	**5,00**
Lecturer:	**Prof. STJEPAN TAKAČ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Wall elements as architectural elements
Innovative wall elements and mortars
Prefabricated masonry structures
Reinforcement and prestressing of walls
Cellular concrete walls
Permanent, temporary and nonregular actions on masonry structures
Fire resistance
Durability of masonry structures

1.4 Purpose of the course

To extend the level of students' knowledge (according to the educational level of the students), to inform students about the specific topics of the masonry structures (scientific-research work).

1.5 Obligatory sources

1. Takač, S: "Zidane konstrukcije", Sveučilišni udžbenik Sveučilišta J. J. Strossmayera u Osijeku, Osijek 2000. ISBN 953-96691-8-9

Untersuchungsbericht des Pruf-und Forschungsinstitut der Schweizerichen Ziegelindustrie Sursee, Biegeversuche an bewertem Backsteinmauerwerk, 1992 – 1995.

1.6 Additional sources

1. Z. Sorić, Zidane konstrukcije, Hrvatski savez građevinskih inženjera, Zagreb, 1999.
2. Furler, Tragverhalten von Mauerwerkswanden unter Druk und Biegung, Institut fur Baustatik und Konstruktion, ETH Zurich, Bericht Nr. 100, Birkhauser Verlag Basel, 1981

3. Gugisberg R., Versuche zum Tragverhalten qerbelasteter Mauerwerkswande, Institut fur Baustatik und Konstruktion, ETH Zurich, Birkhauser Verlag Basel, 1990.

1.7 Exam

Exam:	Oral: yes	Written:	Seminar: yes
Pre/Corequisites:			

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-216	**COMPOSITE STRUCTURES**	**2 + 2**	**OPTIONAL-K**	**WINTER**	**5,00**

Lecturer: **Ass. prof. DAMIR MARKULAK**	**Collaborators:** **TIHOMIR ŠTEFIĆ, B. Sc. In Civ. Eng.**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Definitions and special terms in treatment of the composite structures. Scope of Eurocode 4 for design of composite structures and members. Material properties required for design calculations. Fundamental requirements and assumptions for design procedure of composite structures. Characteristic types of composite members for buildings, manners for providing of composite action. Composite beams – initial design, basis of design, verifications, ultimate limit states - elastic and plastic resistance of the composite cross-section, serviceability limit states –calculation of deflections. Shear connection – types of connection, resistance of shear connectors. Composite columns – design assumptions, types of columns, resistance of the cross-section, resistance of members. Composite slabs-initial slab design, construction conditions, composite action, basis of design, deflections. Composite connections-general, classification, beam-to-column connection. Fire resistance of composite members.

1.4 Competence

Composite structures are specific form of connecting the same or different materials in the unique member. Scientific and proffesional research are still actual, and purpose of the course is introduction to design and deta of steel-concrete composite structures.

1.5 Obligatory sources

1. D. Horvatić: Spregnute konstrukcije čelik-beton, Masmedia d.o.o., Zagreb, 2003.g.
2. Interna skripta : Uvod u spregnute konstrukcije – Spregnuti nosači čelik-beton, Građevinski fakultet Sveučilišta J.J. Strossmayera, Osijek, 2002.g.
3. Markulak, D.: Čelične konstrukcije, dio II, Interna skripta, GF Osijek, Osijek 2004., str. 200

1.6 Additional sources

1. ENV 1994-1-1:1992: Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings
2. R. P. Johnson: Composite structures of Steel and Concrete, Vol. 1., Collins London, 1986
3. R. P. Johnson: Composite structures of Steel and Concrete, Vol. 2., Bridges, Collins London, 1986
4. ECCS – Technical Committee 11, the Group Authors: Design of Composite Joints for Buildings, First Edition, ECCS Publications No. 109, Brusseles 1999.
5. ECCS – Technical Committee 11, the Group Authors : Composite beams and columns to Eurocode 4, Composite structures, First edition 1993.

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar: Yes
Pre/Corequisites: Attendance to lectures and exercise, positive Semestral project, positive exam in Steel structures II and Concrete structures.		

1.8 Quality control

Semestral project is divided into different phases, and students need to work on project continually during semester. Attendance to lectures and exercise will be also monitoring.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-217	**STRUCTURE MODELLING**	**2 + 2**	**OPTIONAL -K**	**SUMMER**	**5,00**
Lecturer:	**Prof. DRAGAN MORIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Types of structures. 1D elements, 2D elements, 3 D elements
Equilibrium and compatibility conditions in discretions points.
Final element theory
Numbers of freedom. Condensation of freedom. SDOF model, 2D model, Story model
Coordinate systems
Joints.: coordinates, level of freedom. Labels, Arrays and Generation.Master-Slave conection
Material behaviour (linear, elastic – non-linear, non-elastic)
Types of final elements: beam, column, shall, plate, solid, nllink, spring
Loads: concetrate force, uniform load, pressure load, spectum, time histories
Static and dynamic analysis. P-delta analysis, Earthquake analysis
Loads combinations
Results. Control of results, Interpretation of results

1.4 Competence

Knowing of structure modelling and using of comertial engineering programs for structural analysis. Students w use that skill during its study in research program and its theses and will be ready to use it when reach gratuac degree.

1.5 Obligatory sources

1. Wilson: Three dimensional static and dynamic finite element analysis and design of structures, University Berleley , California, USA., pgs 413, 2000.

1.6 Additional sources

1. Manuals of engineering programs (..SAP, Robot, Tower…)

1.7 Exam

Exam*:*	Oral: yes Written: no	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

Practical exercises and seminar solving engineering problem with one of existing programs

Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-218	**ANALYSIS OF STRUCTURE STREE AND BEARING CAPACITY**	**2 + 2**	**OPTIONAL-K**	**WINTER**	**5,00**
Lecturer: **Prof. VLADIMIR SIGMUND**		**Collaborators:** **Ass.Prof. MIRJANA BOŠNJAK-KLEČINA**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Review of fundamentals in stress-strain, engineering materials, concepts of the theory of elasticity, Airy stress function, Prandtl's stress function for torsion, advanced mechanics of materials, energy techniques in stress analysis, strength, failure modes and design consideration, fracture mechanics, fatigue analysis, structural stability, inelastic behavior, engineering approximations.

1.4 Competence

Overall insight in the advanced strength and applied stress analysis.

1.5 Obligatory sources

1. Alfirević, I., Linearna analiza konstrukcija, FSB, Zagreb 1999.
2. Kostrenčić , Z.: Teorija elastičnosti, -Školska knjiga, Zagreb, 1982.

1.6 Additional sources

1. R.G.Budynas, Advanced strength and applied stress analysis, McGraw-Hill IE, 1999.
2. A.C.Ugural, Stresses in plates and shells, McGraw-Hill WCB, 1999. (3) Alfirević, I., Nauka o čvrstoći I,

1.7 Exam

Exam: yes	Oral: yes	Written: no	Seminar: yes
Pre/Corequisites: Continuum mechanics I and II			

1.8 Quality control

Seminar

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-219	**ROCK MECHANICS**	**2 + 2**	**OPTIONAL -K**	**SUMMER**	**5,00**

Lecturer:	**Collaborators:**
Prof. MENSUR MULABDIĆ	**KRUNOSLAV MINAŽEK, B.Sc. in Civ.Eng.** **DEJAN MRAČKOVSKI, B.Sc. in Civ.Eng.**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**NO**	**NO**	**YES**

1.3 Course curricula

Introductory lecture, development of profession, problems and achievements - Basic properties of rocks, classification - Testing of rocks in laboratory - Testing of rocks in situ - Mechanical properties of rocks - Slope stability in rocks – Underground work, types, execution - Stabilisation of tunnel excavation - Anchors in rocks – Foundation in rocks - Measurements and instrumentation of work in rocks

1.4 Competence

Introduce geoechnical activities in rock materials, type and way of rock stress-strain behaviour analyses, technology, safety and control of work

1.5 Obligatory literature

1. P.Miščević : Uvod u inženjersku mehaniku stijena, Građevinski fakultet Sveučilišta u Splitu, 2004.
2. Prof. E.Nonveiller (1981.): Mehanika tla i temeljenje, Školska knjiga
3. M.Mulabdić: Notes for Lectures

1.6 Additional literature

1. Hudson, J.A.: Rock Mechanics Principles in Engineering Practice, CIRIA, 1989

1.7 Exam

Exam:	Oral: Yes Written: No	Seminar: Yes
Pre/Corequisites: soil mechanics		

1.8 Quality control

tests, small size working examples

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
5.01-103	**MARKETING**	**2 + 2**	**OPTIONAL -OTM**	**WINTER**	**5,00**
Lecturer: **Asc.Prof.ZLATKO LACKOVIĆ**		**Collaborators:** **Prof.BARBARA MEDANIĆ**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**NO**	**NO**	**YES**

1.3 Course curricula

Introduction in marketing. Analysis of surrounding of construction firms. Market of construction products and services. Research of buyers and trade segmentation. Determination of elements of marketing mix. Organization of marketing and marketing strategy.
Seminar work: Analysis of marketing surrounding, Research of market, Definition od market segments, Analysis of elements of marketing mix, Organization of marketing, Marketing plan, Example of electronical business in marketing.

1.4 Competence

Discovering and implementation of marketing in civil engineering. Determination of trends in marketing activities. Analyses and determination of elements of maketing mix. Organization,ethics and culture in marketing.

1.5 Obligatory sources

1. Karpati,T.,Transparentnost tržišta marketing etikka,HAZU,Osijek,1992.
2. Kotler, P., Upravljanje marketingom 1, Prijevod, Informator, Zagreb, 1988.
3. Marušić, M., Vranešević, T., Istraživanje tržišta, ADECO, Zagreb, 2001.
4. Marhold,K.,Bau-Marketing-Management,DVP-Verlag,Wuppertal,1992
5. Lacković,Z.,Marketing u građevinarstvu,Građevinski fakultet,Osijek,2005

1.6 Additional sources

1. Medanić,B.,Management u građevinarstvu,Građevinski fakultet,Osijek,1996.
2. Rocco, F., Marketinško upravljanje, Školska knjiga, Zagreb, 2000.
3. Senečić, J., Osnove marketinga, Mikrorad, Zagreb, 2002.

1.7 Exam

Exam:	Oral: yes Written: no	Seminar: yes
Pre/Corequisites: Made and positively marked seminar work		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.15-116	**INDUSTRIALIZED CONSTRUCTION**	**2 + 2**	**OPTIONAL -OTM**	**WINTER**	**5,00**
Lecturer:	**Prof.PETAR BRANA**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

The principles of industrial construction (the industrialization process, basic problems of industrial construction, Technical and economic relations of industrial construction).
Construction site prefabrication (Basic construction site production for bearing structures, Large paneling and tunnel paneling, sliding paneling, pneumatic paneling).
Construction with prefabricated elements (open and closed mounting systems, Construction examples in a sys with components and semi-products, modular basics and geometrical principles for projecting assembled objec
Transport procedures and problems of assembled construction. The principles of construction assembling and disassembling parts made of reinforced concrete. A proposal for standardizing construction elements in a prefabricated system (Columns, Panels, Stairways, Foundations, Paths, Beams)
Production of final parts (Construction site and factory). Measurements and tolerance. Links between elements (Budget principles and dimensions for various phases of production and exploitation, Distributing links, Selecting links, Treating elements in the junction zone, protecting junctions, props).
Typical assembled buildings (Production installations, Garage, Agricultural objects, Warehouses, Bridges, Apartments and High rise business towers).

1.4 Competence

Introduce the students with the possibilities and advantages of using industrially manufactured elements for construction.

1.5 Obligatory sources

1. T. Koncz, Handbuch der Fertigteil -Bauweise, Bauverlag, Berlin, 1986.
2. K. S. Elliott, Precast Concrete Structures, Butterworth Heinemann, Oxford, 2002

1.6 Additional sources

1. S. Rex, Industrijski način građenja I i II dio, GF Zagreb, 1983.
2. B. Kotulla, M. Gropp, Industrielles Bauen, Expert verlag, Renningen, 1994.

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar:
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
5.01-104	**FINANCIAL MANAGEMENT**	**2 + 2**	**OPTIONAL -OTM**	**SUMMER**	**5,00**
Lecturer: **Ph.D.BARBARA MEDANIĆ**		**Collaborators:** **Ph.D. KSENIJA ČULO**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Idea and tasks of the modern financial management.
Financial decision making.
Kinds of financial decisions - about investing, about financing, about stock.
Likvidity.
Internal and external rentability.
Time value of the short term and long term capital of the construction business firm.
Reinvesting retained profit and the other profit resources.
Investment to securities.
Credit acquiring anr returning.
Capital costs.

1.4 Competence

The goals of the course are: to give to students knowledge about of importance of the manifestation capital for in the construction business; to give feeling for input and output resource dynamics; to give sense for money ti value in the financial decision making.

1.5 Obligatory sources

1. Medanić, B.; Pšunder,I.; Skendrović,V.; Some financing aspects in construction, Faculty of Civil Engineering, Osijek, 2005
2. Van Horne,J.C.; Financial Management and politics, MATE., Zagreb, 1997

1.6 Additional sources

1. Salvatore, D.; Economy for Managers, MATE, Zagreb, 1989.
2. Čirović, G.;Luković, O.; Financial Business and Investments in Construction, Beograd, 2004.

1.7 Exam

Exam:	Oral: Yes Written: No	Seminar: Yes
Pre/Corequisites: passed exam Engineering Economy and Management		

1.8 Quality control

Analysis of the individual seminar papers, level of the students' activities on the practical and experimental exercises, analysis students' polling results about course quality.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.15-117	**TOTAL QUALITY MANAGEMENT**	**2 + 2**	**OPTIONAL -OTM**	**WINTER**	**5,00**
Lecturer: **Prof. KSENIJA ČULO**		**Collaborators:** **M.Sc.ZLATA DOLAČEK**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Completely access to managing quality of the construction production, processes and business.
Importance of quality product and process, their relation towards the other business competitiveness elements.
Assets and procedures of managing quality.
Baldridge model – description quality through buyers' satisfaction by construction products and services.
Implementation buyers' attitudes in stategy of global quality management.
Quality as strategy and its' substantially defining.
Measuring quality, quality function.
Methodology of stimulating and of implementation management changes.
Trening of employees in organization,managing by quality, programming of experiments and theirs execution.
Tacugen method.
Reingeneering and TQM.
Competitive engineering.
Role of the informatical technologies.

1.4 Competence

In this course students are introducing by main tasks of market competitiveness – QUALITY and its' importanc Quality has direct impact to business effectiveness. In the lectures there are main ideas and professional examples, during the exercises and seminars students are tought about adequately technics according to real professional problems. Target is to learn importance of sentence: "Do it only once, but do it correct!"

1.5 Obligatory sources

1. Crosby, P.: Quality is free, Privredni vjesnik / Binoza press, Zagreb, 1996
2. HRN EN ISO 9001:2002 Quality Management Systems
3. HRN EN ISO 9004:2003 Quality Management Systems

1.6 Additional sources

1. Beckford, J.: Quality, Routledge, London, 2002
2. Juran, J; Godfrey, B.: Juran's Quality Handbook, 5th Edition, McGraw-Hill, New York, 1999
3. McCabe, S.: Quality Improvement Techniques in Construction, Addison Wesley Longman Limited, Harlow, Essex, 1998

1.7 Exam

Exam:	Oral: Yes Written: No	Seminar: Yes
Pre/Corequisites: course presence		

1.8 Quality control

During seminars students have to write one seminar paper. Final evaluation is formed on the base of quality seminar paper and oral exam.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.15-118	**MAINTENANCE MANAGEMENT**	**2 + 2**	**OPTIONAL -OTM**	**SUMMER**	**5,00**
Nastavnik:	**Ass.Prof.SAŠA MARENJAK**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**NO**	**YES**	**NO**

1.3 Course curricula

Legislation in maintenance management Maintenance costs. Defects, diagnosis and methods of inspections. Causes of defects. Life cycles of construction materials and elements. Maintenance management planning, resources, technology and costsImportance of design and construction fase in maintenance management. Ways of defining optimal strategies in maintenance. Maintenance of buildings, and civil engineering structures. Importance of integrated logistic support in maintenance..

1.4 Competence

The objective of the course is to equip the students with the importance of maintenance management, definitio optimal strategies in maintenance, and optimal maintenance cost solutions.

1.5 Obligatory sources

1. Lee, R., Building Maintenance Management, Blackwell Science Ltd,Oxford, 1987.

1.6 Additional sources

1. Spedding, A., Management of Maintenance - The Need for and Uses of Data, Building Maintenance Economics and Management, E & FN Spon, London, 1987.

1.7 Exam

Exam:	Oral: Yes Written: Yes	Seminar: no
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-312	**WATER CONDITIONING**	**2 + 2**	**OPTIONAL -H**	**SUMMER**	**5,00**
Lecturer: **Ass.Prof.LIDIJA TADIĆ**		**Collaborators:** **M.Sc.TATJANA MIJUŠKOVIĆ-SVETINOVIĆ**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Water as a part of environment. Physical, chemical and biological characteristics of water quality. Drinking water quality standards, regulations, and goals. Health and aesthetic aspects of water quality. Water quality management. Different use of water and water treatment process selection. Synopsis of water treatment processes – conventional and advanced water treatment processes. Air Stripping and Aeration. Coagulation and Flocculation. Sedimentation and Flotation. Filtration. Water softening. Ion Exchange and Inorganic Adsorption. Iron and manganese remove. Chemical Precipitation. Membranes. Chemical Oxidation. Adsorption of Organic Compounds. Disinfection. Water Fluoridation. Internal Corrosion and Deposition Control. Water Treatment Plant Residuals Management. Municipal water treatment plant: structures, functional and hydraulic design of unit processes, wastewater from facilities, satellite objects, plant lay-out, disposition of the process objects and equipment. Microbiological Quality Control in Distribution Systems.

1.4 Competence

Learn to characterize a raw water based on its source. Introduce conventional water treatment processes. Undestand the principles, practices and learn basic design criteria of conventional water treatment system for t removal of turbidity, pathogenic bacteria, dissolved organic matter, iron, manganese, hardness and total dissol solids. Become familiar with the principles and practices the minimization of THM production, flouridation and corrosion control. Introduce new advanced water treatment processes. Introduce principles and practice wastewater treatment on the specific project and drinking water treatment plant.

1.5 Obligatory sources

1. Gulić, I.: Kondicioniranje voda, HSGI, Zagreb, 2003.

1.6 Additional sources

1. Water Quality & Treatment. A handbook of Community Water Supplies, (5th Edition), McGraw- Hill Book Company, London, 1999.
2. Steel, E. W., Mc Ghee T. J.: Water Supply and Sewerage, (6th Edition), Mc Graw Hill Book Company, London, 1991.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: yes
Pre/Corequisites: Hydrology, Hydromechanic, Water Supply and Sewerage		

1.8 Quality control

Midterm exam, seminary work

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-313	**HYDROLOGY II**	**2 + 2**	**OPTIONAL -H**	**SUMMER**	**5,00**
Lecturer:	**Asc.Prof.Vladimir PATRČEVIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Ground water and subsurface discharge. Underground and surface water relationship, infiltration, capillarity, evaporation, factors of the vertical water balances of ground water. The measuring method and measuring technique in subsurface hydrology. Formation hydrograph of the natural watershed. Baseflow separation methods. Conception of the effective precipitation. Parametric hydrology, meaning, methods and applications. Method SCS, unit hydrograph, Rational method, Izohron method. The mathematical modelling of hydrological processes. Regulation of discharge, accumulation and natural retention. Erosion processes. Suspended sediment transport and deposit in rivers. Methods and instruments for the measurement of flow of deposit. Processing of empiric data and applications.

1.4 Competence

Getting to know of hydrological processes, which are influential on the change quantity ground water. Getting t know of problem erosion and sedimentation. Use parametric hydrology.

1.5 Obligatory sources

1. Srebrenović D.: Primjenjena hidrologija, Tehnička knjiga, Zagreb, 1986.

1.6 Additional sources

1. Srebrenović D.: Problemi velikih voda, Tehnička knjiga , Zagreb, 1986

1.7 Exam

Exam:	Oral: Written:	Seminar: **yes**
Pre/Corequisites:		

1.8 Quality control

Programs and partial seminary thesis

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-314	**TORRENT CONTROL**	**2 + 2**	**OPTIONAL -H**	**SUMMER**	**5,00**
Lecturer:	**Asc.Prof. VLADIMIR PATRČEVIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Factors of erosion processes in river catchments; Categorisation of erosion; Technical activity for protection of land surfaces; Torrent watercourses – parts, parameters; Defining discharge of torrential flow; Regulation torrent channel; Torrent division – lodgemental, consolidational, retardational); Regulation torrent structures – thresholds, water stairs, cascades, consolidation zones (strips); Systems for regulation torrent catchments;

1.4 Competence

Indication of erosion processes and induced problems. Introduction to determination of water erosion paramet protection measures and techniques and torrent control building. Problems identification and analysis of releva treatments and building application regarding erosion protection, especially protection on torrent stream.

1.5 Obligatory sources

1. Svetličić, E., Otvoreni vodotoci - regulacije, udžbenik, Fakultet građevinskih znanosti Zagreb, Zagreb, 1987
2. Vuković, Ž.: Osnove hidrotehnike, Prvi dio, druga knjiga, Akvamarine, Zagreb, 1995.

1.6 Additional sources

1. Tehničar – građevinski priručnik – 6, Građevinska knjiga, Beograd, 1989.
2. Gavrilović, S.: Inženjering o bujičnim tokovima i eroziji; »Izgradnja« posebni izdanje, Beograd, 1972.

1.7 Exam

Exam:	Oral: Written:	Seminar:
Pre/Corequisites:		

1.8 Quality control

Analyses: seminary works, case study of some torrent regulation structures.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
2.05-315	**HYDROTECHNICAL MODELING**	**2 + 2**	**OPTIONAL -H**	**WINTER**	**5,00**
Lecturer:	**Asc. Prof. LIDIJA TADIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Introduction to hydrotechnical modeling
Scenarios
Hydrological models
Modeling in fluid mechanics
Testing and calibration
Modeling of water distribution system
Modeling of urban drainage
Open channel modeling
Groundwater modeling
Environmental models

1.4 Competence

Synthesis of gained knowledge from hydraulic engineering and information technology and its application in th process of hydrologic, hydraulic and environmental modelling

1.5 Obligatory sources

1. Walski,T.M,Barnard,T.E,Durrans,S.R.Meadows,M.E.(2002):Computer Applications in Hydraulic Enineering-Theory and Practice
2. Jović,V.(1993).Uvod u inženjersko modeliranje

1.6 Additional sources

1. Walski,T.M,Chase,D.V,Savic,D.A.(2001):Water Distribution Modeling
2. Durrans,S.R. (2003):Stormwater Conveyance Modeling and Design
3. Dyhouse G.R.(2003):Floodplain Modeling Using HEC-RAS

1.7 Exam

Exam:	Oral: yes Written:	Seminar: yes
Pre/Corequisites:		

1.8 Quality control

Individual case study

Differentiated year

Differentiated year is a prerequisite for entering Graduate University Degree Studies for students with Bachelor degrees aquired after finishing professional studies.

	I SEMESTER		**Hours a week**		**ECTS credits**
	Course	Lecturer	Lectures	Practices	
1	Mathematics	Ass.Prof. NINOSLAV TRUHAR	4	4	**10**
2	Physics	Ph.D. JOSIP BRANA	3	1	**5**
3	Descriptive Geometry	M.Sc.Stipančić-KLAIĆ IVANKA	2	2	**5**
4	Mechanics	Ass.Prof. ALEKSANDAR JURIĆ	3	2	**6**
5	Construction Materials	Ass.Prof. MIROSLAV MIKOČ	2	1	**4**
	total of all courses		14	10	**30**

	II semester		**Hours a week**		**ECTS credits**
	Course	Lecturer	Lectures	Practices	
6	Structural Analysis	Ass.Prof. SILVA LOZANČIĆ	3	3	**6**
7	Strenght of Materials	Ass.Prof. MIRJANA BOŠNJAK-KLEČINA	3	2	**6**
8	Fluid Mechanics	Ass.Prof. LIDIJA TADIĆ	3	2	**6**
9	Concrete Structures	Asc.Prof. DRAGAN MORIĆ	3	2	**6**
10	Timber and Metal Structures	Asc.Prof. STJEPAN TAKAČ Ass.Prof. DAMIR MARKULAK	3	2	**6**
	total of all courses		15	11	**30**

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	MATHEMATICS	**4 + 4**	**DIFFERENCE**	**I**	**10,00**
Lecturer:	**Ass. Prof. NINOSLAV TRUHAR**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

Sets in R^n and metrix. The basic concept of multivariable function. Sketch the graph of a function of two variables. Series in R^n. Limits and the concept of continuity of a multivariable function. Partial derivative and concept of differentiability higher-order partial derivatives of a function of two or three variables. Schwartz's theorem. Jacobian. The Chain Rules for functions of several variables. Lagrange's mean value theorem. equations of tangent planes and normal lines to surfaces. Taylor's mean value theorem. Taylor's series. The absolute and relative extrema of a function of several variables. Polar, cylindric and spherical coordinate system.
Multiple integration: Double and triple integral. Evaluation of double and triple integral using substition. Application of double and triple integrals. Derivation under integral.
Space curves and line integral: The basic concept of vector-valued function. Curves. Line integral. Mass and lenght of the curve. Green's Theorem. Orientation of curves. Work. Surface integral. Parametric equation of curves. Curvature and torsion. Frenet frame field.
Scalar and vector field: Gradient of the scalar field. Directional derivatives for scalar and vector fields. Divergence and curl of a vector field. Conservative fields.Surface integrals: Definition of a parametric surface. Definition of a surface integral. Surface integral for a parametric surface. Orientation of a surface. The concept of a flux integral. The Divergence Theorem to calculate flux. Stoke's Theorem. Boundary problems: Initial and boundary conditions. Kinematic (Dirichletov, geometric, the first) boundary condition. Dynamic (Neumann, natural, the second) boundary condition. Initial condition. Linearity: homogenisation of boundary conditions. Uniqueness of the solution. Koncentrirano djelovanje. Greenova funkcija. Računanje Green's function. Solving the boundery problem using Green's function.
Fourier's method: Eigenfunctions and eigenvalues. Fourier's series, convergence. Even and odd functions. Free oscillations. Interpretation of solution. Homogenization of the boundary conditions. Forced oscillations. heat transfer trouth beam. Varition princip. Exact solution. Varition calculus.

1.4 Competence

To inform students about the fundamentals of integral calculus for one variable functions. The basic results of the vector analysis and their application at calculating volumes and surface areas will be analysed as well.

1.5 Obligatory sources

1. S. Suljagić, Matematika 3, Građevinski fakultet,Zagreb,
2. R. Scitovski, Numerička matematika, Odjel za matematiku, Elektrotehnički fakultet, Osijek, 2000.
3. S. Kurepa, Matematička analiza 2, Tehnička knjiga, Zagreb, 1990.
4. G. Strang, Applied Mathematics and Engineeering Mathematics-Course Outline, http://www-math.mit.edu/.

1.6 Additional sources

1. McGraw-Hil, Schaum`s outline series, New York, 1991.

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar: no
Pre/Corequisites:		

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	PHYSICS	**3 + 1**	**DIFFERENCE**	**I**	**5,00**
Lecturer:	**Ph.D. JOSIP BRANA**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

Introduction and system of units. Vectors. Motion in one dimension. Motion in two dimensions. Newton`s law of motion. Applications of Newton`s laws of physics. Newton`s law of universal gravitation. Work, energy and power. Conservation of energy. Momentum and the motion of systems. Momentum conservation law. Collisions. Static equilibrium of a rigid body. Torque about fixed axis. Rotation and translation. Rotational kinetic energy. Moment of inertia. Angular momentum. Rotational dynamics. Rotational work for a rigid body. Conservation of angular momentum. Oscillations. Solids and fluids.
Temperature and heat transfer. Heat conduction law and heat conduction material properties. Properties of solids and fluids to up warming. State equation of an ideal gas. Specific heat and latent heat. Work. First and second law of thermodynamics and applications.
Electric charges, Coulomb`s law and electric field. Potential energy of a charge in electric field, electric potential and voltage. Units. Capacitance, and properties of insulators. Current and resistance in DC circuits. Instruments for voltage and current measurements. Ohm's law. Energy and power of DC current. Batteries and currents in electrolytes. Magnetic field and sources of magnetic fields. Biot and Savart's law. Faraday's law and inductance. Magnetic field in matter. Units. AC generators. Properties of AC – power.
Harmonic and unharmonic waves. Mathematical description and characteristics. Power of waves. Interference and diffraction of harmonic waves. Acoustic waves in different media. Sources of a sound. Sound intensity. Interference of acoustic waves. Doppler's effect.
Basic laws of geometrical optics. Mirrors and lenses. Lasers. Basics of photometry.

1.4 Competence

1.5 Obligatory sources

1. Nikola Cindro; Fizika I, II, „Školska knjiga“, Zagreb, 1991.

1.6 Additional sources

1. Frederick J. Keller, Edward W. Gettys, Malcolm J. Scove, PHYSICS, Mc Graw-Hill

1.7 Exam

Exam:	Oral: yes	Written: yes	Seminar: no
Pre/Corequisites:			

1.8 Quality control

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	DESCRIPTIVE GEOMETRY	**2 + 2**	**DIFFERENCE**	**I**	**5,00**
Lecturer:	**M.Sc.IVANKA STIPANČIĆ-KLAIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**NO**

1.3 Course curricula

The task of Descriptive Geometry. The basic geometrical constructions.The basic geometrical curves and their construction. The perspective affinity and collineation.
Monge's method of projections: orthogonal projections onto the pair of planes the laws of the projections. The basic geometrical elements: the point, line, plane and their relationships. The projection of 2-dim (planar) contents, the general and special relationships (the parallelism and orthogonality) between them, the metrics. The additional projections, the rotation of plane, the valid laws, the projections of 2-dim (planar) objects. The basic 3-dim relationships, the problems in space, the projections of 3-dim objects.
The general parallel projection, the valid laws. The axonometric (3-D) projections of objects.
The planar intersections of some surfaces.
The use of computer support graphics is included in all sequences.

1.4 Competence

At the end of the course a student is expected to meet and to know a graphical communication between 3-dimensional space objects and their presentation on 2-dim spaces (and vice versa). Those competences are learned across the different methods of projections which are used in civil engineering. The basic quality of this knowledge is in use of laws which are valid in some methods of projection.

1.5 Obligatory sources

1. Babić, S. Gorjanc, A. Slijepčević, V. Szirovicza: Nacrtna Geometrija-zadaci, HDKGIKG, Zagreb, 2002.
2. V. Niče: Deskriptivna geometrija, Školska knjiga, Zagreb 1992.

1.6 Additional sources

1. K. Horvatić-Baldasar, I. Babić: Nacrtna geometrija SAND d.o.o., Zagreb, 1997.
2. Z. Kurnik, D. Palman, B. Pavković: Zadaci iz nacrtne geometrije-Mongeova projekcija,Tehnička knjiga, Zagreb,1973.

web-sites: www.hdgg.hr , www.grad.hr/nastava/geometrija and every other book or web site in all world's languages

1.7 Exam

Exam:	Oral: yes	Written: yes (eliminatory)	Seminar: no
Pre/Corequisites: No prerequisites			

1.8 Quality control

Four programs

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	MECHANICS	**3 + 2**	**DIFFERENCE**	**I**	**6,00**
Lecturer: **Ass.Prof.ALEKSANDAR JURIĆ**		**Collaborators:** **M.Sc.ĐURĐICA MATOŠEVIĆ**			

1.2 Instructional format

Lectures	Practical exercises	Eksperimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Content

Analytic equilibrium conditions. Elements of graphic-static for plane force system. Analytic and graphic determination position of centre of gravity. Equilibrium of rigid bodies, mechanical systems, simple structures and loads. Internal forces in members and the diagrams. Statically determinate plane trusses. Forces in cables. Work. Method of virtual work. Kinematics of particles. Kinematcs of rigid bodies. Kinetics of particles. Kinetics of system of particles. Kinetics of rigid bodies. Impact. Vibration and time response. Free response. Introducion into vibration of a beams a concentrated mass.

1.4 Competence

The purpose of the study of mechanics is to learn basic principles und methods for solution kinematics and kin probems.

1.5 Obligatory sources

1. Kiričenko A.:Mehanika I, Tehnička knjiga zagreb,1990.
2. Tehnička mehanika II – kinematika, A. Kiričenko, FGZ Zagreb, 1984.;
3. Tehnička mehanika III – dinamika, A. Kiričenko, PBI,d.o.o. Zagreb, 1996.

1.6 Additional sources

1. matejiček F., Semenski D., Vnučec Z.: Uvod u statiku s zbirkom zadataka ,Golden Marketing, Zagreb, 1999.
2. Beer F.,Johnston R,:Statics, Mc Graw-Hill New York, 1998.
3. Beer F., Johnston R.: Problems Supplement to Accompany Vector Mechanics for Engineers, Statics;MvGraw-Hill, New york, 1992.
4. Dynamics - F.P. Beer, E.R. Johnston, Jr., McGraw-Hill Publishing Company, New York, 1988.;
5. Dynamics - J.L. Meriam, John Wiley & Sons, Inc., New York, 1975.;
6. Statics and Dynamics - A. Ruina, R. Pratap, Oxford University Press, 2002.

1.7 Exam

Exam:	Oral:yes	Written: yes	Seminar: yes
Pre/Coreguisites:			

1.8 Quality control

Assessment of knowledge is carried out in the semester by two colloquia and seminar.

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	CONSTRUCTION MATERIALS	**2 + 1**	**DIFFERENCE**	**I**	**4,00**
Lecturer: **Ass.Prof.MIROSLAV MIKOČ**		**Collaborators:** **IVANKA NETINGER, B.Sc. in Civil Engineering**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Distributes building materials. Physical, physical-mechanical and chemical features of building materials. Quality Control. Norms. Stability of building materials. Stone. Wood. Ceramics. Glass. Metals. Polymers. Needleworks. Colours and lacquers Glues. Cement. Cements general property. Cements special property. Cement quality control. Concrete aggregate. Aggregates quality control. Water to concrete preparation. Concrete. Properties of Fresh Concrete. Hardenend Concrete. Influence moisture and temperature on concrete. Concrete quality controly. Aditives. Concrete Manufaturing. Concretes special property.

1.4 Competence

Introduce Students with Production, Characteristics properties and Testing, how would could executive correct Selection Building Materials at Building Construction

1.5 Obligatory sources

1. Ukrainczyk, V.; Poznavanje gradiva, Alkor, Zagreb, 2001.
2. Krstulović, P.; Svojstva i tehnologija betona, Građevinski fakultet Sveučilišta u Splitu, Split, 2000.
3. Ukrainczyk, V.; Bjegović D.; Mikulić D.; Rak, Z.; Poznavanje gradiva, auditorne vježbe, praktikum, aktivna nastava, Građevinski fakultet, Sveučilišta u Zagrebu, Zagreb, 1994

1.6 Additional sources

1. Ukrainczyk, V.; Beton, Alkor, Zagreb, 1994.
2. Beslać, J. Materijali u arhitekturi i građevinarstvu, Školska knjiga, Zagreb, 1989.
3. Ghosh, N.; Cement and Concrete Science Technology Vol – 1, Part – I, New Delhi, 1991.
4. Đureković, A.; Cement, cementni kompozit i dodaci za beton, Školska knjiga, Zagreb, 1996.

1.7 Exam

Exam:	Oral: yes	Written: yes	Seminar: yes
Pre/Corequisites: attend Lectures and Practical exercises 75 percent of total Number of hours. Make and delivary the Programs.			

1.8 Quality control

Seminars

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	STRUCTURAL ANALYSIS	**3 + 3**	**DIFFERENCE**	**II**	**6,00**
Lecturer: **Ph. D. SILVA LOZANČIĆ, Civ. Eng.**		**Collaborators:** **TANJA KALMAN,B.Sc in Civ. Eng.**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Subject, objective and methods of structural analysis. Basic principles. Structural systems classification. Structural systems geometric invariability. Loadings. Analysis methods and properties of statically determinate structures: plane structures with hinges; trusses, assemblied systems: three-hinged arches and frames with solid and truss girders, reinforced structural systems, supported and suspended girders, space trusses. Moving loads. Influence lines.Displacements and deformations. Bar energy theorems.
Statically undeterminate structures. Analysis, basic assumptions and methods. Analysis of statically undeterminate structures-solid and truss girders, continuous girders, frames and arches.Method of forces. Idealisation of Structures. Compatibility equations. Elements and structural systems flexibility matrices. Flexibillity coefficients and vectors determination.Displacement method of analysis. Numerical model determination. Equilibrium equations. Elements of stiffness and forces matrices.Application of displacement method: moment distribution-iteration analysis methods.Space bar structural systems – properties and calculation methods.

1.4 Competence

To learn the basics of statically determinate structural systems, the methods of calculating internal forces and structure displacements and numerical analysis of statically determinate systems.

1.5 Obligatory sources

1. V. Simović: Građevna statika I, 1988., sign. 1.19-155
2. M. Anđelić: Statika neodređenih štapnih konstrukcija, 1993., sign. 1.19-169
3. V. Simović: Zidovi s otovorima okvirne konstrukcije, Tehnička knjiga, Zagreb, 1972.

1.6 Additional sources

1. W. Wagner, G. Erlhof: Praktična građevinska statika I i III, 1979.i 1981, sign. 1.19-124
2. A.Ghali, A.M.Neville and T.G.Brown : "Structural analysis ",Spon press, 2003.
3. Đurić: Statika konstrukcija, Građevinska knjiga, Beograd, 1979.
4. P. Prokofjev: Teorija konstrukcija I i II, Građevinska knjiga, Beograd, 1966.
5. Đ. Solovjev: Statika konstrukcija. Statički neodređeni nosači, 1956., sign. 1.19-75

1.7 Exam

Exam:	Oral:yes	Written:yes	Seminar:yes
Pre/Corequisites: Mechanics I			

1.8 Quality control

Through preliminary exams, seminars and short tests

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	STRENGTH OF MATERIALS	**3 + 2**	**DIFFERENCE**	**II**	**6,00**
Lecturer: Ass.Prof.MIRJANA BOŠNJAK-KLEČINA					

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**COLLOQUIA**

1.3 Course curricula

General Assumptions and Fundamental Postulates. Analysis of Stress. Equilibrium Equations and Transformation Properties. Analysis of Strain. Displacement and Deformation. Equations of Compatibility. Hooke's Law. Mechanical Properties of Materials. Axially Loaded Bar. Stress Concentration. Indeterminate Force System. Thin-Walled Pressure Vessels. Direct Shear Stresses. Moments of Inertia, Products of Inertia of Plane Areas. Effect of Torsion. Elastic Torsion of Thin-Walled Tubes. Elastic Bending of Beams**.** Bending of Composite Beams and Beams with variable Stiffness. Shear center. Elastic Deflection of Beams and Methods for Determinations.
Special beam problems, statically indeterminate beams, special topics in elastic beam theory, theories of failure, members subjected to combined loadings, the energy methods, buckling and elastic stability, theory of plasticity, experimental elasticity, fundamentals of FEM.

1.4 Competence

Understanding of Stress and Strain Analysis and their Determination.

1.5 Obligatory sources

1. Šimić, V.: Otpornost materijala I I II, Školska knjiga, Zagreb, 2002.
2. I.Alfirević, Nauka o čvrstoći I i II, Tehnička knjiga i Golden marketing, 1994. i 1999.

1.6 Additional sources

1. Timošenko, S.: Otpornost materijala I. i II. dio, Građevinska knjiga, Beograd, 1965
2. Brnić, J.: Nauka o čvrstoći, Školska knjiga, Zagreb, 1991
3. Bochmann-Festigkeitslehre Verlag für Bauwessen, Berlin, 1990

1.7 Exam

Exam: Yes	Oral: Yes Written: Yes	Seminar: Colloquia
Pre/Corequisites: Mathematics , Mechanics		

1.8 Quality control

Written and oral Colloquia

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	FLUID MECHANICS	**3 + 2**	**DIFFERENCE**	**II**	**6,00**
Lecturer: **Ass.Prof.LIDIJA TADIĆ**		**Collaborators:** **Ass.Prof. MARIJA ŠPERAC**			

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**NO**

1.3 Course curricula

Properties of fluids
Hydrostatics- Properties of hydrostatic force. Basic differential equations of hydrostatics. Total hydrostatic force on plane and curved area. Archimedes Principle.
Hydro kinematics-Fluid flow and deformations. Velocity and acceleration fields. Streamlines and stream tubes. Flow types, Principle of mass conservation. Equation of continuity.
Hydrodynamics. Surface and gravity forces. Principle of impulse conservation. Bernoulli theorem for ideal fluid. Bernoulli theorem for real fluid. Hydrodynamic losses. Reynolds number. Boundary layer. Laminar and turbulent flow. Nikuradze experiment. Shearing stress at a pipe wall. Shape head losses. Steady uniform flow in open channels. Chezy equation. Specific energy. Froude number. Supercritical, critical and subcritical flow. Hydraulic jump. Non-uniform steady flow in open channels in prismatic and non-prismatic channels. Holes and weirs

1.4 Competence

Introduction to the basic principles of fluid mechanics as a foundation for the solution of all hydro technical problems

1.5 Obligatory sources

1. Vuković,Ž(1996): Osnove hidrotehnike 1

1.6 Additional sources

1. Virag Z(2002): Odabrana poglavlja mehanike fluida –primjeri I zadaci
2. Werner, A (2002):Odabrana poglavlja mehanike fluida-zbirka zadataka

1.7 Exam

Exam:	Oral: yes Written: yes	Seminar:
Pre/Corequisites:		

1.8 Quality control

3 preliminary exams and anaysis of experimental excercises

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	CONCRETE STRUCTURES	**3 + 2**	**DIFFERENCE**	**II**	**6,00**
Lecturer:	**Prof. DRAGAN MORIĆ**				

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**NO**	**YES**

1.3 Course curricula

Basic concept of structural engineering. Project phases. Codes for design and construction works for RC structures. Essential and special requirements for RC structures. Safety requirement for Rc structures. Basic variables. Two values of essential variables principies. Durability requirement.
Bearing and servicebility limit states. Limit states concept. Engineering analysis phases. Calculation approach. Idealisation of structures. Classification of loads. Definitions of calculation values of initial structural forces and cross section bearing capacity.
Strains and stresses in cross section.Rectangular cross sections, Single and double reinforced zones, T cross sections, Cross sections with changeable width, Triangular cross sections.
Axial compression centric force on shorts and slenders columns. Local compression stresses, Axial tensile centric force.Shear stresses in reinforceconcrete cross section in elastic and cracked conditions, Beams with changeable height, Design models: Clasic and modificated Moersch grates.
Design procedure. Structural rules. (Course based on EC-2)
Global informations of deflections and cracks limit states for some RC structural elements.

1.4 Competence

Knowing of structural shapes and forms and rules for construction of RC structures, with basic procedures in design of cross sections based on analysis of strain-stress conditions in cross section.

1.5 Obligatory sources

1. I. Tomičić, Reinforced concrete structures (In Croat) DHGK, Zagreb, 1996.

1.6 Additional sources

1. I. Tomičić, Reinforced concrete structures, Chosen chapters (In Croat) DHGK, Zagreb, 1999.

1.7 Exam

Exam: yes	Oral:yes	Written: yes	Seminar: no
Pre/Corequisites: Materials, Resistance of materials, Mechanics			

1.8 Quality control

Three colloquial exams during course lecture

1 Course

1.1 General data

Code	Course title	Hours	Status	Semester	ECTS
	TIMBER AND METAL STRUCTURES	**3 + 2**	**DIFFERENCE**	**II**	**6,00**

Lecturer: **Prof. STJEPAN TAKAČ** **Ass.Prof. DAMIR MARKULAK**	**Collaborators:** **TIHOMIR ŠTEFIĆ, B.Sc. in Civil Engineering**

1.2 Instructional format

Lectures	Practical exercises	Experimental exercises	Seminar
YES	**YES**	**YES**	**YES**

1.3 Course curricula

Wood as a building material – wood biology; timber production; technical properties of wood; wood rheology; wood preservation in timber structures.Fundamentals of timber structures – graphic representation of timber structures; material wood constants; Eurocode 5. Connections in timber structures – types; basics of connection design; connection stability; connecting devices. Joints in timber structures – types; joint dimensioning. Stability of timber structures – technical properties; stability proof; loads and influences; stability proof of timber structure elements; elements of space stability.
Introduction to steel design procedure – limit states and fundametal requirements. Desig situations. Introduction to Eurocode 3. Resitance of steel members. Ultimate limit state. Clasification of steel cros-sections. Resistance of steel sections. Tension members. Bucling resistance of members. Compression members. Beams. Members with combined axial force and moment. Serviceability limit states. Corrosion resistance of steel structural elements – general, protection methods. Fire resistance of steel structural elements – general, definitions, fire protection methods. Connecting devices – general, classification. Connection made with bolts, rivets or pins. Welded connections. Fabrication and erection of steel constructions. Another metals in civil engineering.

1.4 Competence

To gain a basic understanding of wood characteristics and properties and timber structures in general,and introduction to design, fabrication and erection of steel structures.

1.5 Obligatory sources

1. Takač, S: “Novi koncept sigurnosti drvenih konstrukcija”, Sveučilišni udžbenik Sveučilišta J. J. Strossmayera u Osijeku, Osijek 1997. ISBN 953_96691-1-1
2. Žagar, Z.: “Drvene konstrukcije I“, Udžbenici Sveučilišta u Zagrebu, Zagreb 1999.
3. Androić, B., Dujmović, D., Džeba, I.: Metalne konstrukcije I, IGH, Zagreb, 1994.
4. Androić, B., Dujmović, D., Džeba, I.: Metalne konstrukcije II, IGH, Zagreb, 1995.
5. Markulak, D.: Čelične konstrukcije, dio I, Interna skripta, GF Osijek, Osijek 2004.
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1.6 Additional sources

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1.7 Exam

Exam:	Oral: yes	Written: yes	Seminar: yes
Pre/Corequisites:			

1.8 Quality control