UNIVERSITY OF RIJEKA
FACULTY OF CIVIL ENGINEERING

CURRICULUM OF THE UNIVERSITY GRADUATE STUDY PROGRAMME

CIVIL ENGINEERING

Rijeka, May 2023

CURRICULUM

University Graduate Study in Civil Engineering

Information about the program holder:

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1. INTRODUCTION

During the implementation of the Bologna Process, the Faculty of Civil Engineering in Rijeka envisages reforming the existing study programmes (university, professional and postgraduate studies) according to the principles of the Bologna Process, i.e. according to the settings of the European Credit Transfer System (ECTS), in order to enable student mobility in the single European Knowledge Area.

The Faculty of Civil Engineering in Rijeka began to organize and implement the study of civil engineering in 1976. During its 46 years of operation, a total of **1355 graduate engineers** at the University of Rijeka and **1431 engineers at the professional study** have graduated from the Faculty of Civil Engineering in Rijeka.

In developing new study programs, the Faculty was guided by previous experiences in the education of construction personnel. The needs of the labor market were taken into account and the assessments of the requirements that will be set before future students, the Faculty and its employees, and experts in the construction profession for the purpose of Croatia's integration into the European Knowledge and Work Area. The fact that the Faculty of Civil Engineering in Rijeka is the only higher education institution that educates construction personnel in the wider area (Primorje-Gorski Kotar County, Istria County, Lika-Senj County) is respected.

Due to today's intensive activity in the field of planning, design and construction of infrastructure (roads, residential areas, water supply systems, etc.), there is a great need for highly educated personnel in the construction profession. The data show that there are generally **no unemployed graduate engineers and civil engineers at the employment services.**

It can be said with certainty that the trend of intensive infrastructure construction will continue in the coming years (during Croatia's approximation and accession to the European Union). In the long run, the need for planning and designing new buildings will be transformed into the need for management, maintenance and reconstruction of communal infrastructure and systems. Therefore, part of the curriculum is adapted to this requirement as well.

During the development of curricula, the Faculty actively cooperated with related faculties of civil engineering in Croatia. **The curriculum, at the undergraduate level, is fundamentally harmonized with equivalent programs at other faculties of civil engineering in Croatia** in order to enable student mobility, in the first step, at the Croatian level.

In the development of the programmes (undergraduate and graduate), the curricula of reputable foreign institutions that educate staff of the same profile (Technical University of Prague, Technical University of Munich: Technische Universität München-Studienplan für studierende des Baiungenieurrwesens, Eidgenossiche Technische Hochschule Zürich-ETH-Abfeilung für bauingenienieurrwesen) were considered. The recommendations of the Association of Civil Engineering Faculties of Europe (European Civil Engineering Education and Training - EUCEET) were taken into account through coordination within the TEMPUS project «Restructuring and Updating of Civil Engineering Curriculum» (in which all 4 civil engineering faculties from Croatia and international experts and scientists also cooperated).

All teachers of the Faculty were actively involved in the development of the curricula, and **students** were also consulted.

The structure of the curricula was accepted by the Scientific and Teaching Council of the Faculty of Civil Engineering on 21. December 2004.

The adopted scheme by education cycles is «3+2+3», i.e.:

- *three-year university undergraduate study of civil engineering*
- *two-year university graduate study of civil engineering*
- *Three-year doctoral study of civil engineering*

The proposed *university graduate studies* are based on all the previously mentioned facts. They are organized

through modules of individual areas of civil engineering. Compared to previous undergraduate programs and majors in the final year of study (*Hydrotechnical, Structural and Road Engineering),* through the planned new subjects and changes in the curricula of existing subjects, new scientific and practical knowledge in a certain scientific and teaching field is respected.

The fact that a certain number of graduated civil engineers are employed in various jobs in local self-government units in all three counties covered by the Faculty is especially respected.

Therefore, a new, interdisciplinary course *of urban engineering* is envisaged, which trains students for the tasks of planning, management and maintenance of communal infrastructure and systems. Given the observed needs and requirements of the market and science, modules in the field *of geotechnics and engineering modelling of buildings* are envisaged at the graduate study as a novelty.

2. GENERAL PART

2.1. NAME OF THE STUDY

At the Faculty of Civil Engineering in Rijeka, the organization of the university study of civil engineering is planned, and the second cycle of this study is the UNIVERSITY GRADUATE STUDY OF CIVIL ENGINEERING.

2.2. HOLDER AND CONTRACTOR OF THE STUDY

The holder and contractor of the program is *the Faculty of Civil Engineering in Rijeka* with its basic teaching units: Department of Architecture and Urban Planning, Department of Physics and Other Subjects, Department of Geotechnics, Department of Hydraulic Engineering, Department of Mathematics, Department of Load-bearing Structures, Department of Organization and Technology of Construction, Department of Roads, Department of Technical Mechanics, Department of Computational Modelling of Materials and Structures.

2.3. DURATION OF STUDY

The estimated duration of the university graduate study of civil engineering is two (2) academic years, and the student upon completion of the study, he/she acquires a minimum of 120 ECTS credits.

2.4. CONDITIONS FOR ENROLMENT IN THE STUDY

Citizens of the Republic of Croatia and citizens of EU Member States have the right to apply for the study, and under the same conditions, the right to foreign citizens and stateless persons are also enrolled.

To apply for *a university graduate study programme, a* prerequisite is *a completed undergraduate programme* at the Faculty of Civil Engineering in Rijeka (with a total of 180 ECTS credits) or completed undergraduate studies at one of the faculties of civil engineering (with which the Faculty of Civil Engineering in Rijeka has a student mobility agreement) or a related (technical) study programme (with which the Faculty of Civil Engineering in Rijeka has a student mobility agreement) in which the candidate has achieved 180 ECTS credits.

Applicants who have completed the professional undergraduate study of civil engineering (with a total of 180 ECTS credits) with the obligation to take differential exams according to the Differential Program for enrollment in the university graduate study of Civil Engineering at the Faculty of Civil Engineering in Rijeka.

The selection of applicants for ranking and enrolment is made on the basis of the number of required differential examinations, the success achieved at the previous level of study and the length of study of the candidate at the previous level of study.

2.5. COMPETENCIES THAT THE STUDENT ACQUIRES UPON COMPLETION OF THE STUDY PROGRAM

Upon completion of the university graduate study, the student acquires basic competencies for understanding general phenomena and problems related to civil engineering, especially for a certain branch of civil engineering (geotechnics, hydraulic engineering, engineering modelling of buildings, structures, roads and the interdisciplinary field of urban engineering).

He/she is able to use general knowledge, acquire new knowledge and views, make scientifically and professionally based conclusions, and develop in terms of scientific and applied scientific research.

He/she is qualified for the design, construction and maintenance of buildings and systems from the point of view of load-bearing capacity, stability, safety, environmental protection and prices.

Upon completion of the university graduate study, the student is specially trained to understand and solve problems in a particular field of civil engineering

During the study, the student is trained for the written and oral design of complex construction solutions.

During the study, the student develops the ability to communicate his/her own ideas, analyses and conclusions related to certain construction engineering problems to the professional and non-professional public.

He/she is able to manage a group of people on the development and execution of complex construction projects.

2.6. ACADEMIC TITLE OR DEGREE ACQUIRED UPON COMPLETION OF STUDIES

According to the envisaged study programme, the academic title and degree upon completion of the university graduate study is *the University Master of Civil Engineering / University Master of Civil Engineering (univ. mag. ing. aedif.).*

3. DESCRIPTION OF PROGRAM

3.1. LIST OF COMPULSORY AND ELECTIVE COURSES

The university graduate study is organized in such a way that all students have a part of a common curriculum (I semester), and the elective part of the program is conditioned by the choice of the field they want to study.

Teaching in the majors is organized through modules of individual areas of civil engineering:

- *Geotechnical Engineering*
- *Hydraulic Engineering*
- *Engineering Modelling of Structures*
- *Structures*
- *Transportation Engineering*
- *The interdisciplinary branch of Urban Engineering*

The list of compulsory and elective courses is composed according to the above structure and the areas from which they are organized modules.

A total of 87 subjects are envisaged in the program:

- compulsory subjects: 38
- elective subjects: 49

3.1.1. List of compulsory and elective courses and modules with the number of hours of active teaching required for their implementation and the number of ECTS credits

LIST OF MODULES/COURSES							
Semester: **winter – 1. semester**							
MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS[1]
All modules	Theory and Technology of Concrete	Assoc. Prof. Silvija Mrakovčić, Ph.D.	30	15	15	5	M
	Project Management	Prof. Diana Car-Pušić, Ph.D.	30	15	15	5	M
	Probability and Statistics	Prof. Svjetlan Feretić, Ph.D.	30	30	0	4	M
	Programming in Modelling	Assoc. Prof. Neira Torić Malić, Ph.D.	30	30	0	6	E
	Computational Modelling	Prof. Ivica Kožar, Ph.D.	30	30	0	6	E
* enrolment in an elective course is mandatory for the module listed in brackets	Concrete and Masonry Structures 1 *(Engineering Modelling of Structures, Structures)*	Prof. Davor Grandić, Ph.D., Asst. Prof. Paulo Šćulac, Ph.D.	45	30	0	6	E*
	Road Intersections *(Transportation Engineering, Urban Engineering)*	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	20	15	15	5	E*
	Engineering Rock Mechanics *(Geotechnical Engineering, Hydraulic Engineering, Transportation Engineering, Urban Engineering)*	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	30	30	0	5	E*
	Computational Hydraulics *(Hydraulic Engineering, Urban Engineering)*	Prof. Vanja Travaš, Ph.D.	45	15	0	5	E*
	Theory of Elasticity *(Engineering Modelling of Structures, Structures)*	Prof. Gordan Jelenić, Ph.D.	35	0	10	4	E*
	Theoretical Soil Mechanics *(Geotechnical Engineering, Urban Engineering)*	Prof. Željko Arbanas, Ph.D.	40	15	20	6	E*
Semester: **summer – 2. semester**							
Geotechnical Engineering	Soil Dynamics	Assoc. Prof. Vedran Jagodnik, Ph.D.	30	30	0	6	M
	Numerical Modelling in Geotechnics	Assoc. Prof. Vedran Jagodnik, Ph.D.	30	30	0	6	M
	Foundations	Assoc. Prof. Leo Matešić, Ph.D.	30	15	15	5	M
	Waste Management	Asst. Prof. Ivana Sušanj Čule, Ph.D.	30	10	5	4	E
	Hydraulic Structures	Prof. Barbara Karleuša, Ph.D.	30	30	0	6	E
	Testing and Monitoring in Geotechnics	Assoc. Prof. Vedran Jagodnik, Ph.D.	20	45	0	4	E
	Soil and Rock Reinforcement	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	15	15	4	E
	Operational Research and Linear Programming	Prof. Boris Podobnik, Ph.D.	30	0	30	6	E
	Environmental Protection		15	0	30	4	E

[1] **M** – the subject is mandatory; **E** – the subject is elective.

Semester: **summer – 2. semester**

MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS
Hydraulic Engineering	Hydraulic Structures	Prof. Barbara Karleuša, Ph.D.	30	30	0	6	M
	Drainage and Wastewater Treatment	Prof. Barbara Karleuša, Ph.D.	30	30	0	6	M
	Water Supply And Water Treatment	Asst. Prof. Elvis Žic, Ph.D.	30	30	0	6	M
	Experimental Hydraulics	Prof. Vanja Travaš, Ph.D.	30	30	0	4	E
	Waste Management	Asst. Prof. Ivana Sušanj Čule, Ph.D.	30	10	5	4	E
	Water Resources Management	Prof. Barbara Karleuša, Ph.D.	30	0	30	4	E
	Karst Hydrosystems		30	0	30	4	E
	Operational Research and Linear Programming	Prof. Boris Podobnik, Ph.D.	30	0	30	6	E
Engineering Modelling of Structures	Structural Modelling	Prof. Ivica Kožar, Ph.D.	30	0	30	6	M
	Numerical Modelling in Materials Engineering		30	0	30	4	M
	Operational Research and Linear Programming	Prof. Boris Podobnik, Ph.D.	30	0	30	6	M
	Energy Methods in Applied Mechanics	Asst. Prof. Teo Mudrić, Ph.D.	24	0	6	3	E
	Building Physics	Prof. Ivica Kožar, Ph.D.	20	0	10	2	E
	Dynamics of Structures	Prof. Gordan Jelenić, Ph.D.	30	6	9	4	E
	Testing of Structures	Prof. Ivana Štimac Grandić, Ph.D.	30	15	0	4	E
	Plate Structures	Asst. Prof. Edita Papa Dukić, Ph.D., Asst. Prof. Nina Čeh, Ph.D.	24	0	6	3	E
	Stability of Structures	Assoc. Prof. Dragan Ribarić, Ph.D.	30	6	9	4	E
	Introduction to Plasticity and Damage Modelling	Assoc. Prof. Leo Škec, Ph.D.	27	12	6	4	E
Structures	Steel Structures	Assoc. Prof. Mladen Bulić, Ph.D.	45	30	0	6	M
	Dynamics of Structures	Prof. Gordan Jelenić, Ph.D.	30	6	9	4	M
	Timber Structures	Prof. Adriana Bjelanović, Ph.D.	45	30	0	6	M
	Concrete and Masonry Structures 2	Prof. Davor Grandić, Ph.D.	30	5	10	4	E
	Energy Methods in Applied Mechanics	Asst. Prof. Teo Mudrić, Ph.D.	24	0	6	3	E
	Testing of Structures	Prof. Ivana Štimac Grandić, Ph.D.	30	15	0	4	E
	Building Design	Assoc. Prof. Iva Mrak, Ph.D.	15	30	0	4	E
	Stability of Structures	Assoc. Prof. Dragan Ribarić, Ph.D.	30	6	9	4	E
	Foundations	Assoc. Prof. Leo Matešić, Ph.D.	30	15	15	5	E
	Plate Structures	Asst. Prof. Edita Papa Dukić, Ph.D., Asst. Prof. Nina Čeh, Ph.D.	24	0	6	3	E
	Introduction to Plasticity and Damage Modelling	Assoc. Prof. Leo Škec, Ph.D.	27	12	6	4	E

Semester: **summer – 2. semester**

MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS
Transportation Engineering	Road Design	Asst. Prof. Sanja Šurdonja, Ph.D.	20	30	0	5	M
	Urban Traffic	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	30	30	0	6	M
	Traffic Engineering	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	30	15	15	5	M
	Soil and Rock Reinforcement	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	15	15	4	E
	Operational Research and Linear Programming	Prof. Boris Podobnik, Ph.D.	30	0	30	6	E
	Transport, Space and Environment	External Associate	30	0	15	3	E
	Transport Infrastructure Buildings	Assoc. Prof. Iva Mrak, Ph.D.	15	20	10	4	E
	Spatial Planning	Bojan Bilić, senior lecturer	20	15	15	5	E
	Traffic Safety	Asst. Prof. Sanja Šurdonja, Ph.D.	30	15	0	4	E
	Technology of Traffic Buildings	External Associate	30	15	0	4	E
	Railway Design	Asst. Prof. Sanja Šurdonja, Ph.D.	30	15	15	5	E
Urban Engineering	Waste Management	Asst. Prof. Ivana Sušanj Čule, Ph.D.	30	10	5	4	M
	Urban Traffic	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	30	30	0	6	M
	Spatial Planning	Bojan Bilić, senior lecturer	20	15	15	5	M
	Water Resources Management	Prof. Barbara Karleuša, Ph.D.	30	0	30	4	E
	Investment Policy	External Associate	30	15	0	3	E
	Construction Management	Assoc. Prof. Ivan Marović, Ph.D.	30	0	15	3	E
	Drainage and Wastewater Treatment	Prof. Barbara Karleuša, Ph.D.	30	30	0	6	E
	Operational Research and Linear Programming	Prof. Boris Podobnik, Ph.D.	30	0	30	6	E
	Road Design	Asst. Prof. Sanja Šurdonja, Ph.D.	20	30	0	5	E
	Transport, Space and Environment	External Associate	30	0	15	3	E
	Traffic Engineering	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	30	15	15	5	E
	Traffic Infrastructure Buildings	Assoc. Prof. Iva Mrak, Ph.D.	15	20	10	4	E
	Foundations	Assoc. Prof. Leo Matešić, Ph.D.	30	15	15	5	E
	Water Supply and Water Treatment	Asst. Prof. Elvis Žic, Ph.D.	30	30	0	6	E

Semester: **winter – 3. semester**

MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS
Geotechnical Engineering	Geotechnical Structures	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	30	5	6	M
	Underground Structures and Tunnels	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	30	30	0	6	M
	Slope Stability	Prof. Željko Arbanas, Ph.D.	30	30	0	6	M
	Construction Regulations	Assoc. Prof. Ivan Marović, Ph.D., Prof. Diana Car-Pušić, Ph.D.	30	0	0	4	E
	Geohazards	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	20	10	15	4	E
	Geotechnics of Transportation Structures	Lecturer Mirko Grošić, Ph.D.	25	20	0	4	E
	GIS and the Basics of Spatial Analysis	Asst. Prof. Bojana Horvat, Ph.D.	30	15	15	6	E
	Coastal Engineering	Assoc. Prof. Igor Ružić, Ph.D.	30	15	15	6	E
	Earthquake Engineering	Prof. Davor Grandić, Ph.D.	30	30	0	6	E
	Seepage and Consolidation in the Soil	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	15	15	4	E
Hydraulic Engineering	Engineering Hydrology	Prof. Nevenka Ožanić, Ph.D.	30	30	0	6	M
	Coastal Engineering	Assoc. Prof. Igor Ružić, Ph.D.	30	15	15	6	M
	Hydraulic Regulations and Meliorations	Prof. Nevenka Ožanić, Ph.D.	30	30	0	6	M
	Geohazards	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	20	10	15	4	E
	GIS and the Basics of Spatial Analysis	Asst. Prof. Bojana Horvat, Ph.D.	30	15	15	6	E
	Construction Regulations	Assoc. Prof. Ivan Marović, Ph.D., Prof. Diana Car-Pušić, Ph.D.	30	0	0	4	E
	Water Power Development	Prof. Barbara Karleuša, Ph.D.	30	30	0	4	E
	Hydraulic Modelling	Prof. Vanja Travaš, Ph.D.	30	30	0	4	E
	Underground Structures and Tunnels	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	30	30	0	6	E
	Computational Hydrodynamics	Prof. Vanja Travaš, Ph.D.	30	30	0	4	E
	Slope Stability	Prof. Željko Arbanas, Ph.D.	30	30	0	6	E
	Seepage and Consolidation in the Soil	Assoc. Prof. Vedran Jagodnik, Ph.D.	30	15	15	4	E
	Urban Water Systems	Asst. Prof. Nino Krvavica, Ph.D.	30	15	15	0	E

Semester: **winter – 3. semester**

MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS
Engineering Modelling of Structures	Inverse Modelling in Structural Assessment	Prof. Ivica Kožar, Ph.D.	30	0	30	6	M
	Finite Element Method	Prof. Ivica Kožar, Ph.D.	30	0	30	6	M
	Computer Aided Design		30	0	30	4	M
	Geometric Modelling of Surfaces		30	0	30	4	E
	Hydraulic Modelling	Prof. Vanja Travaš, Ph.D.	30	30	0	4	E
	Lightweight Structures	Prof. Adriana Bjelanović, Ph.D.	30	20	10	5	E
	Earthquake Engineering	Prof. Davor Grandić, Ph.D.	30	30	0	6	E
	Computer Systems Engineering	Prof. Ivica Kožar, Ph.D.	15	0	15	4	E
	Computational Hydrodynamics	Prof. Vanja Travaš, Ph.D.	30	30	0	4	E
	Computational Durability Mechanics		30	30	0	5	E
Structures	Solid Bridges	Prof. Ivana Štimac Grandić, Ph.D.	30	30	0	5	M
	Fundamentals of Composite Structures	Assoc. Prof. Mladen Bulić, Ph.D.	30	15	0	4	M
	Prestressed Concrete Structures	Asst. Prof. Željko Smolčić, Ph.D.	30	15	0	4	M
	Steel Bridges	Assoc. Prof. Mladen Bulić, Ph.D.	30	15	0	4	E
	Geotechnical Structures	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	10	20	6	E
	Coastal Engineering	Assoc. Prof. Igor Ružić, Ph.D.	30	15	15	6	E
	Lightweight Structures	Prof. Adriana Bjelanović, Ph.D.	30	20	10	5	E
	Finite Element Method	Prof. Ivica Kožar, Ph.D.	30	0	30	6	E
	Earthquake Engineering	Prof. Davor Grandić, Ph.D.	30	30	0	6	E
	Reliability of Civil Engineering Structures	Assoc. Prof. Mladen Bulić, Ph.D.	24	0	6	3	E
	Precast Concrete Structures	Asst. Prof. Paulo Šćulac, Ph.D.	30	15	0	4	E
Transportation Engineering	Roadbed Design	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	30	20	10	5	M
	Rigid Pavement Structures	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	25	10	5	4	M
	Flexible Pavement Structures	Prof. Aleksandra Deluka-Tibljaš, Ph.D.; Marijana Cuculić, senior lecturer	30	30	0	6	M
	Airports	Prof. Aleksandra Deluka-Tibljaš, Ph.D.	20	10	0	3	E
	Geotechnics of Transportation Structures	Lecturer Mirko Grošić, Ph.D.	25	20	0	4	E
	GIS and the Basics of Spatial Analysis	Asst. Prof. Bojana Horvat, Ph.D.	30	15	15	6	E
	Construction Regulations	Assoc. Prof. Ivan Marović, Ph.D., Prof. Diana Car-Pušić, Ph.D.	30	0	0	4	E
	Construction Machinery and Equipment	Prof. Diana Car-Pušić, Ph.D.	30	30	0	4	E
	Finite Element Method	Prof. Ivica Kožar, Ph.D.	30	0	30	6	E
	Maintenance and Repair of Roads	Prof. Aleksandra Deluka-Tibljaš, Ph.D.; Marijana Cuculić, senior lecturer	30	15	0	3	E

Semester: **winter – 3. semester**							
MODULE	COURSE	PROFESSOR	L	W	S	ECTS	STATUS
Urban Engineering	GIS and the Basics of Spatial Analysis	Asst. Prof. Bojana Horvat, Ph.D.	30	15	15	6	M
	Public Buildings and Spaces	Assoc. Prof. Iva Mrak, Ph.D.	30	20	10	6	M
	Urban Water Systems	Asst. Prof. Nino Krvavica, Ph.D.	30	15	15	6	M
	Geohazards	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	20	10	15	4	E
	Geotechnical Structures	Asst. Prof. Martina Vivoda Prodan, Ph.D.	30	30	5	6	E
	Construction Regulations	Assoc. Prof. Ivan Marović, Ph.D., Prof. Diana Car-Pušić, Ph.D.	30	0	0	4	E
	Engineering Hydrology	Prof. Nevenka Ožanić, Ph.D.	30	30	0	6	E
	Coastal Engineering	Assoc. Prof. Igor Ružić, Ph.D.	30	15	15	6	E
	Building Maintenance	Prof. Diana Car-Pušić, Ph.D.	30	15	0	4	E
	Maintenance and Repair of Roades	Prof. Aleksandra Deluka-Tibljaš, Ph.D.; Marijana Cuculić, senior lecturer	30	15	0	3	E
	Underground Structures and Tunnels	Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.	30	30	0	6	E
	Hydraulic Regulations and Meliorations	Prof. Nevenka Ožanić, Ph.D.	30	30	0	6	E
	Flexible Pavement Structures	Prof. Aleksandra Deluka-Tibljaš, Ph.D.; Marijana Cuculić, senior lecturer	30	30	0	6	E
Semester: **summer – 4. semester**							
All modules	Master's Thesis					30	M

3.2. DESCRIPTION OF EACH COURSE

3.2.1. Description of compulsory and elective courses

Back to the list of courses

General information		
Course leader	Assoc. Prof. Silvija Mrakovčić, Ph.D.	
Course	THEORY AND TECHNOLOGY OF CONCRETE	
Study program	University Graduate Study in Civil Engineering	
Course Status	Mandatory	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of this course is to familiarize students with the specifics of the microstructure of concrete, to train students for the correct selection of components of the composition of ordinary and special concretes, the methods of appropriate preparation, installation and compaction of concrete in order to ensure the required properties of concrete in fresh and fresh concrete.
I'm in good condition for the required purpose.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the relationship between the properties and type of ingredients and the microstructure of fresh concrete and explain the impact of
   hydration reaction to the properties and structure of hardened concrete.
2. Argue the choice of a suitable type of concrete and the method of preparation, transport, installation, compaction and nurturing of concrete for a given application.
3. Design the composition of a special type of concrete.
4. Independently carry out laboratory tests of the physical and mechanical properties of fresh and hardened
   concrete using relevant standards, and analyze the results obtained.
5. express oneself in writing and orally in an appropriate engineering vocabulary when processing a given topic related to
   with recent research on special concretes.
6. Define terms related to the durability of concrete and analyze the factors influencing the corrosion of concrete and reinforcement.

1.4. Content of the course

- Components of the concrete composition
- Hydration, bonding and hardening processes
- Design of the composition of special concretes
- Production, transport, installation, compaction and care of concrete
- Properties of fresh concrete
- The structure of hardened concrete
- Stress states in concrete
- Concrete Strength and Dimensional Stability
- Concrete Quality Control
- Durable properties of concrete

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☐ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Students are required to regularly attend lectures, pass the colloquium and final exam, actively participate in the implementation of experimental work in the laboratory, prepare and submit and defend a seminar paper within the prescribed deadline.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	0,5
Written exam		Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of reports, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Bjegović, D., Štirmer, N.: Theory and Technology of Concrete,

1.11. Supplementary literature

1. Bjegović D., Balabanić G., Mikulić D.: Building Materials – A Collection of Solved Problems, Zagreb, 2007.
2. Mehta P K., Paulo J M. Monteiro: Concrete, Microstructure, Properties and Materials, McGraw Hill 2006.
3. Muravlov M.: Fundamentals of Concrete Theory and Technology, Construction Book, Belgrade, 2005.
4. Neville A M.: Properties of Concrete, Prentice Hall, 1995.
5. Ukrainczyk V.: Concrete – Structure, Properties, Technology, Alcor, Zagreb, 1994.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the Subject

Title	*Number of copies*	*Number of students*
Bjegović, D., Štirmer, N.: Theory and Technology of Concrete,	20	75

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Diana Car-Pušić. Ph.D.**	
Course	PROJECT MANAGEMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquisition of basic knowledge and skills in the field of project management, with an emphasis on construction projects.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Interpret methods for managing individual phases of the life cycle of construction projects
2. Apply different management methods and instruments in individual phases of the construction project
3. Independently set up, describe and analyze all phases of a medium-complex construction project

1.4. Content of the course

Basic knowledge of project management. Basics of construction project management. Management in the preparatory stages. Management in the implementation phases. Construction project manager. Teamwork. Risk management in construction projects. Change management. Human resource management. Quality/cost/time management. Information and communication management in construction projects. New trends and the future of project management.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes 70%, colloquium, seminar paper, final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper	1	Experimental work	
Written exam	1,0	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,0	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs and seminar papers, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Radujković, M. et al.: Project Planning and Control, University of Zagreb, Faculty of Civil Engineering, Zagreb, 2012.
2. A Guide to the Project Management Body of Knowledge (PMBOK Guide) Fifth Edition, 2013.
3. Croatian National Guide to Core Project Management Skills (NCB) – e-textbook at The CAPM website

1.11. Supplementary literature

1. Vukmir, B.: Contracts on Construction and Services of Consulting Engineers, RRIF-Plus, Zagreb, 2009.
2. Cobb, C.G.: Making Sence of Agile Project Management:Balancing Control and Agiliity, John Wiley and Sons, Inc. Hoboken New Jersey, 2011.
3. Burtonshaw-Gunn, S.A.: Risk and Financial Management in Construction, Gower, 2009.
4. Vukomanović, M.; Radujković, M.: Business Excellence in Civil Engineering of the Republic of Croatia, University of Zagreb, Faculty of Civil Engineering and Croatian Association for Construction Organization, 2011.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the Subject

Title	*Number of copies*	*Number of students*
Radujković, M. et al.: Project Planning and Control, University of Zagreb, Faculty of Civil Engineering, Zagreb, 2012.	12	75
A Guide to the Project Management Body of Knowledge (PMBOK Guide) Fifth Edition, 2013.	2	
Croatian National Guide to Core Project Management Skills (NCB) – e-textbook on the CAPM website	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Svjetlan Feretić, Ph.D.**	
Course	**PROBABILITY AND STATISTICS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Students will: acquire concepts such as event, probability of an event, random variable, probability distribution, mathematical expectation and variance, learn to estimate unknown parameters of probability distribution based on a sample, learn to use statistical tests to evaluate whether a given probability model is acceptable, and which of the two probability models is more acceptable.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

After passing the course exam, students will be able to:

1. Explain concepts such as event, probability of an event, random variable, probability distribution, mathematical expectation and variance,
2. Estimate on the basis of the sample unknown parameters of the probability distribution,
3. Evaluate, using statistical tests, whether a given probabilistic model is acceptable, and which of the two probabilistic model is more acceptable.

1.4. Content of the course

An experiment, an outcome, an event. Probability. Basic probability theorems. Conditional probability, independent events. Factorials, binomial coefficients, permutations, and combinations. Random variables - discrete and continuous. Probability distributions. Mathematical expectation and variance. Moments. The most discreet divisions: binomial, geometric, Poisson. Normal distribution. Approximation of the binomial distribution by the normal distribution. Two-dimensional random vector, two-dimensional probability distribution. Marginal distributions. Independent random variables. Functions of a random vector. The additivity of expectations and the (non)additivity of variance. The coefficient of correlation. Parameter estimation. The method of the highest probability. Confidence intervals. Testing of parametric hypotheses. A chisquare test. Nonparametric tests. Regression analysis and correlation analysis. Markov processes.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Colloquiums and final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity	0,5	Seminar paper		Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio							

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquiums – 70%, exam – 30%.

1.10. Compulsory literature

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley, New York, 8th edition, 1999.
2. Ž. Pauše, Probability – Information - Stochastic Processes, Školska knjiga, Zagreb, 1988.
3. I. Pavlić, Statistical Theory and Application, Tehnička knjiga, Zagreb, 1988.

1.11. Supplementary literature

1. R. A. Johnson, G. K. Bhattacharyya, Statistics: Principles and Methods, Wiley, New York, 4th edition, 2000.
2. J.T. McClave, P.G. Benson, Statistics for Business and Economics, Dellen, San Francisco, 4th edition, 1988.
3. Ž. Pauše: Introduction to Mathematical Statistics, Školska knjiga, Zagreb, 1993.
4. V. Vranić, Probability and Statistics, Tehnička knjiga, Zagreb, 1971.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
E. Kreyszig, Advanced Engineering Mathematics, Wiley, New York, 8th edition, 1999.	1	75
Ž. Pauše, Probability – Information - Stochastic Processes, Školska knjiga, Zagreb, 1988.	5	
I.Pavlić, Statistical Theory and Application, Technical Book, Zagreb, 1988.	3	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Neira Torić Malić, Ph.D.**	
Course	PROGRAMMING IN MODELLING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of the course is to introduce students to the basics of programming and some basic numerical algorithms through application to solving engineering problems. The goal is to give students a brief introduction to multiple topics, so that they get an idea of what and in what way can be solved by applying computers and computation.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Apply a computational mindset to basic engineering problems
2. Extract and interpret the necessary information from data obtained by computer means
3. Computationally solve problems
4. Programming language Phyton
5. Have a systematized approach to designing, organizing, and writing medium-sized programs
6. Use a certain number of algorithms
7. Apply some basic numerical procedures through software solving engineering problems
8. Use computational tools, model, visualize and apply the obtained data

1.4. Content of the course

The Basics of Programming. Introduction to the Python programming language: variables and types of variables, objects, and expressions. Operators and functions. Branching and loops. Data input and output. Testing and debugging. Classes and Object-Oriented Programming. Some simple numerical algorithms: Newton-Raphson, secant method, bisection. Dynamic programming. Visualization in PyLab.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Passing the colloquium, final exam and solving program tasks.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	2	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquium, solving tasks in exercises, submitting a program task, exam. During classes 70%, final exam 30%.

1.10. Compulsory literature

1. Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013. ISBN: 9780262519632.
2. Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.
3. Kožar, Ivica: Some subroutines of importance for engineering programs, with program listing, FRaK, No.9, 1984., pp.6-10.
4. Phyton tutorial

1.11. Supplementary literature

1. Kreyszig, Erwin, Advanced Engineering Mathematics, John Wiley & Sons Australia, Limited, 2006
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey
3. The Art and Craft of Programming, Phyton edition, John C. Lusth

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013. ISBN: 9780262519632.	3	25-75
Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.	1	
Kožar, Ivica: Some Subroutines of Importance for Engineering Programs, with Program Listing, FRaK, No.9, 1984., pp.6-10.	1	
Phyton tutorial	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Ivica Kožar, Ph.D.**	
Course	COMPUTATIONAL MODELLING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Use at least one programming language for graphics programs.
2. Compare the efficiency of different numerical methods used to solve the same problem (secant method, Newton's method, and bisection method when looking for solutions to nonlinear equations)
3. Know the concept of optimization and the simplex method
4. Argumentative use of numerical derivation and integration
5. Use the finite difference method to solve partial differential equations.

1.4. Content of the course

Introduction. Programming languages. Programming in mathematical programs. Interpolation of polynomials. Linear and nonlinear equations. The method of least squares. Introduction to statistical models ("kriging", the principle of inverse modelling). Numerical derivation and integration. Introduction to differential equations (elliptical, parabolic, hyperbolic). Introduction to optimization methods. Introduction to evolutionary algorithms and methods of artificial intelligence.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Passing the colloquium and final exam and solving program tasks

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	2	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquium, solving tasks in exercises, submitting a program task, exam. During classes, 70%, final exam 30%.

1.10. Compulsory literature

1. Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.
2. MathCAD 2001 user manual.
3. Kožar, Ivica: Systems of Nonlinear Equations, with Program Listing, FRaK, No.7, 1983., pp.36-39.
4. Kožar, Ivica: Some subroutines of importance for engineering programs, with program listing, FRaK, No.9, 1984, p. 6-10.

1.11. Supplementary literature

1. Smith, A., Hinton, E., Lewis, R.W.: Civil Engineering Systems Analysis and Design", John Wiley & Sons, 1983.
2. Kožar, Ivica: Artificial Intelligence in Engineering Practice, FRaK, No.17, 1986, pp.5-8.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.	1	25-75
MathCAD 2001 user manual.	Available online	
Kožar, Ivica: Systems of Nonlinear Equations, with Listing program, FRaK, No.7, 1983., pp.36-39.	1	
Kožar, Ivica: Some Subroutines of Importance for Engineering Programs, with Program Listing, FRaK, No.9, 1984, p. 6-10.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Davor Grandić, Ph.D., Asst. Prof. Paulo Šćulac, Ph.D.**	
Course	CONCRETE AND MASONRY STRUCTURES 1	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	45+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Gain knowledge of the concepts and properties of various load-bearing concrete and masonry structures and independent design ability. It is the basis for future professional and scientific education in the field of load-bearing concrete and masonry structures and load-bearing structures in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Size elements stressed by oblique bending with or without longitudinal force.
2. Calculate the stresses caused by shrinkage and long-term loading.
3. Explain the methods of determining static quantities in reinforced concrete rod structures and calculate compressively stressed slender elements and structures.
4. Calculate the usability limits of reinforced concrete beams and slabs.
5. Define the basic terms and advantages and disadvantages of masonry structures, masonry materials, types, mechanical properties of masonry, construction details of masonry and masonry rules.
6. Define the basic concepts of prestressed masonry.
7. Calculate the basic structural elements of a masonry building and apply simplified ones calculation methods and rules for the design of masonry buildings
8. Develop a project for reinforced concrete and masonry structures.

1.4. Content of the course

Concrete structures:
Dimensioning of elements subjected to oblique bending with or without axial force. Fundamentals of rheology concrete. Expressions for the relationship between stress and strain. Stresses caused by shrinkage and prolonged loading. Serviceability: calculation of stress, deformation and cracks. Determination of static quantities in reinforced concrete rod structures. Calculation of slender elements and structures. Calculation and reinforcement of short brackets and wall mounts. Calculation and reinforcement of beamless panels. Dimensioning of reinforced concrete walls. Frame nodes. Unreinforced and lightly reinforced concrete structures.

Masonry structures:
History, pros and cons, basic concepts. Masonry materials. Types and mechanical properties of masonry. Calculation and construction of unreinforced masonry walls. Calculation and construction of reinforced masonry elements: walls, beams and wall mounts. Ceilings and lintels made of prefabricated brick elements. Preloaded walls. Bounded walls and frames filled with masonry. Design of masonry structures according to simplified calculation methods and rules.

1.5. Types of teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending classes, creating a program assignment, taking colloquia and final exams.

1.8. Monitoring student work

Attendance teaching	2,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester (continuous examination of knowledge through colloquiums, preparation of a program assignment) 70% of the total grade, exam 30% of the total grade.

1.10. Compulsory literature

1. Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.
2. Tomičić, I.: Manual for the Calculation of Reinforced Concrete Structures, DHGK, Zagreb, 1993.
3. Tomičić, I.: Concrete Structures – Selected Chapters, DHGK, Zagreb, 1996.
4. Sorić, Z.; Kišiček T.: Concrete Structures 2, Faculty of Civil Engineering, Zagreb, Zagreb, 2018.
5. Sorić, Z.: Masonry Constructions, Zagreb, 2016.
6. Hadzima-Nyarko, M.; Ademović, N.; Jeleč, M.: Structural reinforcements of masonry buildings: methods and examples, Faculty of Civil Engineering and Architecture Osijek, Osijek, 2020.

1.11. Supplementary literature

1. Fib Model code for concrete structures 2010, Ernst & Sohn, 2013.
2. Aničić D., Tomaževič M.: Construction and Design of Masonry Structures, Construction Calendar, GK Belgrade, 1990-91

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.	6	20-40
Tomičić, I.: Manual for the Calculation of Reinforced Concrete construction, DHGK, Zagreb, 1993.	5	
Tomičić, I.: Concrete Structures – Selected Chapters, DHGK, Zagreb, 1996.	4	
Sorić, Z.; Kišiček T.: Concrete Structures 2, Civil Engineering Faculty Zagreb, Zagreb, 2018.	10	
Sorić, Z.: Masonry Constructions, Zagreb, 2016.	13	
Hadzima-Nyarko, M.; Ademović, N.; Jefar, M.: Structural reinforcements of masonry buildings: methods and examples, Faculty of Civil Engineering and Architecture Osijek, Osijek, 2020.	10	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	ROAD INTERSECTIONS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	20+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of this course is to train future engineers to identify, define and solve engineering problems in the area of intersections in one and more levels.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define types of hubs and applications with respect to conditions
2. Apply numerical methods for calculating traffic light bandwidth and cycle
3. Use computers independently, apply design rules
4. Comparison and optimization of the selected hub project solution
5. Comprehensible written and oral expression
6. Develop a conceptual design for a deleveled hub.
7. Create a complete master design of the hub (level or circular)

1.4. Content of the course

Intersections on one level: types (''classic'' and roundabout), features, design elements, capacity calculation, vertical signage and horizontal markings.

Multi-level intersections: types, features, design elements, capacity calculation, vertical signaling and horizontal markings.

Other intersections: with the railway, river and canal and other utility lines.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Colloquiums, seminar paper, program assignment - development of a conceptual design of an intersection at the level (standard, circular).

1.8. Monitoring student work

Attending classes	1,7	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	1,3	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar paper, program assignment, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Legac, I: Intersections of Public Roads, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb 2008.
2. T. Tollazzi: Roundabouts, IQ Plus d.o.o., Kastav, 2007.
3. Guidelines for the design of roundabouts on state roads, Hrvatske ceste, Zagreb, 2014.
4. NORM U.C4.050 Surface Intersections

1.11. Supplementary literature

1. Guidelines for the design of roundabouts with spiral traffic flow on state roads, Hrvatske ceste d.d., 2014.
2. Ordinance on Conditions for the Design and Construction of Connections and Accesses to Public Roads (OG 119/07)

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Legac, I.: Intersections of Public Roads	4	20
Guidelines for the design of roundabouts at state Roads	Available online	
T. Tollazzi: Roundabouts	2	
NORM U.C4.050 Surface Intersections	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

All quality assurance procedures are carried out according to the Faculty Quality Assurance Manual.

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General information		
Course leader	**Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.**	
Course	ENGINEERING ROCK MECHANICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introduction of the principles of rock mechanics into engineering practice. Understanding the properties of rocks and rock masses and existing boundary conditions. Application of engineering classifications of rock mass. Choosing the right ones laboratory and field tests to obtain the necessary parameters. Determination of strength and deformability of the rock mass. Application of methods and analyses in the design and construction of substructure systems.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the basic principles of the behavior of the rock mass as a system consisting of intact parts and discontinuity
2. Quantitatively describe the rock mass
3. Describe the physical and mechanical characteristics of the rock mass and their connections.
4. Determine the methods of determining the parameters of the rock mass
5. Numerically analyze stress and strain states in the rock mass by independent use software
6. Analyze the impact of excavation on the rock mass using different technologies.
7. Explain common procedures for stabilizing the rock mass
8. To devise a solution to an engineering problem in the rock mass through all phases: from exploration works, classification of rock mass, analysis of stress states, determination of stabilization, construction and monitoring of an object or intervention in the rock mass predict and independently solve a simpler geotechnical problem

1.4. Content of the course

Description of rock as an engineering material and engineering classification of rock mass. Tectonic deformations and rock weathering. Index and physical properties of rocks. Mechanical properties of intact rock and rock mass: strength and fracture criterion; the Constitution of the United States; shear strength of discontinuity. Analyses and design in rock mechanics. Excavation and principles of stabilization. Mechanisms of instability in surface and underground excavations. Stabilization techniques: cables and anchors, shotcrete, landslide protection nets, barriers. Methods of testing rocks in the laboratory and in the field. Stresses and methods of their measurement (primary and secondary stresses). Stability of slopes in rock, fracture models, 2D and 3D analyses. Application of rock mechanics to foundation and tunnel construction problems. Method of observation.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☒ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes (lectures, exercises, field work, laboratory exercises), periodic checking knowledge – colloquiums, field and laboratory reports, taking the final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	0,75	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquium and other activities during classes 70%, final exam 30%.

1.10. Compulsory literature

1. Vrkljan, I., 2001., Engineering Rock Mechanics (digital version of scripts), Faculty of Civil Engineering in Rijeka
2. Hoek, E.: Rock Engineering, A Course Notes, http://www.rocscience.com

1.11. Supplementary literature

1. Harrison, J.P., Hudson, J.P., 2000., Engineering Rock Mechanics, Illustrative Worked Exsamples, Pergamon, 506 p.
2. Miščević, P., 2004., Introduction to Engineering Rock Mechanics ; University of Split – Civil Engineering Faculty of Architecture; Split
3. Hudson, J.A., (editor-in-chief), 1993., Comprehensive Rock Engineering, Volume 1,2,3,4 i 5
4. Bell, F.G., 1995. Engineering Geology. Blackwell Science, Cambridge.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Vrkljan, I., 2001, Engineering Rock Mechanics (digital version of scripts), Faculty of Civil Engineering in Rijeka	1	20-50
Hoek, E.: Rock Engineering, A Course Notes, http://www.rocscience.com	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Vanja Travaš, Ph.D.**	
Course	**COMPUTATIONAL HYDRAULICS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	45+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of the course is to ensure the development of competencies in the field of computer modelling of hydraulic systems envisaged by the curriculum. Mastering the curriculum provides the competencies necessary for active monitoring of the teaching of other subjects of commercial and sanitary hydraulic engineering.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Modelling of the water supply network (1D).
2. Modelling of water mass oscillations (0D).
3. Modelling of hydraulic shock (1D).
4. Modelling of the deceleration section (1D).
5. Modelling of water wave transformation (1D).
6. Inundation Flooding Modelling (2D).
7. Regional flow modelling (2D).
8. Modelling of the transport of substances (2D).
9. Modelling of vertical infiltration (1D).

1.4. Content of the course

Flow modelling in pressurized systems: (a) water supply network model, (b) water mass oscillation model, (c) hydraulic shock model. Surface water flow modelling: (a) deceleration section model, (b) water wave transformation model, (c) inundation flooding model. Groundwater flow modelling: (a) regional flow model, (b) substance transport model, (c) vertical infiltration model.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Regular attendance at classes, preparation and submission of program tasks, attendance at oral colloquium and final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam		Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment	1,0	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester, a knowledge test is carried out on three occasions in the form of oral colloquia where students answer questions related to previously processed teaching units. In addition to the above, students create and defend 9 program tasks or 3 program tasks for each of the 3 teaching units (hydraulics of pressure systems, hydraulics of surface waters and hydraulics of groundwater). The final exam is oral.

1.10. Compulsory literature

1. Agroskin I.I., Dimitrijev G.T., Pikalov F.I., Hydraulics, Tehnička knjiga, Zagreb, 1973.
2. Chow V.T., Open Channel Hydraulics, Mc Graw-Hill Kogakusha, 1959.
3. Bear J., Dynamics of Fluids in Porous Media, American Elsevier Publishing Company, New York, 1988.

1.11. Supplementary literature

1. Raus H., Technical Hydraulics, Construction Book, Belgrade, 1969.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Agroskin I.I., Dimitrijev G.T., Pikalov F.I., Hydraulics, Tehnička knjiga, Zagreb, 1973.	3	20-40
Bear J., Dynamics of Fluids in Porous Media, American Elsevier Publishing Company, New York, 1988	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Gordan Jelenić, Ph.D.**	
Course	THEORY OF ELASTICITY	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	35+0+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introduction to the basic principles of continuum mechanics, the theory of elastic behavior of materials, solutions to boundary problems within the theory of elasticity, introduction to the basic theories of nonlinear and viscoelastic behavior of materials.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the basic principles of the mechanics of the continuum of a deformable body, the physical meaning of stress and deformation and the meaning of different stress tensors and their interrelation
2. Explain the concepts of strain gradient and strain tensor, list several different tensors deformation and define the relationships between them
3. Application of Compatibility Equations within the Stress Method
4. Connect strain tensors with strain tensors based on strain energy invariance
5. Define the relationship between the strain tensor and the strain tensor in the case of a linearly elastic material
6. Define the relationship between the strain tensor and the strain tensor in the case of linear viscoelastic material
7. Define the mechanical problem of elastic equilibrium of a deformable body for know boundary conditions of stress or deformation
8. Solve a simple problem of an edge task by applying the strain function

1.4. Content of the course

Introduction. Strain at a continuum point. Deformations at the point of the continuum. The relationship between stress and strain is a generalized Hooke's law. Basic equations of elasticity of a deformable body. Viscoelasticity. Applying the theory to simple examples.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Regular attendance at lectures. Preparation of a seminar paper as a condition for taking the exam. Taking the exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity	1	Seminar paper	0,5	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, seminar, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Timoshenko, S. and Goodier, N.: Theory of elasticity, McGraw-Hill, 1970.

1.11. Supplementary literature

1. Valliappan, S. Continuum mechanics - fundamentals, Scool of Civil Engineering, The University of New South Wales Ed. A.A.Balkema, Rotterdam, 1981.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Timoshenko, S. and Goodier, N.: Theory of elasticity, McGraw-Hill, 1970.	1	20-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Željko Arbanas, Ph.D.**	
Course	THEORETICAL SOIL MECHANICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	40+15+20

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Preparing students to understand the application of nonlinear continuum mechanics and constitutional equations in describing the behavior of real soil. Describes the theory of critical states in the mechanical behavior of real soils. It clarifies the theoretical behavior for different soil models. Introduces the student to the application theoretical models of soil behavior in practical application.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the theoretical foundations and regularities in soil behavior analyses.
2. Distinguish between soil behavior in drained and undrained conditions.
3. Distinguish between the principles of behavior of bound and unbound materials
4. Distinguish soil behavior models (elastic, elastopalst, viscoplastic behavior)
5. Explain the differences between real behavior and simplified models of soil behavior.
6. Analyze the existence of critical soil conditions
7. Explain the application of soil behavior models to engineering problems

1.4. Content of the course

Critical State Theory and Mechanical Behavior of Real Soils. Nonlinear Continuum Mechanics and Constitutional Equations. Application to the soil as a multiphase continuum. Elasticity and elastoplasticity. Loosening surfaces and the plastic potential. Isotropically hardening models. Complex soil models and their limitations: model Duncan and Chang, "Cam clay" and variants, models with multiple loosening surfaces, models with kinematic curing. Ideal plasticity and limit analysis. Application in practical problems.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes (lectures, exercises). Preparation of a seminar paper. Periodic examination of knowledge – colloquia. Passing the final exam.

1.8. Monitoring student work

Attending classes	2,5	Teaching activity		Seminar paper	1,5	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Activities (seminars, laboratory work, etc.) and continuous examinations during classes - 70%, final exam - 30%.

1.10. Compulsory literature

1. Wood, D.M., Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, Cambridge, 1990, p. 462.

1.11. Supplementary literature

1. Schofield, A.N., Worth, C.P.: Critical State Soil Mechanics, McGraw-Hill Book Company, London, 1968, p. 310.
2. Desai, C. S., Siriwardane, H.J.,: Constitutive Laws for Engineering Materials with Emphasis on Geologic Materials, Prentice-Hall, In., Englewood Cliffs, New Jersey, 1984, p. 468.
3. Atkinson, J.H., Bransby, P.L.: The Mechanics of Soil - An Introduction to Critical State Soil Mechanics, McGraw-Hill Book Company (UK) Limited, London, 1978, p. 376.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Wood, D.M., Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, Cambridge, 1990, p. 462.	2	40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Vedran Jagodnik, Ph.D.**	
Course	SOIL DYNAMICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introducing students to the basics of Soil Dynamics, including soil behavior under cyclic and dynamic loads. Knowledge of the types of laboratory experiments in small and medium relative deformations. The influence of plasticity on cyclic behavior and overall deformation.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish basic facts related to: (a) types of soil dynamics problems, (b) theories of vibration and wave propagation, (c) soil behavior under dynamic and cyclic loads and deformations, (d) models of cyclic soil behavior, (e) experiments for the evaluation and determination of dynamic and cyclic properties of soil, (f) soil liquefaction, and (g) analysis of seismic terrain response
2. Interpret differences in cyclical soil behavior depending on soil characteristics.
3. Independently solve a problem in the field of soil dynamics related to the cyclical behavior of soil
4. Interpret laboratory experiments conducted under cyclic loading conditions for different soils

1.4. Content of the course

1. Theoretical components of soil dynamics
   - Behavior of a rigid block on a horizontal plane or slope when an earthquake is applied
   - A system with one degree of freedom
   - A system with multiple degrees of freedom
   - Wave equation in 1D space
2. Basics of static and cyclical soil behavior
3. Influence of plasticity index on cyclic soil behavior
4. Laboratory tests of soil at low and medium relative deformations
5. Soil liquefaction
6. Analysis of soil response using computers

1.5. Types of execution teaching		
	☒ Class	☒ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Mandatory attendance at the class. Creating a program task. Final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam	0,5	Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During classes 70%, final exam 30%.

1.10. Compulsory literature

1. Das, B. M. (1992) Principles of Soil Dynamics. PWS-KENT
2. Holtz, R.D., Kovacs, W.D., Sheahan, T.C.(2010) An introduction to geotechnical engineering. Pearson.

1.11. Supplementary literature

1. Ishihara, K., (1996): Soil Behaviour in Earthquake Geotechnics. Clarendon Press - Oxford University Press
2. Novak, M. (1987) State of the art in analysis and Design Of Machine Foundations, Soil structure interaction. Elsevier Science Publications: 171-192,

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Das, B. M. (1992) Principles of Soil Dynamics. PWS-KENT	1	20
Holtz, R.D., Kovacs, W.D., Sheahan, T.C.(2010) An introduction to geotechnical engineering. Pearson.	3	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Martina Vivoda Prodan**	
Course	GEOTECHNICAL STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+5

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Educating future engineers in geotechnical design techniques. Getting to know the basics specifics of geotechnical design. Introducing future engineers to processes, methods and procedures in geotechnical design. Introducing future engineers to the content of geotechnical project.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Describe and distinguish basic geotechnical constructions
2. Explain the role of certain geotechnical constructions
3. Apply methods of analysis of geotechnical structures
4. Explain the principle of designing geotechnical structures
5. Describe the measuring equipment for verifying the behavior of geotechnical structures during construction
6. Interpret the results of modified quantities on the measuring equipment and interpret the behavior of the geotechnical construction
7. Describe the principle of active design.
8. Choose an approach to the observation of geotechnical structures

1.4. Content of the course

Project requirements and design process. Selection of geotechnical parameters. Geotechnical modelling. Selection of geotechnical structures. Methods of numerical modelling. A critical approach to results. Content of geotechnical project. An approach to active design. Execution of geotechnical works. Geotechnical surveillance. Applied monitoring measures.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Mandatory for the Geotechnics module	

1.7. Obligations of students

Periodic examinations of knowledge – colloquiums, preparation of seminar papers, attendance and active participation in classes (lectures, exercises, seminars, field work), taking the final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper	0,2	Experimental work	
Written exam	1,2	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,4	Report		Practical work	
Portfolio		Program	1,2	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Nonveiller, E.: Soil Mechanics and Foundation of Buildings, Školska knjiga, Zagreb, 1979.

1.11. Supplementary literature

1. Nicholson, D.P., Tse, C.M., Penny, C.: The Observational Method in Ground Engineering: Principles and Applications, Report 185. CIRIA, London, 1999.
2. Wood, D.M.: Geotechnical Modelling, Spon Press, London, 2004.
3. Wyllie, D.C. and Mah, C.W.: Rock Slope Engineering, Civil and Mining, 4th. Edn., Spon Press, New York,Taylor & Francis Group, 2004.
4. Stillborg, B.: Professional Users Handbook for Rock Bolting, Trans Tech Publications, Series on Rock and Soil Mechanics, Vol. 18, 2nd Edn., Clausthal-Zellerfeld, 1994.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, 1979.	6	20-50

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Vedran Jagodnik, Ph.D.**	
Course	NUMERICAL MODELLING IN GEOTECHNICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Educating future engineers to understand the application of nonlinear continuum mechanics and constitutive equations in describing the behavior of real ground in practical problems and their solution by numerical methods. Introduces students to the functioning of numerical solution software packages Knowledge of different constitutive soil models as well as different numerical methods for solving partial differential equations.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Apply knowledge of continuum mechanics in the formation of a simple constitutive model.
2. Apply knowledge of constitutive models in the approximation of laboratory experiments.
3. Apply knowledge of finite differences methods to solve simple problems of geotechnical design.
4. Apply knowledge of the finite element method to solve simple problems of geotechnical design.
5. Understand the differences in the approach of nonlinear analysis

1.4. Content of the course

1. Fundamentals of Continuum Mechanics
2. Theory of elasticity
3. Theory of plasticity
4. Constitutive Models in Geotechnical Engineering
    - Mohr – Coulombov model
    - Drucker – Pragerov model
    - Cam – Clay and the modified Cam Clay
    - NorSand model
    - Hoek - Brownov model
5. Finite Differences Method
6. Finite element method

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures. Attendance at exercises. Creating a program.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. D. M. Wood, Soil Behaviour and Critical State Soil Mechncis. Cambridge, 1991

1.11. Supplementary literature

1. Naylor, D.J., Pande, G.N., Sompson, B., Tabb, R.: Finite Elements in Geotechnical Engineering, Pineridge Press Ltd., Swansa (UK), 1981, p. 245.
2. Bathe, K.J.: Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, New Jersey, 1984.
3. Desai, C.S., Abel, J.F.: Introduction to The Finite Element Method, A Numerical Method for Engineering Anaylisis, Van Nostrand Reinchold Company, New York, 1972, p.477.
4. D. Deb, Finite Element Method: Concepts and Applications in Geomechanics. Prentice-Hall of India, 2006.
5. S. Pietruszczak, Fundamentals of Plasticity in Geomechanics. Taylor & Francis Group, 2010.
6. D. M. Potts and L. Zdravković, Finite Element Analysis in Geotechnical Engineering: Theory. Thomas Telford, 1999.
7. D. Potts, Guidelines for the Use of Advanced Numerical Analysis. Thomas Telford, 2002.
8. J. Sorić, The Finite Element Method. Golden Marketing, 2004.
9. D. M. Wood, Geotechnical modelling. Spon Press, 2004.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
D. M. Wood, Soil Behaviour and Critical State Soil Mechncis. Cambridge, 1991	2	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.**	
Course	UNDERGROUND STRUCTURES AND TUNNELS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Students should understand and explain the techniques and principles of geotechnical design, observation, excavation and stabilization of the rock mass; select appropriate methods for specific geotechnical profile conditions and types of underground projects.

1.2. Conditions for enrolment in courses

Engineering Rock Mechanics

1.3. Expected learning outcomes for the subject

1. Define the basic principles of the behavior of the rock mass in the vicinity of underground openings with regard to the different characteristics of the rock mass, the method of excavation, the methods of substructure and the purpose
2. Define the principles of drainage, waterproofing and ventilation of tunnels
3. Distinguish between tunnels, shafts and underground structures
4. Numerically analyze changes in the state of stress and deformation during different phases of tunnel construction. Analyze the causes of possible instability of the rock mass in the vicinity of the tunnel, as well as the construction methods and stabilization measures commonly used in these conditions.
5. Compare different tunnel excavation technologies according to their possibilities of use, advantages and disadvantages. Independently develop simpler geotechnical designs of tunnels and underground structures

1.4. Content of the course

Classification of rock masses. Stresses in the vicinity of underground openings. Mechanisms of rock mass breakdown in the vicinity of underground openings. Analysis of instabilities resulting from the structural properties of the rock mass. Design of the tunnel substructure. Stabilization techniques: cables and anchors, shotcrete, steel arches, tubular umbrella. Tunnel excavation machines and other methods of excavation of underground structures under special conditions.
Blasting and classic excavation of underground openings. Tunnel ventilation. Drainage and waterproofing of tunnels. Use of underground spaces. Repositories of radioactive and other waste. Observations during the construction of the tunnel.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☒ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the modules Hydraulic Engineering, Roads and Urban Engineering	

1.7. Obligations of students

Attending lectures, attending exercises (cabinet and field), creating programs.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,5				

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Vrkljan, I.,: 2001., Engineering Rock Mechanics (digital version of the scripts). Faculty of Civil Engineering in Rijeka
2. Hoek, E.: Rock Engineering, A Course Notes, http://www.rocscience.com

1.11. Supplementary literature

1. Hudson, J.A., (editor-in-chief), 1993., Comprehensive Rock Engineering, Volume 1,2,3,4 i 5

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Vrkljan, I.: 2001., Engineering Rock Mechanics, Faculty of Civil Engineering in Rijeka	1	20-50
Hoek, E.: Rock Engineering, A Course Notes, http://www.rocscience.com	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Željko Arbanas, Ph.D.**	
Course	SLOPE STABILITY	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

It provides the student with an overview of knowledge about the problems of slope stability in the soil and rock mass. It allows him to identify slope stability problems in engineering practice, acquire the necessary knowledge to approach the analysis of these problems and get to know the existing experiences in this field. It introduces him to the development of methods of slope stability analysis.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the basic principles of instability in soil and rock mass.
2. Apply strength criteria to the stability of slopes in the soil and rock mass.
3. Describe the basic methods of slope stability analysis.
4. Analyze the slope stability of given software packages.
5. Explain the principles of remediation of instabilities in slopes.
6. List and describe the measuring equipment for monitoring the behavior of slopes.
7. Interpret the results of measured quantities on the measuring equipment and interpret the behavior of the slope condition.
8. Choose appropriate methods of instability analysis and possible remedial measures.

1.4. Content of the course

Principles and definitions. Types and processes in slopes. Investigative works. Measurements and observations. Soil and rock mass strength. Analyses of slope stability in the soil. Analyses of slope stability in the rock mass. Stabilization of slopes in the soil. Stabilization of slopes in the rock mass. Embanked buildings. The use of software in stability analyses. Special cases and materials.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes (lectures, exercises, field classes). Periodic examination of knowledge – colloquia. Report. Passing the final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	2	Report	1	Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Activities (field exercises) and continuous tests of knowledge during classes - 70%, final exam - 30%.

1.10. Compulsory literature

1. Nonveiller, E.: Sliding and stabilization of slopes, Školska knjiga, Zagreb, 1987.

1.11. Supplementary literature

1. Turner, A.K., Schuster, R.L.: Landslides, Investigation and Mitigation, Special report 247, Transportation Research Board, National Research Council, National Academy Press, p. 675, 1996.
2. Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, 1979.
3. Erismann, T.H. and Abele, G. (2001): Dyamics of Rockslides and Rockfalls. Springer-Vrelag, Berlin-Heidelberg -New York.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Nonveiller, E.: Sliding and stabilization of slopes, Školska knjiga, Zagreb, 1987.	4	20-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Leo Matešić, Ph.D.**	
Course	FOUNDATIONS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introducing students to the types of building foundations. It gives students an overview of the analyses of different types of foundation structures. It enables students to acquire knowledge and skills in the design of foundation structures and forms the basis for parts of other subjects.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish the basic facts related to geotechnical structures.
2. Describe the basic methods of soil improvement, slope repair and foundation.
3. Independently calculate stresses and deformations when solving problems of foundations, pits, slope stabilization, etc. with the use of computer programs, and analyze the resulting solutions.

1.4. Content of the course

Shallow foundation: soil breakdown, rigid foundation structures, elastic foundation structures. Deeply Foundation: soil breakdown, piles, diaphragms, horizontally loaded piles, wells, caissons, crates. Complex foundation structures. Dynamically loaded foundations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective courses in the Structures and Urban Engineering modules	

1.7. Obligations of students

Attendance at lectures. Attending exercises. Preparation of seminars and programs. Colloquium and final exam.

1.8. Monitoring student work							
Attending classes	2	Teaching activity		Seminar paper	0,75	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Nonveiller, E.: Soil Mechanics and Foundation of Buildings, Školska knjiga, Zagreb, p.780, 1979.

1.11. Supplementary literature

1. Naval Facilities Engineering Command: Foundation, Design Manual 7.01, Alexandria, VI, 1986.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, p.780, 1979.	6	20-50

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Sanja Dugonjić Jovančević, Ph.D.**	
Course	GEOHAZARDS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	20+10+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Basic understanding of the relationship between the endodynamics and exodynamics of the Earth and the phenomenon of geohazards, assessment, reduction and avoidance of geohazards, as well as the impact of spatial planning and construction on the change in the level of hazard and risk. Students will be prepared for later courses in geotechnics and hydraulic engineering.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the concepts of natural and anthropogenic hazard, risk and vulnerability of terrain
2. Define the impact of natural disasters on the environment and architectural heritage
3. Analytically evaluate with a geohazard map overlay system

1.4. Content of the course

Introduction: Hazard and Risk. Major natural disasters. Volcanic and seismic activity. River erosion, accumulation and the floods. Marine erosion and accumulation. Soil erosion and mass movements. Mapping and monitoring of gambling. Assessment, reduction and avoidance of geohazards.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes (lectures, exercises and field classes). Preparation and presentation of the seminar paper. Periodic examination of knowledge – colloquiums. Passing the final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	0,75	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Activities (classroom activity, creation and presentation of seminars, field exercises) and continuous checks knowledge during classes - 70%, final exam - 30%.

1.10. Compulsory literature

1. Bell, G.F. GEOLOGICAL HAZARD. Their assesment, avoidance and mitigation. Spon Press, London-New York, 2003.
2. Bell, G.F. ENVIRONMENTAL GEOLOGY, Principles and Practice. Blackwell Science, Cambridge, 1998.

1.11. Supplementary literature

1. Botkin, D.B.and Keller, E.A. ENVIRONMENTAL SCIENCE, John Wiley and Sons (4. ed.), 2003.
2. Bell, G.F. ENGINEERING GEOLOGY. Blackwell, 1995
3. van Westen, C.J., Application of geographic information systems to landslide hazard zonation. Vol. 1: Theory.- ITC Publication No. 15, Enschede, 1993.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Bell, G.F. GEOLOGICAL HAZARD. Their assesment, avoidance and mitigation. Spon Press, London-New York, 2003.	1	20-50
Bell, G.F. ENVIRONMENTAL GEOLOGY, Principles and Practice. Blackwell Science, Cambridge, 1998.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Lectorer Mirko Grošić, Ph.D.**	
Course	**GEOTECHNICS OF TRANSPORTATION STRUCTURES**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	25+20+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

It provides the student with an overview of knowledge about geotechnical problems in road construction. It enables him/her to determine the needs of learning about geotechnical problems of road construction in engineering practice, adopt necessary knowledge to approach the analysis of these problems and get to know the existing experiences in this field. It introduces him to the basic geotechnical aspects of road construction.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define basic geotechnical problems in traffic structures.
2. To clarify the role of exploration works as a basis for the design of traffic structures.
3. Describe methods of analysis of geotechnical structures in traffic structures.
4. Analyze slope stability problems on roads
5. Describe the principle of designing pavement structures.
6. Describe the methods of observation in the use of geotechnical structures on roads.

1.4. Content of the course

Geotechnical investigation works in road construction. Classifications of soils and rocks in road construction. Soil compaction. Embankments. Supporting structures. Slope stability. Protection against erosion. Drainage. Geotechnical aspect of pavement structures. Geotechnics in Tunnel Construction.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes (lectures, exercises, field classes). Periodic examination of knowledge – colloquia. Taking the final exam

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

70% colloquia and class activity, 30% final exam.

1.10. Compulsory literature

1. Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, p.780, 1979.
2. General Technical Conditions for Road Works, Institute of Civil Engineering of Croatia, Zagreb, 2001

1.11. Supplementary literature

1. Rodrigez, A.Rico, Del Castillo, H., Sowers, G.F.: Soil Mechanics in Highway Engineering, Trans Tech publications, Clausthal Zellerfeld, p.843, 1988.
2. Nonveiller, E.: Sliding and stabilization of slopes, Školska knjiga, Zagreb, p.204, 1987.
3. Hoek, E., Bray, J.W.: Rock Slope Engineering, 2nd. Edn., The Institute of Mining and Metallurgy, London, 527 p., 1977.
4. Hoek, E.: Rock Engineering, A Course Notes, http://www.rocscience.com, p. 313, 2000.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes in the course

Title	*Number of copies*	*Number of students*
Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, p.780, 1979.	6	20-40
General Technical Conditions for Road Works, Institute of Civil Engineering of Croatia, Zagreb, 2001	23	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Vedran Jagodnik, Ph.D.**	
Course	TESTING AND MONITORING IN GEOTECHNICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	20+45+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introduction to laboratory and field methods of testing soils, rocks and rock masses. Description of the role of geotechnical instrumentation during the various phases of the construction of facilities including embankments, dams, artificial and natural slopes, underground openings, drilled piles and shafts.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Describe and distinguish measuring equipment for monitoring geotechnical structures during construction.
2. Determine the role of the observational method and reverse analyses in geotechnics.
3. Interpret the results of the measured quantities on the measuring equipment and determine the need to interpret the behavior of the geotechnical structure.
4. Select the appropriate measuring equipment for individual geotechnical structures.

1.4. Content of the course

Laboratory and field tests of soil, rocks and rock masses. Application of geophysical methods for solving geotechnical problems and problems of environmental protection and earthquake engineering. Program Planning observations. Observation methods and devices (observation of groundwater, deformation, total stresses in the soil, changes in stress in the rock, temperature, stresses and deformations in the structure). Introduction to Eurocode 7 (ENV 1997-1:1994). General guides for the realization of the observation program. Examples of observations.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☒ Laboratories
	☐ Distance education	☐ Mentor work
	☒ Terrain Occurs	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance of classes (lectures, exercises and field classes). Creating a program. Passing the colloquium. Work in the laboratory.

1.8. Monitoring student work

Attending classes	2,2	Teaching activity		Seminar paper		Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	0,5	Laboratory	0,8		

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquium, program assignments, laboratory work 100% during classes

1.10. Compulsory literature

1. Vrkljan, I., 2001, Engineering Rock Mechanics (digital version of the scripts). Faculty of Civil Engineering in Rijeka
2. Dunnicliff, J., 1993., Geotechnical instrumentation for monitoring field performance, John Wiley and Sons, Inc, 577 p.

1.11. Supplementary literature

1. Harrison, J.P., Hudson, J.P., 2000., Engineering Rock Mechanics, Illustrative Worked Exsamples, Pergamon, 506 p.
2. Hudson, J.A. and Harrison J.P., 2000., Engineering Rock Mechanics, An introduction to the principles, Pergamon, 444 p.
3. Hudson, J.A., (editor-in-chief), 1993., Comprehensive Rock Engineering, Volume 1,2,3,4 i 5

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Vrkljan, I., 2001., Engineering Rock Mechanics, Civil Engineering Faculty of Rijeka	1	20
Dunnicliff, J., 1993., Geotechnical instrumentation for monitoring field performance, John Wiley and Sons, Inc, 577 p.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Martina Vivoda Prodan. Ph.D.**	
Course	SOIL AND ROCK REINFORCEMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Educating future engineers with soil and rock reinforcement techniques. Introduction to the procedures of reinforcement and the applied methods of calculation of reinforced soils and rock mass. Getting to know the basics designing the implementation of the reinforcement process.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. List possible techniques for strengthening the soil and rock mass.
2. Determine the roles of soil reinforcement and rock mass
3. Describe the methods of soil reinforcement and rock mass analysis.
4. Describe the measuring equipment for verifying the contribution of the reinforcement element during construction.
5. Interpret the results of measured quantities on measuring equipment and determine geotechnical behaviors constructions.
6. Choose the appropriate technology for strengthening the soil and rock mass.

1.4. Content of the course

Project requirements and choice of procedures. Consolidation of soil by preload and drains. Deep compaction (vibroflotation, dynamic compaction). Soil reinforcement and geotextiles. Grouting of soil and rocks. Improvement of rocks and soil by anchoring (prestressed and rod anchors). Analyses of stability and state of stress and deformation. Design. Test fields. Technical conditions and regulations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures, exercises and field classes. Preparation of seminars, periodic examinations of knowledge- colloquia, taking the final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity	0,1	Seminar paper	0,6	Experimental work	
Written exam	0,6	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,7	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Nonveiller, E.: Soil Injection, Školska knjiga, Zagreb, 1989, p. 274.
2. Koerner, R.M.: Construction and Geotechnical Methods in Foundation Engineering, McGraw -Hill Book Company, NY, 1984, p. 496.

1.11. Supplementary literature

1. Hobst, L., Zajic, L.: Anchoring in Rock, Developments in Geotechnical Engineering, Vol. 13, Amsterdam: Elsevier Scientific Publishing Co., 1977, p. 390.
2. Stillborg, B.: Professional Users Handbook for Rock Bolting, Trans Tech Publications, Series on Rock and Soil Mechanics, Vol. 18, 2nd Edn., Clausthal-Zellerfeld, 1994, p164.
3. Windsor, C.R., Thompson, A.G.: Terminology in Rock Reinforced Practice, Proc. 2nd North American Rock Mechanics Conference NARMS'96 – Tools and Techniques, Montreal, Eds. M. Aubertin, F. Hassani and H. Mitri, V1, Rotterdam: A. A. Balkema, 1996, pp. 225 – 232.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Nonveiller, E.: Soil Injection, Školska knjiga, Zagreb, 1989, p. 274.	4	0-20
Koerner, R.M.: Construction and Geotechnical Methods in Foundation Engineering, McGraw -Hill Book Company, NY, 1984, p. 496.	5	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Martina Vivoda Prodan, Ph.D.**	
Course	SEEPAGE AND CONSOLIDATION IN THE SOIL	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The course studies the flow of water in incompressible and compressible soil. The course should enable the student to the correct way formulates the solution of a real engineering problem, either by direct analytical or numerical methods.

1.2. Conditions for enrolment in courses

Theoretical soil mechanics

1.3. Expected learning outcomes for the subject

1. Distinguish the basic principles of stationary and non-stationary water flow in the soil.
2. Describe the concept of potential and potential field in the soil.
3. Describe the flow of water in the soil and the process of soil consolidation.
4. Analyze the basic solutions of differential equations of flow and consolidation in soil.
5. Analyze basic numerical solutions and the representation of soil flow and consolidation in one-dimensional, two-dimensional and three-dimensional space.
6. Describe the basic principle of flow and consolidation in unsaturated soil.

1.4. Content of the course

Water in the soil: capillarity, clamping, swelling, the action of frost. Effective stresses in the soil. Water flow in the soil: permeability, power grid, flow force, critical hydraulic gradient. Measurement of water permeability. Seepage control. The process of consolidation. Edometric experiment. Preconsolidation strain. Speed of consolidation. Consolidation subsidence calculations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures. Attending exercises. Preparation of a seminar paper. Lectures and colloquiums final exam.

1.8. Monitoring student work							
Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Holtz, R.D. & Kovacs, W.D. (1981) An Introduction to Geotechnical Engineering. Prentice Hall
2. Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, p.780, 1979.

1.11. Supplementary literature

1. Azizi, F. (1999) Applied Analyses in Geotechnics. Brunner-Routledge
2. Šuklje, L. (1969) Reological aspects of soil mechanics, London

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Holtz, R.D. & Kovacs, W.D. (1981) An Introduction to Geotechnical Engineering. Prentice Hall	3	
Nonveiller, E.: Soil Mechanics and Building Foundations, Školska knjiga, Zagreb, p.780, 1979.	6	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	ENVIRONMENTAL PROTECTION	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	15+0+30

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Preparing students for a basic understanding of the global ecological system, the importance of biodiversity and biogeochemical cycles, then the basic principles of environmental protection and the possible negative impact of construction works. Students will be prepared for later courses: Geohazards, Transport and Environment and Waste Management.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Define the basic principles of environmental protection and its components, as well as laws and regulations in this field 2. Define the ways in which the global environment and its components (air, water, sea and soil) and regulations are endangered related to it 3. Define the impact of construction activities on endangering the environment and protection measures in this regard		
1.4. Content of the course		
Basic principles of environmental protection. Global ecosystem: the interaction of the geosphere, hydrosphere, biosphere and atmosphere. Human activity and environmental changes. Climate change. Sea level changes. Pollution and protection of surface and groundwater. Pollution and protection of seas and oceans. Soil pollution and protection. Construction works and environmental protection. Waste Management. Nature protection in the Republic of Croatia. Environmental protection in the Republic of Croatia. Sustainable development planning.		
1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures. One seminar and a colloquium during the lecture period. Final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar and colloquium 70%, final exam 30%.

1.10. Compulsory literature

1. Benac, Č. ENVIRONMENTAL PROTECTION FOR STUDENTS OF CIVIL ENGINEERING. Faculty of Civil Engineering, University of Rijeka,2004.
2. Glavač, V., INTRODUCTION TO GLOBAL ECOLOGY. Croatian University Fee, Ministry of Environmental Protection and Physical Planning, Public Open University-Zagreb. Zagreb, 2001.

1.11. Supplementary literature

1. Springer, P.O., ed., ECOLOGICAL LEXICON. Ministry of Environmental Protection and Physical Planning, Barbat, Zagreb. Zagreb, 2001.
2. Botkin, D.B.and Keller, E.A. ENVIRONMENTAL SCIENCE, John Wiley and Sons (4. ed.), 2003
3. Prohić, E., GEOKEMIJA. Targa Zagreb, Zagreb, 1998
4. Črnjar, M.,: ECONOMICS AND ENVIRONMENTAL POLICY. Faculty of Economics, University of Rijeka, Glosa River. Rijeka, 2002.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Benac, Č. ENVIRONMENTAL PROTECTION FOR STUDENTS OF CIVIL ENGINEERING. Faculty of Civil Engineering, University of Rijeka, 2004	2	0-40
Glavač, V., INTRODUCTION TO GLOBAL ECOLOGY. Croatian University Fee, Ministry of Environmental Protection and Physical Planning, Public Open University-Zagreb. Zagreb, 2001.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Barbara Karleuša, Ph.D.**	
Course	HYDRAULIC STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to hydraulic structures, their role and functions, and the basics their design and construction. To train students to independently solve problems related to the design of hydraulic structures and their elements.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define, describe and sketch the types of hydraulic structures with special emphasis on dams and parts of dams (spillways, foundation outlets, inrush structures, etc.)
2. Enumerate, define and describe the environmental impacts of dams
3. Choose the appropriate type of dam, overflow, foundation outlet, intake structure, water evacuation during construction, etc. based on the analysis of available data and substrates
4. Develop a conceptual design of the dam with all its parts (which includes: writing a technical description, hydraulic calculations and dimensioning, graphical representation of solutions - situation, longitudinal profiles, characteristic cross-sections, details, etc.)

1.4. Content of the course

Introduction, basic concepts, historical overview. Place in the role of hydrotechnical structures in solving water management problems, the basics of solving and the choice of solutions. Inspection of hydraulic structures. Investigative works. Changes in the environment through the construction of hydrotechnical facilities. Foundation, grouting, diaphragms. Accumulations: purpose, dimensioning, watersustainability, management. Dams: purpose, types, loads, oscultations. Concrete defend; types, properties, calculations. Embankments and embankments. Sluices, overflows, outlets, culverts, waterfalls. Hydromechanical equipment. Protection of construction sites from water, pollution and derivation. Conductors with a free water face (channels, tunnels, pipelines). Pressurized conductors (pressure pipes, hydrotechnical tunnels). Hydropower plants. Pumping stations. Buildings in the river bed. Flood defence. Inland navigation.

1.5. Types of execution teaching		
	☒ Class	☒ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☒ Terrain Occurs	☐ Other _____

1.6. Comments	Elective on the module: Geotechnics

1.7. Obligations of students

Attending lectures, exercises and field classes according to the standards of the faculty. Production, handover and presentation of the program from exercises before the end of the semester. Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Stojić, P.: Hydrotechnical Structures I, Split, Faculty of Civil Engineering in Split, 1997.
2. Stojić, P.: Hydrotechnical Structures II, Faculty of Civil Engineering in Split, Split, 1998.
3. Stojić, P.: Hydrotechnical Structures III, Faculty of Civil Engineering in Split, Split, 1999.

1.11. Supplementary literature

1. Savić, Lj.: Introduction to Hydraulic Engineering Structures, Faculty of Civil Engineering in Belgrade, Belgrade, 2003.
2. Nonveiller, E: Nasute brane, Školska knjiga, Zagreb, 1983.
3. Design of Small Dams, United States Government Printing, 3rd edition, 1987.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Stojić, P.: Hydrotechnical Structures I, Split, Civil Engineering Faculty in Split, 1997	7	20-40
Stojić, P.: Hydrotechnical Structures II, Civil Engineering Faculty in Split, Split, 1998.	6	
Stojić, P.: Hydraulic Engineering Structures III, Construction Faculty in Split, Split, 1999.	6	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Nevenka Ožanić, Ph.D.**	
Course	ENGINEERING HYDROLOGY	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To ensure that within the course students master the basic knowledge and ideas about runoff processes and models. To provide students with an insight into stochastic processes and time series. To train students for independent implementation of basic regional hydrological analyses.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Analyze the spatial-temporal distribution of precipitation and variations of short-term intense precipitation over time
2. Create a simple model of heavy precipitation and showers for design
3. Create simple models of linear and nonlinear runoff processes
4. Define multiple distribution functions of individual measured parameters
5. To make hydrological forecasts using ARMA and ARIMA, and multiple-regression models
6. Apply simpler generation of synthetic time series data for the forecast of individual events
7. To make a simpler regionalization of the stochastic peculiarities of water phenomena in the basin

1.4. Content of the course

Processes in the atmosphere and hydrological phenomena. Precipitation: analysis of spatial-temporal distribution of precipitation, variations of short-term intense precipitation over time, modelling of heavy precipitation, showers for design. Water infiltration into the soil. Processes of interrelation of precipitation and runoff: linear and nonlinear modelling of runoff processes, Hydrogram analyses. Regional hydrological analyses. Hydrological forecasts. Multiple distribution functions. Stochastic processes and time series. Stochastic analysis of extreme events. Spectral analyses. Markov processes. Generation of synthetic time series. Self-regression models. ARMA and ARIMA models. Multiple-regression models. Regionalization of stochastic peculiarities of water phenomena in river basins.

1.5. Types of teaching	☒ Class	☒ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☒ Laboratories
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	Elective on the module: Urban Engineering

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Development and submission of exercise programs (application of statistical and parametric methods in hydrological calculations). Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Žugaj, R., Hydrology, Faculty of Mining, Geology and Petroleum Engineering, Zagreb, 2000.

1.11. Supplementary literature

1. Suhir, E.: Applied Probability for Engineers and Scientists. McGraw-Hill, New York, 1997.
2. Srebrenović, D.: Applied Hydrology, Tehnička knjiga, Zagreb, 1986.
3. Bonacci, O.: Karst Hydrology, Springer Verlag, Heidelberg, 1989.
4. Bonacci, O.: Precipitation - the main input quantity in the hydrological cycle, University Textbook, Geing, Split, 1994.
5. Ožanić, N.(editor).: Handbook for Hydrotechnical Land Reclamation, III Round, Book 1, Faculty of Civil Engineering in Rijeka, Rijeka, 2003.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Žugaj, R., Hydrology, Faculty of Mining, Geology and Petroleum Engineering, Zagreb, 2000.	4	20-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Igor Ružić. Ph.D.**	
Course	COASTAL ENGINEERING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Secons	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Developing specific competencies of students on statistical methods for determining project conditions of waves, geotechnical aspects of construction in the coastal area, dynamic impacts of the sea on coastal and coastal off-shore structures, the problems of dissected coastal structures, the properties and changes in the properties of building materials exposed to the action of the sea.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define and explain numerical methods for determining design wave conditions
2. Define and explain numerical methods for the assessment of geotechnical influences
3. Enumerate, describe and apply different methods for the design and construction of embanked, dissected and massive coastal structures
4. Define and explain the degradation processes of building materials in the marine environment
5. Develop a coastal construction project

1.4. Content of the course

Statistical Methods in Coastal Engineering. Foundation, consolidation and subsidence of coastal and off-shore structures. Natural sediment transport and drift induced by coastal structures. Dynamic influences on vertical walls, rod and tile profiles in the sea. Calculation and sizing of elastic line underwater structures (pipelines). Calculation and dimensioning of dissected coastal structures. Properties and corrosion of building materials in the marine environment.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective courses in the modules: Geotechnics, Structures and Urban Engineering	

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Development and submission of programs and seminars from exercises before the end of the semester. Colloquiums.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. USACE Engineering manuals http://www.usace.army.mil/inet/usace-docs/eng-manuals/em.htm
2. WEB script of the Faculty of Civil Engineering in Zagreb, 2019.

1.11. Supplementary literature

1.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
USACE Engineering manuals http://www.usace.army.mil/inet/usace-docs/eng-manuals/em.htm	Available online	20-50
WEB script of the Faculty of Civil Engineering in Zagreb, 2019.	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Barbara Karleuša, Ph.D.**	
Course	DRAINAGE AND WASTEWATER TREATMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To ensure that within the course students master the knowledge necessary to solve complex problems. hydrotechnical tasks in the field of drainage and wastewater treatment, as well as the detection of interconnections natural and built water systems. To train students for the independent realization of complex tasks in the field of drainage and wastewater treatment.

1.2. Conditions for enrolment in courses

Computational Hydraulics

1.3. Expected learning outcomes for the subject

1. To develop a conceptual design of a complex sewerage system (which includes: writing a technical description, hydraulic calculation and dimensioning, graphical presentation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)
2. Analyze and calculate the quantities of sanitary rainwater, industrial and other people's water that needs to be disposed of by the drainage system
3. Analyze potential wastewater and stormwater receivers into which water will be discharged after appropriate treatment
4. Choose the appropriate type of sewage system based on the analysis and comparison of different solutions
5. Enumerate, define and describe wastewater treatment processes
6. Analyze and compare potential wastewater and stormwater treatment procedures according to discharged water standards and receiver standards, and choose the appropriate treatment process

1.4. Content of the course

General issues and principles of drainage and protection of wastewater and rainwater in settlements. Types and basic physical, chemical-biological and microbiological characteristics of water. Properties of wastewater. Types of drainage systems. Features of the recipient and water protection. Basic schemes of sewage systems. Relevant quantities of wastewater and rainwater for the dimensioning of the channel. Design of the sewerage network. Horizontal and vertical routing. Limitations of project parameters. Dimensioning of the sewer network. Static calculation of collectors. Sewerage system facilities: unloading structures, pumping stations, retention basins, sewerage system equipment. Outlets: types, hydraulic, static and environmental dimensioning. Maintenance and management of sewage. Wastewater treatment plant. Mechanical purification (grates and sieves, comminutors, settling tanks and separators). Biological treatment (aerated tanks with active sludge, lagoons, drip trays, swivel biological carriers, anaerobic digesters). Physicochemical purification. Sludge treatment.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒Terrain Occurs	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Urban Engineering	

1.7. Obligations of students

Attending lectures, exercises and field classes according to the standards of the faculty. Creation and submission of the program from the exercises before the end of the semester. Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes (field classes included), colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Margeta, J.: Sewerage of settlements: drainage and disposal of wastewater and rainwater; Faculty of Civil Engineering and Architecture in Split, 2009.
2. Margeta, J.: Rainwater and Wastewater: Pollution Burden and Protection Measures, Faculty of Civil Engineering and Architecture in Split, 2007
3. Tedeschi, S.: Water Protection, HDGI, Zagreb, 1997.

1.11. Supplementary literature

1. Vuković, Ž.: Basics of Hydraulic Engineering (Part One, Book Two), Aquamarine, Zagreb, 1996.
2. Steel, E. W., Mc Ghee T. J.: Water Supply and Sewerage, Mc Graw Hill Book Company, London, 1988.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Margeta, J.: Sewerage of Settlements: Drainage and disposal of wastewater and rainwater; Faculty of Civil Engineering and Architecture in Split, 2009	10	20-40
Margeta, J.: Rainwater and Wastewater: Cargo Pollution and Protection Measures, Faculty of Civil Engineering and Architecture in Split, 2007	2	
Tedeschi, S.: Water Protection, HDGI, Zagreb, 1997.	10	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Nevenka Ožanić, Ph.D.**	
Course	HYDRAULIC REGULATIONS AND MELIORATIONS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To ensure that within the course students master the elements of engineering perception, reasoning and solving hydrotechnical tasks in the domain of regulation and land reclamation structures. Enable students for independent solving of tasks and calculations in the field of river flow regulation and land reclamation.

1.2. Conditions for enrolment in courses

Computational Hydraulics

1.3. Expected learning outcomes for the subject

1. To develop a conceptual solution for the regulation of a simpler watercourse (which includes: writing a technical description, hydrological and hydraulic calculation and dimensioning, graphic presentation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)
2. To develop a conceptual solution for a simpler regulation (which includes: writing a technical description, hydrological and hydraulic calculation and dimensioning, graphic representation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)
3. To develop a conceptual design of a simpler land reclamation building (which includes: writing a technical description, hydrological and hydraulic calculation and dimensioning, graphic representation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)
4. To develop a conceptual solution for a simpler irrigation system (which includes: writing a technical description, hydrological and hydraulic calculation and dimensioning, graphic representation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)

1.4. Content of the course

Purpose, problems and tasks of watercourse regulation. Morphology of the river flow. Drawn and suspended drift; The function of the nanny. Longitudinal and transverse structures; embankments. Regulation structures. Regulation of the water regime; Accumulation; Retention; vent ducts. Flood defence; regulations; technique. Building materials code regulation. Erosion processes; Division and classification of torrents. Basics of basin management; technical and biological measures. Stages of the arrangement of torrents and torrential buildings. Plant-soil-water relationships. Drainage systems. Detailed drainage systems. Planning detailed underground drainage systems. Construction of drainage systems. Soak. Quality and origin of soaking water. Calculation of water needs for irrigation. Elements of the irrigation system. Drive soaking. Soaking methods. Planning and design of irrigation systems.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Urban Engineering	

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Development and submission of exercise programs (development of solutions for water flow regulation and/or land reclamation). Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report	0,5	Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Gjurović, M.: Regulation of Rivers, Tehnička knjiga Zagreb, 1967.
2. Svetličić, E.: Open Watercourses - Regulation. Faculty of Civil Engineering, University of Zagreb, 1987
3. Kos, Z.: Hydrotechnical Soil Reclamation - Irrigation, Školska knjiga Zagreb, 1987.
4. Kos, Z.: Hydrotechnical Land Reclamation - Drainage, Školska knjiga Zagreb, 1989

1.11. Supplementary literature

1. Chin A.D.: Water – Resources Enginnering, Prentice Hall, New Jersey, 2000.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Gjurović, M.: Regulation of Rivers, Tehnička knjiga Zagreb, 1967.	1	20-40
Svetličić, E.: Open Watercourses - Regulation. Faculty University of Zagreb, 1987.	2	
Kos, Z.: Hydrotechnical Land Reclamation - Irrigation, Školska knjiga Zagreb, 1987.	5	
Kos, Z.: Hydrotechnical Soil Reclamation - Drainage, Školska knjiga Zagreb, 1989.	7	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Elvis Žic, Ph.D.**	
Course	**WATER SUPPLY AND WATER TREATMENT**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To ensure that within the course students master the knowledge necessary to solve complex hydrotechnical tasks in the field of water supply and water conditioning, as well as to notice interconnections natural and built water systems. To train students for the independent realization of complex tasks from the domain of water supply and water conditioning.

1.2. Conditions for enrolment in courses

Computational Hydraulics (enrolled)

1.3. Expected learning outcomes for the subject

1. Develop a conceptual design for a complex water supply system (which includes: writing a technical description, hydraulic calculation and dimensioning of the water supply network, graphical presentation of the solution - situation, longitudinal profiles, characteristic cross-sections, details, etc.)
2. Analyze the needs for water and calculate the necessary quantities for the water supply of the population and industry, as well as for the needs of extinguishing fires in settlements and industry,
3. Analyze potential sources of drinking water and choose an appropriate source of water from the aspect of quantity and quality, and argue the choice
4. Choose the right type of water supply system based on the analysis and comparison of different solutions
5. Describe and sketch the captage of springs and groundwater and accompanying hydrotechnical facilities
6. Describe and sketch home plumbing
7. Define the ways of supplying water in emergency situations
8. Enumerate, define and describe the processes and phases of water conditioning
9. Analyze and compare potential water conditioning procedures according to the characteristics of the affected water, and choose the appropriate conditioning process.

1.4. Content of the course

Introduction: general importance of water and review of the issue of water supply and protection. Basic physical, chemical, biological and microbiological characteristics of water. Types of natural water sources. Protection zones. Water quality indicators for public water supply of the population. Types of consumers, supply norms, total need for supply of settlements, fluctuations in water consumption. Supporting buildings. Water supply systems: function, system foundation, facilities and their function. Water tanks: function, volume calculation, sizing, execution. Pumping stations: function, power calculation and selection of pumping units. Water supply pipes, fittings and plumbing fittings. Pipelines: routing, hydraulic calculation, execution. Pressure tests. Distribution water supply network of settlements: network,

permissible operating pressures, supply zones, network dimensioning, performance. Household connections and distribution network in buildings as the final part of the water supply system. Supply		
water in extraordinary circumstances. Physico-chemical and biological bases of the water conditioning process. Purification and disinfection procedures for drinking water. Desalination procedures.		
1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Urban Engineering as part of the course, two field visits to hydrotechnical facilities are organized.	

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Creation and submission of two software exercises before the end of the semester. Writing two colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,0	Report		Practical work	
Portfolio		Program	2,0	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Creation and submission of two program tasks, attendance at classes, Flash exam, field classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Gulić, I.: Water Supply, HSGI, Zagreb, 2000.
2. Gulić, I: Water Conditioning, HSGI, Zagreb, 2003.

1.11. Supplementary literature

1. Vuković, Ž.: Basics of Hydraulic Engineering (Part One, Book Two), Aquamarine, Zagreb, 1996.
2. Margeta, J.: Water Supply Part I, Faculty of Civil Engineering in Split, Split, 1985.
3. Steel, E. W., Mc Ghee T. J.: Water Supply and Sewerage, Mc Graw Hill Book Company, London, 1988.
4. Tedeschi, S.: Water Protection, HDGI, Zagreb, 1997.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Gulić, I.: Water Supply, HSGI, Zagreb, 2000.	20	20-40
Gulić, I: Water Conditioning, HSGI, Zagreb, 2003.	2	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Vanja Travaš, Ph.D.**	
Course	**EXPERIMENTAL HYDRAULICS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

In order for students to be able to participate in all phases of experimental research/testing in the chapters covered by hydraulic engineering, the aim of the course is to develop students' competencies in the field of experimental methods of mechanics and especially experimental hydraulics.

1.2. Conditions for enrolment in courses

Computational Hydraulics

1.3. Expected learning outcomes for the subject

1. Define and describe the experimental method.
2. Create an experiment project for the purpose of optimizing metrology activities.
3. Scale the prototype of the building to a laboratory or model scale.
4. Perform measurements of selected scalar, vector and tensor quantities.
5. Perform statistical processing of measured data.

1.4. Content of the course

1. Introduction to the College
2. Hydrotechnical Laboratory
3. Stream visualization
4. Statistical data processing
5. Designing Experiments
6. Model similarity
7. Signal Collection and Processing
8. Measurement of scalar quantities
9. Measurement of vector quantities
10. Measurement of tensor quantities

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☒ Laboratories
	☐ Distance education	☐ Mentors work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Regular attendance and active participation in classes. Participation in teamwork for the preparation of studies of laboratory tests. Presentation and defense of the study of laboratory tests. Taking the final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	1,0
Written exam		Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory		Made	0,5

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

The evaluation of learning outcomes is carried out during classes in laboratory exercises within which students in working groups prepare and conduct laboratory tests envisaged by the task previously defined by the teacher and necessary for the purpose of preparing a study of the conducted laboratory tests, which is also evaluated at the end of the semester. The final exam is oral.

1.10. Compulsory literature

1. Novak, P.; Čábelka, J.: Models in Hydraulic Engineering – Physical Principles and Design Applications, Pitman Publishers, London, 1981.

1.11. Supplementary literature

1. Goldstein R.J., Fluid Mechanics Measurements, Second edition, Taylor and Francis, London, 1996.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Novak, P.; Čábelka, J.: Models in Hydraulic Engineering – Physical Principles and Design Applications, Pitman Publishers, London, 1981.	1	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Ivana Sušanj Čule, Ph.D.**	
Course	WASTE MANAGEMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+10+5

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Introducing students to the basic understanding of the problem of waste in modern society, the problems of waste management, methods of reducing, reusing and recycling waste, problems of soil and water pollution by waste, understanding engineering problems in the design and construction of municipal waste landfills		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Define and describe types of waste and methods for determining the properties of waste. 2. List the basic elements of a landfill and describe their function. 3. Specify and explain the criteria for determining the favorable location of the landfill. 4. Indicate the factors affecting the composition and quantity of leachate and describe the leachate drainage from the landfill. 5. Explain the origin of gases at landfills. 6. Describe the method of degassing the landfill. 7. Describe the procedures for calculating the stability of the landfill. 8. Explain the phases and time course of landfill settling. 9. Describe the program of observations. 10. Define the types of radioactive waste and describe disposal procedures.		
1.4. Content of the course		
Modern civilization and the problem of waste. Types of waste. Municipal waste. Hazardous waste. Radioactive waste. Problems of soil and water pollution. Comprehensive waste management (reduction, reuse and recycling). Sanitary landfills. Design and construction of landfills. Monitoring of leachate and gases. Laws and regulations. The Role of the Public in Solving the Problem of Waste Avoidance, Evaluation and Disposal More Efficiently		
1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____

1.6. Comments	Elective in the module: Geotechnics and Hydraulic Engineering

1.7. Obligations of students

Attending lectures, exercises and seminars according to the standards of the faculty. Attending field classes and creating a program. Drafting, submitting and presenting a seminar paper. Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,8	Report		Practical work	
Portfolio		Program	0,2	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Milanović, Z. Deponij. ZGO-ZAGREB, Zagreb, 1992.
2. Jahić, M.: Urban Systems and Solid Waste Management. Faculty of Engineering. Bihać, 2005.
3. Jahić, M.: Sanitary Landfills. Faculty of Engineering, Bihać, 2006

1.11. Supplementary literature

1. Botkin, D.B.and Keller, E.A. ENVIRONMENTAL SCIENCE, John Wiley and Sons (4. ed.), 2003.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Milanović, Z. Deponij. ZGO-ZAGREB, Zagreb, 1992.	1	20-50
Jahić, M.: Urban Systems and Solid Waste Management. Faculty of Engineering. Bihać, 2005.	1	
Jahić, M.: Sanitary Landfills. Faculty of Engineering, Bihać, 2006	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Barbara Karleuša, Ph.D.**	
Course	WATER RESOURCES MANAGEMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Development of knowledge about the complexity and multidisciplinarity of water management issues. Introduction to various aspects of the occurrence of water in nature and built systems. Development of a methodological approach in the planning of water management solutions. Training to solve tasks in the field of planning and management of water resources.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain and apply appropriate methodological approaches in the domain of water management analysis problem
2. Generate variant solutions to problems related to water management and discuss the features of these solutions using systematic analysis, simulation and optimization modelling
3. Assess the impact of water management solutions on water systems and their environment
4. Evaluate water management solutions from an economic and social point of view
5. Develop concepts of program tasks in the field of water management

1.4. Content of the course

Basic concepts of water management: historical development, integrated approach, sustainable development. Water resources, Basin as a basic unit of management. Features of natural water systems: surface and groundwater, sea, transitional waters. Water Needs, Balancing Water Resources and Needs. Water Use, Water Protection, Water Protection. Types and characteristics of built water management systems, Reservoirs as the most complex structural multipurpose facilities, Human impact on changes in the water regime. Water and its role in the socio-economic system. Ecological component of hydrotechnical solutions. Planning the use of water resources: basics of planning, goals and criteria, methodology for generating and selecting water management solutions. Application of simulation and optimization methods in the selection of solutions. Information Support, Modelling management of water resources in the catchment area. Implementation of water management, Legislation, Water management bases and plans.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and seminars according to the standards of the faculty. Drafting, submitting and presenting a seminar paper. Creating program tasks at workshops. Colloquium. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Margeta, J.: Basics of Water Management. GF Split, 1992
2. Margeta, J.: An Integrated Approach to Water Management. In: Construction Yearbook '99 , HDGI, Zagreb, 1999.
3. Gereš,D., Filipović, M.: Water Management Planning Program in Croatia. In: Construction Yearbook 2000, HDGI, Zagreb, 2000.
4. Bonacci, O.: Ecohydrology of Water Resources and Open Water Open Watercourses, GAF in Split, IGH, 2003.

1.11. Supplementary literature

1. Gereš, D.: Modelling of water resources management in the catchment area. In: Construction Yearbook '01/'02, HDGI, Zagreb, 2002.
2. Grigg, N.S.: Water Resources Management: Principles,Regulations and Cases. McGraw-Hill,NY,1996.
3. Mays, L.W.(ed.): Water Resources Handbook. McGraw-Hill, New York, 1996.
4. Biswas, A.K.: Water Resources: Environmental Planning, Management and Development,, McGraw-Hill Book Comp.Inc., New York, 1997.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Margeta, J.: Basics of Water Management. GF Split, 1992	10	
Margeta, J.: An Integrated Approach to Water Management. In the: Construction Yearbook '99 , HDGI, Zagreb, 1999	1	

Gereš,D., Filipović, M.: Water Management Program planning in Croatia. In: Construction Yearbook 2000, HDGI, Zagreb, 2000.	1	0-40
Bonacci, O.: Ecohydrology of Water Resources and Open Water Open Watercourses, GAF in Split, IGH, 2003.	2	
1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies		
Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.		

Back to the list of courses

General information		
Course leader		
Course	KARST HYDROSYSTEMS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Ensuring basic knowledge about the characteristics of karst environments and the laws of occurrence and movement of water in them. Development of the ability to recognize the specifics of water management problems of karst. Training for independent solving of basic tasks in the planning and use of water management interventions in karst.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Recognize the specifics of the occurrence and functioning of water resources and solutions for technical interventions in karst
2. To carry out hydrological analyses related to the surface and underground karst hydrographic network – analyses runoff, losses, the dynamics of groundwater leakage and fluctuations, aquifer emptying
3. To link the hydrological cycle with the characteristics of water quality
4. To investigate the water regime and the functioning of water resources in karst
5. Conduct a regional analysis and create synthetic conclusions about the analyzed water phenomena

1.4. Content of the course

Geological basis of karst. General principles of water movement in karst. Karst hydrology. Cavities in karst rocks. Hydraulic conductivity. Karst aquifers. Springs in the karst. Source flow curves. Analysis of the components of the runoff hydrogram. Principles of Salinization of Coastal Karst Springs and Aquifers. Watercourses and fields in karst. Balance of karst fields. Analyses of sinking and capacity of abyssal zones. Groundwater dynamics in karst aquifers. Analyses of water level fluctuations. Water temperatures in karst. Transport of sediment through karst aquifers and impact on water quality. Hydrological models of karst aquifers. Human Influence on the Water Regime in Karst. Peculiarities of hydrotechnical interventions in karst. Capture of karst origins. Water abstractions from karst aquifers. Regulation of watercourses in karst environments. Accumulations in karst. Protection of water in karst. Hydrological elements of the designation of zones of sanitary protection of water in karst. Specifics of planning and water management in karst.

1.5. Species Run teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and seminars according to the standards of the faculty. Attendance at the field. Drafting, submitting and presenting a seminar paper. Colloquiums.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of seminars, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Bonacci, O.: Karst hydrology, Springer Verlag, 1987.
2. Bonacci, O., Roje-Bonacci,T: Peculiarities of Karst Aquifers, Construction Yearbook 03-04, Croatian Association of Civil Engineers, Zagreb, 2004.
3. Breznik, M.: Storage reservoirs and deep wells in karst regions. Balkema, Rotterdam - Brookfild, 1998.

1.11. Supplementary literature

1. Petrič, M.: Characteristic of recharge-discarge relations in karst aquifer, Slovene academy of scieneces and arts, Karst research institute, Postojna – Ljubljana, 2002.
2. Trček, B.: Epikarst Zone and the Karst Aquifer Behaviour, Geološki zavod Slovenije, Ljubljana, 2003.
3. Bogli, A.: Karst Hydrology and Physical Speleology, Springer Verlag, Berlin, 1980.
4. Milanović, P.: Karst Hydrology, WRP, Littletoon, 1981.
5. Dreydroat, W.: Processes in Karst Systems, Springer Verlag, Berlin, 1988.
6. Ford, D., Williams, P.: Karst Hydrogeology and Geomorphology, Wiley, Chichester, 2007.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Bonacci, O.: Karst hydrology, Springer Verlag, 1987.	6	0-20
Bonacci, O., Roje-Bonacci,T: Peculiarities of the Karst aquifers, Construction Yearbook 03-04, Croatian Association of Civil Engineers, Zagreb, 2004.	1	
Breznik, M.: Storage reservoirs and deep wells in karst regions. Balkema, Rotterdam - Brookfild, 1998.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies
Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Barbara Karleuša, Ph.D.**	
Course	WATER POWER DEVELOPMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to the basic principles of the use of hydropower, hydroelectric power plants and their equipment, as well as the environmental impacts of the construction of such facilities.

To train students to solve tasks in the field of water power use.

1.2. Conditions for enrolment in courses

Hydrotechnical structures

1.3. Expected learning outcomes for the subject

1. Define and describe forms of energy in nature.
2. Define, describe and sketch the ways of using hydropower (hydropower)
3. Define, describe and sketch types of hydroelectric power plants with all parts (turbines, inlet structures, pressure pipelines...)
4. Select the appropriate type of HPP and all its elements (turbines, design of the entrance structure, design of the diffuser, etc.) based on the analysis of available data and substrates
5. To develop a conceptual design for the inlet structure of the supply and pressure pipeline to the HPP
6. Calculate the energy and power of HPP (for the gate and derivation type of HPP)
7. Determine the volume of the reservoir and the manner of using water from the reservoir for daily, weekly, annual, multi-year and dispatch flow leveling
8. Consider the environmental impacts of HPPs

1.4. Content of the course

The energy and power of water in nature. The basic principle of the use of water power. Strength and energy needs, role the water forces. Types of hydroelectric power plants (HPPs). Exploration works from the point of view of the use of water power. Hydropower calculations and analyses of water flows. Calculation of power and energy at variable drops and flows. Economic characteristics of HPP. Impact of HPPs on the environment. Size and choice of construction size. Low-pressure HE. Medium and high pressure HPPs. The main group of buildings in HE. Water turbines – basic properties and purview. Other HPP equipment (generators, transformers, switchyards, control and maintenance). Use and maintenance of HPP. Examples of derived HE. Pumped-storage HPPs. Small HPPs. Use of water power in water transport systems. Use of tidal energy, and waves.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Creation and submission of the program from the exercises before the end of the semester. Colloquium. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Stojić, P.: Hidroenergetics, Faculty of Civil Engineering in Split, Split, 1995.
2. Đorđević, B.: Use of Water Power - Basics of Hydropower Water Use, Faculty of Civil Engineering and Belgrade, Belgrade, 1981.
3. Đorđević, B.: Utilization of Hydroelectric Power – Hydroelectric Power Plant Facilities; Scientific Book and Faculty of Civil Engineering in Beograd, Belgrade, 1989.
4. Žugaj, M.: Special Analyses in Hydraulic Engineering, Civil Engineering Institute, Zagreb, 1981.

1.11. Supplementary literature

1. Mosony, E.: Water Power Development, Vol. I-II, Budapest, Akademiai Kiado, 1987; Third Ed.
2. Civil Engineering Guidelines for Planning and Designing Hydroelectric Developments; Vol 1-3; New York, American Society of Civil Engineers, 1989.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Stojić, P.: Hidroenergetics, Faculty of Civil Engineering in Split, Split, 1995.	5	0-20
Đorđević, B.: Use of water power - Basics Hydropower Utilization of Water, Faculty of Civil Engineering in Beograd, Belgrade, 1981.	4	
Đorđević, B.: Utilization of Hydroelectric Power – Hydroelectric Power Plant Facilities; Scientific book and Faculty of Civil Engineering, Belgrade, 1989.	6	

Žugaj, M.: Special Analyses in Hydraulic Engineering, Civil Engineering Institute, Zagreb, 1981	2	
1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies		
Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.		

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General information		
Course leader	**Prof. Vanja Travaš, Ph.D.**	
Course	HYDRAULIC MODELLING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To ensure that within the course students master the elements of engineering perception, reasoning and solving tasks in hydrotechnical modelling. To train students for the independent realization of tasks in hydrotechnical modelling.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain and analyze stationary and non-stationary processes.
2. Explain the boundary layer and the models that describe it
3. Enumerate, describe and explain numerical methods of modelling fluid motion necessary for the design of hydraulic structures
4. Enumerate and explain the laws of similarity, and types of physical and mathematical models
5. Define and explain hybrid, two-phase and other types of models
6. To make a simpler model-nature correlation analysis

1.4. Content of the course

Equations of motion. the dominant forces. Stationary and non-stationary processes. Boundary layer. Description models boundary layer. Methods of modelling fluid motion. Importance in the design of hydrotechnical facilities. Types and choice of models. Physical models. The Laws of Similarity. Limitations and advantages. Types of models. Mathematical models. Numerical methods of solving. Limitations and advantages. Stability and reliability of the model. Hybrid models. Far and near field of modelling. Other types of models. Two-phase models. Liquid phases. Mixed stages. Transmission of substances. Model-nature correlation analysis.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Attendance at laboratory exercises. Creation and submission of the program from the exercises. Colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Lamb, H.: Hyhrodinamics, Dover Publications, New York, 1945.
2. Kobus, H.: Hydraulic Modelling, German Association for Water Resources and Land Improvement, Verlag PaulParcy, Hamburg, 1980.
3. Novak, P.; Cabelka, J.: Models in Hydraulic Engineering, Physical Principles and Design Applications, Pitman Advanced Publishing Program, Boston, 1981.

1.11. Supplementary literature

1. Jović, V.: Introduction to Modelling of Hydraulic Processes, Aquarius, Split, 1983.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Lamb, H.: Hyhrodinamics, Dover Publications, New York, 1945.	1	0-40
Kobus, H.: Hydraulic Modelling, German Association for Water Resources and Land Improvement, Verlag PaulParcy, Hamburg, 1980.	1	
Novak, P.; Cabelka, J.: Models in Hydraulic Engineering, Physical Principles and Design Applications, Pitman Advanced Publishing Program, Boston, 1981.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Vanja Travaš, Ph.D.**	
Course	COMPUTATIONAL HYDRODYNAMICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The main goal of the course is to prepare students for the use of advanced software packages for modelling turbulent fluid flows (primarily liquids). To this end, the curriculum contains selected theoretical aspects of turbulent flows and the basics of numerical flow analysis methods.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define a digital model of the spatial dome of the flow using the SALOME program.
2. Discretization of the spatial dome of the flow using the SALOME program.
3. Define initial and boundary conditions using the SALOME program.
4. Define turbulent model parameters using the OPENFOAM program.
5. Perform a numerical flow analysis using the OPENFOAM program.
6. Visualize numerical flow analysis data using the PARAVIEW program.
7. Analyze numerical flow analysis data using the PARAVIEW program.

1.4. Content of the course

Computational fluid dynamics. The kinematics of the continuum. Laws of conservation and thermodynamic restrictions. Rheology and selected rheological models. Navier-Stokes equations. Boundary and initial conditions. Determination of the pressure field. Basics of the finite difference method. Basics of the finite element method. Basics of the finite volume method. Theoretical foundations of numerical methods. Discretization of the flow domain. Turbulence. Turbulence modelling. Visualization and validation of results.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Regular attendance and active participation in classes. Independent creation of a program task. Presentation and defense of the program task. Taking the final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam		Viva voce	0,5	Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Assessment and evaluation of students is carried out in lectures and as part of exercises within which students independently create a numerical model of the spatial flow of fluids. Continuous work and progress in work and the complexity of the numerical model are evaluated. The final exam is oral.

1.10. Compulsory literature

1. Abbott M., Basco D.: Computational Fluid Dynamics An Introduction for Engineers, John Wiley, New York, 1989.
2. P. Wesseling: Principles of Computational Fluid Dynamics. Springer, 2001.

1.11. Supplementary literature

1. R.W. Lewis, P. Nithiarasu, K. Seetharamu: Fundamentals of the finite element method for heat and fluid flow. John Wiley & Sons, 2004.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Abbott M., Basco D.: Computational Fluid Dynamics An Introduction for Engineers, John Wiley, New York, 1989.	1	0-20
P. Wesseling: Principles of Computational Fluid Dynamics. Springer, 2001.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Ivica Kožar, Ph.D.**	
Course	INVERSE MODELLING IN STRUCTURAL EVALUATION	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the basic properties of inverse problems and give some examples
2. Describe inverse systems in matrix form
3. Solve simpler optimization problems using Mathcad and Matlab
4. Solve simpler inverse modelling tasks using Mathcad and Matlab

1.4. Content of the course

Introduction, Inverse Problem Examples. Inverse system in matrix form. decomposition of singular values. Solving by optimization.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures, creating program tasks on the computer and seminar papers, final exam.

1.8. Monitoring student work							
Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	2	Labortorij			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Liu, G.R., Han, X.: Computational Inverse Techniques in Nondestructive Evaluation, CRC Press, 2003.

1.11. Supplementary literature

1. Kožar, Ivica: Computer Programs, Construction Yearbook 1997, pp.565-574.
2. MathCAD 2001 user manual.
3. MATLAB and SYMULINK user manual.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Liu, G.R., Han, X.: Computational Inverse Techniques in Nondestructive Evaluation, CRC Press, 2003.	1	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Ivica Kožar, Ph.D.**	
Course	FINITE ELEMENT METHOD	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Be able to describe and differentiate between different types of finite elements
2. Compare the application of different finite elements to individual problems
3. Independently create and analyze a structural model using the finite element method
4. Use software packages for modelling and analysis of structures in construction that use finite elements (rod, triangular, isoparametric or shell analysis elements)
5. Critically observe the results of the analysis

1.4. Content of the course

Introduction, Finite Elements by Deformation Method, Rod Finite Elements, Triangular Elements, Quadrilateral and Isoparametric Finite Elements, Finite Elements for Analysis of Axially Symmetric Problems, Plates and Shells. Finite elements in dynamic analysis, partial differential equations and fluid dynamics equations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on modules: Structures and Roads	

1.7. Obligations of students

Attending lectures, creating program tasks on the computer, seminar paper and final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	2	Labortorij			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.
2. Kožar, Ivica: Some subroutines of importance for engineering programs, with program listing, FRaK, No.9, 1984., pp.6-10.

1.11. Supplementary literature

1. Zienkiewitz, O.C., Taylor, R.L.: The Finite Element Method Vol. I i II, McGraw-Hill 1989. i 1991.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.	1	20-50
Kožar, Ivica: Some Subroutines of Importance for Engineering programs, with program listing, FRaK, No.9, 1984., pp.6-10.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Ivica Kožar, Ph.D.**	
Course	STRUCTURAL MODELlING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Know how to use at least some numerical methods in the analysis of structures
2. Compare the practicality and application of different numerical methods
3. Independently create a model of the structure
4. To Manage Stresses in a Structure Under Load
5. Use software packages for modelling and analysis of structures in construction and critically observe the results of the analysis

1.4. Content of the course

Introduction, Rod Element Modelling, Modelling of Walls, Slabs and Shells, Dynamic Load Modelling, Stability Modelling, Soil Interaction Modelling, Prestress Modelling, Construction Phase and Special Loads, Stress Details and Concentration.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures, creating program tasks on the computer, seminar paper and final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	2	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Kožar, Ivica: Computer Programs, Construction Yearbook 1997, p. 565-574.
2. Ghali, A. and Neville, A.M.: Structural Analysis - A Unified Classical and Matrix Approach, Chapman and Hall, London, 1979.
3. MathCAD 2001 user manual.

1.11. Supplementary literature

1. Zienkiewitz, O.C., Taylor, R.L.: The Finite Element Method Vol. I i II, McGraw-Hill 1989. i 1991.
2. Toniolo, G.: Analisi numerica, Heopli, Milano, 1981.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Kožar, Ivica: Computer Programs, Construction Yearbook 1997, p. 565-574.	1	
Ghali, A. and Neville, A.M.: Structural Analysis - A Unified Classical and Matrix Approach, Chapman and Hall, London, 1979.	1	
MathCAD 2001 user manual.	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	NUMERICAL MODELLING IN MATERIALS ENGINEERING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of the course is to introduce students to computer simulations in materials engineering using traditional numerical methods (finite differences and finite elements) as well as stochastic methods (cellular automats).

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Describe the continuity equations and the constitutive equations of mass and energy transport
2. Use the finite difference and finite element method to solve linear and nonlinear problems.
3. Solve differential equations using the method of cellular automata
4. Simulate the microstructure of cement and concrete
5. Model mechanical properties and transport processes

1.4. Content of the course

Continuum (Continuity and conservation equations, Constitutive equations of mass and energy transport). The finite difference method. The finite element method. Numerical algorithms (Procedures for generating networks, Procedures for solving linear and nonlinear problems). Inverse methods. Method of cellular automata. Cellular automata and differential equations. Creating a virtual microstructure of cement and concrete. Determination of mechanical and transport properties using a virtual microstructure.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments

1.7. Obligations of students

Students are required to regularly attend lectures and exercises, prepare and submit a program and seminar paper within the prescribed deadline.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

80% creation of a computer program, 20% presentation of the created program.

1.10. Compulsory literature

1. Rappaz M, Bellet M, Deville M: Numerical Modelling in Materials Science and Engineering, Springer, 2002.

1.11. Supplementary literature

1. Raabe D: Computational Materials: The Simulation of Materials Microstructures and Properties, John Wiley & Sons Inc 1998.
2. Margolus, N.; Toffoli, T.: Cellular Automata Machines. A new environmet for modelling, MIT Press, 1987.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Rappaz M, Bellet M, Deville M: Numerical Modelling in Materials Science and Engineering, Springer, 2002.	1	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Boris Podobnik, Ph.D.**	
Course	OPERATIONS RESEARCH AND LINEAR PROGRAMMING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The goal is to instruct students in methods that help them make decisions by applying linear and non-linear programming.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Know how to use at least some numerical methods in the analysis of structures
2. Compare the practicality and application of different numerical methods
3. Analyze stresses in a structure under load
4. Use software packages for modelling and analysis of structures in construction and critically observe The results of the analysis

1.4. Content of the course

Linear programming. A simple method. Duality and sensibility. Integer programming. A transverse algorithm. Stock models. Prediction. Nonlinear programming. Problem optimization of multiple variables with and without constraints. Network analysis. Dynamic programming. The theory of decision-making. Markov processes.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments	Elective on the modules: Geotechnics, Hydraulic Engineering, Roads and Urban engineering	

1.7. Obligations of students

Attending classes. Preparation of a seminar paper. Passing the colloquium and final exam.

1.8. Monitoring student work							
Attending classes	2,0	Teaching activity		Seminar paper	1,5	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Seminar paper, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Martić, Lj.; Mathematical Methods for Economic Analyses, Official Gazette, Zagreb, 1972.
2. Schaum's Outline of operations Research: Bronson, R., Naadimuthu, G.; The McGraw-Hill Companis, 1997.

1.11. Supplementary literature

1. Martić, Lj.: Nonlinear Programming, Informator, Zagreb, 1973.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Martić, Lj.; Mathematical methods for economic analyses, Official Gazette, Zagreb, 1972.	4	20-50
Schaum's Outline of operations Research: Bronson, R., Naadimuthu, G.; The McGraw-Hill Companis, 1997.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader		
Course	COMPUTER AIDED DESIGN	
Study program	University Graduate Study in Civil Engineering	
Course Status	Mandatory	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Know how to draw in CAD programs using programming
2. Independently create a model of the structure
3. Analyze stresses in a structure under load
4. Use software packages for modelling and analysis of structures in construction

1.4. Content of the course

Introduction. Application of computer programs in construction with examples. Drawing in CAD using Programming. Geographic Information Systems (GIS).

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments

1.7. Obligations of students

Attending lectures, creating program tasks on the computer, creating a seminar paper.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Kožar, Ivica: Computer Programs, Construction Yearbook 1997, pp.565-574.
2. MathCAD 2001 user manual.
3. DesignCAD 3000 user manual.

1.11. Supplementary literature

1. Kožar, Ivica: Freely Supported Board, with Program Listing, FRaK, No.5, 1983., pp.37-41.
2. Kožar, Ivica: Beam on an elastic base, with program listing, FRaK, No.6, 1983., pp.33-39.
3. Kožar, Ivica: Some subroutines of importance for engineering programs, with program listing, FRaK, No.9, 1984., pp.6-10.
4. Kožar, Ivica: Dynamic Analysis of Constructions, with Program Listing, FRaK, No.14, 1985, pp.4-9.
5. Kožar, Ivica: Complexly Loaded Sticks, with Program Listing, FRaK, No.18/19, 1987., pp.52-61.
6. Smith, A., Hinton, E., Lewis, R.W.: Civil Engineering Systems Analysis and Design", John Wiley & Sons, 19

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Kožar, Ivica: Computer Programs, Construction Yearbook 1997, pp.565-574.	1	20
MathCAD 2001 user manual.	Available online	
DesignCAD 3000 user manual.	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Ivica Kožar**	
Course	BUILDING PHYSICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	2
	Number of hours (L+E+S)	20+0+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training for independent solving of practical engineering problems in this subject.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the basic concepts related to heat and sound transfer
2. Describe the process of passage of heat, moisture and sound through a constructive element
3. Use computer programs to calculate the thermal and sound resistance of high-rise buildings
4. Critically observe and argue the results obtained by analysis
5. Propose a constructive solution in case of unfavorable results

1.4. Content of the course

Introduction. Modelling of the basic equations of diffusion and heat. Modelling of the Helmholz wave equation. Computer programs for calculating the thermal and sound resistance of high-rise buildings.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures, creating program tasks on the computer, seminar work.

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper	0,25	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	0,25	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Kožar, Ivica: Computer Programs, Construction Yearbook 1997, pp.565-574.
2. Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.
3. MathCAD 2001 user manual.

1.11. Supplementary literature

1. Gertis, K., Mehra, S-R., Veres, E., Kießl, K.: Building Physics Task Collection with Solutions, Teubner, Stuttgart, 1996.
2. Ožbolt, J., Kožar, I., Eligehausen, R., and Periškić, G., (2005). "Instationäres 3D Thermo-mechanisches Modell für Beton," Beton und Stahlbetonbau, in press (to be published in January, 2005).

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Kožar, Ivica: Computer Programs, Construction Yearbook 1997, pp.565-574.	1	0-20
Chapra, S.C., Canale, R.P.: Numerical Methods for Engineers, McGraw Hill, 1988.	1	
MathCAD 2001 user manual.	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	GEOMETRIC MODELLING OF SURFACES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+30

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Deepen knowledge of higher-order surfaces. Develop critical thinking and problem-solving skills and encourage creativity. Gain experience in advanced modelling techniques on problem-oriented tasks in CAD. Interdisciplinary approach to the problem of surfaces.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Know how to use modelling and transformation techniques in CAD in advance.
2. Use software packages for modelling and analysis of structures in construction

1.4. Content of the course

Classification of higher-order surfaces. Application of surfaces on objects. Constructive processing of surfaces. Modelling and Transformation Techniques in CAD. Bézier surfaces. Coiled surfaces. Realistic modelling, animations, lighting, materials...

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending classes. Complete work on project topics for the duration of the semester is accepted. Seminars. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio							

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Project topics, seminar paper, periodic examinations (70%, final exam (30%)

1.10. Compulsory literature

1. Babić; Gorjanc; Sliepčević; Szirovicza: Constructive Geometry, IGH, Zagreb, 2004.
2. Pletenac, Lidija: Geometric Modelling in CAD, Repeater.
3. DesignCAD Software Manual (on your computer in "help")

1.11. Supplementary literature

1. Niče, dr. Vilko: Descriptive Geometry I and II, Školska knjiga, Zagreb, 1992.
2. Stanko Turk: Computer graphics. Basics of Theory and Application, Školska knjiga, Zagreb, 1987.
3. John Vince: 3-D computer animation, Addison –Wesley Publishing Company, New York 1994
4. Alan Watt, Mark Watt: Advanced Animation and Rendering Techniques, Addison –Wesley Publishing Company, New York 1996.
5. Alan Watt, 3D Computer Graphics, Addison –Wesley , Workingham, 1993.
6. Journals and proceedings

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Babić; Gorjanc; Sliepčević; Szirovicza: Konstruktivna geometry, IGH, Zagreb, 2004.	6	0-20
Pletenac, Lidija: Geometric Modelling in CAD, Repeater.	0	
DesignCAD Software Manual (on your computer in "help")	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Ivica Kožar, Ph.D.**	
Course	COMPUTER SYSTEMS ENGINEERING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	15+0+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Independently solving engineering problems that have more than one goal, understanding and incorporating conditions in determining the solution to a problem, using computers in solving engineering problems.

1.2. Conditions for enrolment in courses

Computational modelling

1.3. Expected learning outcomes for the subject

1. Identifying a Related Problem (System)
2. Mastering the basic methods of solving the system
3. Developing computer skills in solving problems related to system engineering (selection of the appropriate algorithm, assessment of the quality of the resulting solution)

1.4. Content of the course

Introduction to Systems, Programming, and Computational Algorithms in Systems Engineering: Unconditional Optimization, Conditioned Optimization, Linear Programming, Nonlinear Programming, Dynamic Programming, network analysis (graph theory), economic aspects, decision and knowledge base analysis, service theory.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Active participation in classes, creating program tasks on the computer, colloquia, seminar work.

1.8. Monitoring student work							
Attending classes	1	Teaching activity		Seminar paper	1	Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

No final exam is scheduled - 100% during classes

1.10. Compulsory literature

1. Kožar, Ivica: Autorska skripta, DOAJ – Directory of Open Access Journals

1.11. Supplementary literature

1. Setscholars – The Open Access Journals

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Kožar, Ivica: Autorska skripta, DOAJ – Directory of Open Access Journals	Available online	0-20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	COMPUTATIONAL DURABILITY MECHANICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to numerous causes and mechanisms and their interaction during the process of degradation of concrete and concrete structures, taking into account the effects of the environment as well as other loads.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Analyze and evaluate the behavior of concrete structures using hygro-thermo-chemo-mechanical concrete model.

1.4. Content of the course

Introduction. Mechanisms of concrete degradation. Model elements for durability mechanics: chemical reaction rate, heat generation, humidity, moisture and heat transport, moisture and heat transport interaction, ion transport, volume changes, strength change.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Creating a computer program and presentations.

1.8. Monitoring student work							
Attending classes	2	Teaching activity	0,5	Seminar paper		Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	2,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

There is no final exam - 100% during classes.

1.10. Compulsory literature

1. Meakawa, K., Chaube, R. and Kishi, T. (1999) Modelling of concrete performance –hydration, microstructure formation and mass transport, E&FN SPON, London.

1.11. Supplementary literature

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Meakawa, K., Chaube, R. and Kishi, T. (1999) Modelling of concrete performance –hydration, microstructure formation and mass transport, E&FN SPON, London.	1	0-20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Assoc. Prof. Mladen Bulić, Ph.D.**	
Course	STEEL STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	45+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The acquired knowledge of the concepts of operation and the peculiarities of various load-bearing systems made of steel is the acquisition of competences in the independent design of steel structures and is the basis for further practical and scientific education in the field of steel structures and structural engineering in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain conceptual design
2. Analyze the effects on the framework systems
3. Explain the reliability of structures
4. Explain frame system sizing and fatigue sizing
5. Explain the design of panel elements and sheet metal supports
6. Explain systems of spatial lattice structures and load-bearing systems of multi-storey buildings
7. Design details in steel structures and size connections
8. Develop a project for the steel structure of the hall

1.4. Content of the course

Features of steel structures. Architecture and steel. Economic parameters of steel construction. Design process – higher level. Introduction to Reliability Engineering. Fatigue–sizing. Multi-part pressure elements. Stability of transversely stressed ridges. Structures made of thin-walled profiles. Design of panel elements and sheet metal girders. Systems of spatial structures. Load-bearing systems of multi-storey buildings. Structures made with a rope. Details in steel structures. Theory of plasticity in steel structures: Modelling of steel structures.

Analysis and dimensioning of frame systems. Classification of frames. Elastic critical load of the frame for laterally movable mode. Imperfections of the frame. Methods of global elastic frame analysis. Global Methods plastic analysis of the frame. Analysis and classification of connections. Modelling of the action on structures. Halls in which cranes operate. Hall project according to EC3. Special types of steel structures. Load-bearing systems of steel structures.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Preparation of the main design of the steel structure and certification of the program in phases with a short oral examination of knowledge. Two mandatory positively graded colloquia and a final exam. Field teaching is included in the course schedule.

1.8. Monitoring student work

Attending classes	2,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	1,25	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

The exam is written and mandatory. On the exam, it is possible to obtain a maximum of 30% of the subject grade. 50% of the content is solved. Exam is a condition of passage.

1.10. Compulsory literature

1. Androić, B.; Dujmović, D.: Steel Structures – Part 1 and 2, IA Projektiranje, Zagreb 2021.
2. Androić, B.; Dujmović, D.; Džeba, I.: Steel Structures 2, IA Projektiranje, Zagreb 2008.
3. Androić, B., Dujmović, D., Džeba, I.: Metal Constructions 4, IAP, Zagreb, 2003.
4. Dujmović, D., Androić, B., Džeba, I.: Modelling of structures according to EUROCODE 3, AGM, Zagreb, 2004.
5. Androić, B.; Dujmović, D.; Androić Brajčić, I.: Steel in Architecture, High-Tech Structures and earthquake, IA Projektiranje , Zagreb 2022.

1.11. Supplementary literature

1. McKenzie, W. C. Design of Structural Steelwork. Macmillan 1998.
2. Davies, J. M.; Brown, B. A. Plastic Design. Blackwell Science 1996.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Androić, B.; Dujmović, D.: Steel Structures – Part 1 and 2, IA Projektiranje, Zagreb 2021.	21	20
Androić, B.; Dujmović, D.; Jeba, I.: Steel Structures 2, IA Projektiranje, Zagreb 2008.	21	
Androić, B., Dujmović, D., Džeba, I.: Metal Structures 4, IAP, Zagreb, 2003.	3	
Dujmović, D., Androić, B., Džeba, I.: Modelling construction according to EUROCODE 3, AGM, Zagreb, 2004.	10	
Androić, B.; Dujmović, D.; Androić Brajčić, I.: Steel in Architecture, High Technology Structures and Earthquake, IA Projektiranje , Zagreb 2022.	5	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Gordan Jelenić, Ph.D.**	
Course	DYNAMICS OF STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+6+9

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Reaching the level of knowledge that the student, when mastering this course, can independently perform the calculation of structures on which dynamic loads act, and with sufficient prior knowledge listen to the courses: Earthquake Engineering, Special Chapters of Concrete and Wall Structures, Steel Structures, Steel Structures Bridges and Basics of Composite Structures in the graduate study.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Mathematically define the linear oscillation of a system with one degree of freedom of motion
2. Propose a way to isolate the oscillations of a system with one degree of freedom exposed to a periodic perturbation force
3. Mathematically define the aperiodic and transient vibrations of a system with one degree of freedom and apply Duhamelov integral
4. Analyze an idealized system with an arbitrary finite number of degrees of freedom and apply this knowledge to the so-called "shear building"
5. Formulate the eigenvalue problem in matrix form
6. By applying integral transformations, solve the forced undamped and damped oscillations of the system with multiple degrees of freedom.

1.4. Content of the course

Systems with a single degree of freedom: free and forced undamped and damped oscillations; Division dynamic actions; Discrete and continuous systems; Aperiodic and transient vibrations of a system with one degree of freedom - Duhamel's integral; Free undamped oscillations of discrete systems with an arbitrary number of degrees of freedom; Orthogonality of proper forms; Basic assumptions and equations of motion of a multi-storey "shear building"; Formulation of eigenvalue problems in matrix form; Conditions orthogonality in matrix form; Normal coordinates; Analysis of forced damped oscillations of a discrete system with n degrees of freedom using the eigenform development procedure - modal analysis; Solution of the modal equation using Laplace integral transformations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Engineering Modelling of Buildings	

1.7. Obligations of students

Students are obliged to regularly and actively follow lectures and exercises during the semester. Preparation of a seminar paper and program assignment. Colloquium.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	1,5	Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

The evaluation and evaluation of students' work will be carried out by continuous examination of knowledge during the preparation of individual tasks and seminar work.

1.10. Compulsory literature

1. Čaušević, M., DYNAMICS OF CONSTRUCTIONS, Školska knjiga, Zagreb, 2005.
2. Čaušević, M., EARTHQUAKE ENGINEERING, Školska knjiga, Zagreb, 2001.

1.11. Supplementary literature

1. Chopra, A. K., DYNAMICS OF STRUCTURES – Theory and Applications to Earthquake Engineering, Second edition, Prentice Hall, New Jersey, 2001.
2. lough, R., Penzien, J., DYNAMICS OF STRUCTURES, McGraw-Hill, New York, 1975.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Čaušević, M., DYNAMICS OF CONSTRUCTIONS, School book, Zagreb, 2005.	6	20-40
Čaušević, M., EARTHQUAKE ENGINEERING, Školska book, Zagreb, 2001.	8	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Adriana Bjelanović, Ph.D.**	
Course	TIMBER STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	45+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Understanding the methodology of designing timber structures, acquiring the ability to analyze and evaluation of project solutions. Application of acquired knowledge and skills to the design of complex plane systems.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Application and synthesis of basic knowledge acquired in theoretical courses and basic knowledge about timber structures and methodology of calculation of structures acquired in the preparatory course (ODK – undergraduate study).
2. Define and explain terms related to wood-based materials and products, production technology from the point of view of application and load-bearing properties, assembled beams and columns, composite wood-concrete systems, prestressing in wooden structures, design, construction and rehabilitation of wooden roofs, load-bearing systems, calculation, details and technology of wooden buildings, design concepts wooden bridges, the calculation of wooden structures exposed to fire.
3. Incorporate the basic elements of the detailed design into the program (design of characteristic details based on the calculation, detailed design of the main girder, transport and assembly plan) – application of expert knowledge.
4. Presentation, argumentative analysis and discussion, evaluation of the achieved solution and consideration of other possible variants.
5. Creation and presentation of a seminar paper – developing the ability to synthesize the material and connect with topics lectures, noticing important facts, clarity of presentation and presentation.

1.4. Content of the course

Overview of modern wooden plain and spatial systems, design methodology and technical legislation. Overview of wood materials and products (technical properties and purpose) in the design system according to the HRN EN 1995 series standard. Glued laminated beams of special geometry (trapezoidal beams, curved and saddle beams): design features, design and calculation specifics, guidelines for reinforcement procedures, application in planar systems. Planar systems made of glued laminated timber (typology, design specifics, spatial stability, connection design): beam and cantilever systems, frames and arches, hybrid systems, prestressed main girders. Calculation of characteristic connections in 2D systems: structures of bearings and clamped supports, joints and mounting attachments. Durability, protection and Maintenance of wooden structures – special features for the construction of wooden buildings and bridges. Legislative framework and the basics of designing wooden structures exposed to fire according to HRN EN 1995-1-2. Classic and modern wooden roofing systems. Assembled elements – glued assemblies and mechanically assembled elements (properties, basics of calculation and application). Wood-concrete composites: typology, types of coupling and effect, fasteners, calculation according to the HRN EN 1995 standard and based on tests, applications (building and bridge structures), wood-steel/glass composites. Basics about wooden buildings: construction typology and structural systems of walls, guidelines for design and construction, characteristic connections. Basics of wooden bridge design: modern structural forms: beam and cantilever bridges, arched, truss and suspension bridges (span assemblies, transverse layouts, spatial stability, pavement structures, characteristic connections).
Assessment of the condition of existing timber structures (methodology of exploration works, methods and techniques "in situ" tests – specifics for timber structures), basics of remediation procedures.

1.5. Types of execution teaching		
	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Active attendance at project exercises, attendance at lectures and auditory exercises. Creating a program (in a team – the main project of the plane system) and oral colloquizing. Periodic written examinations (partial exams – colloquiums). Presentation and defense of the program. Final exam.

1.8. Monitoring student work

Attending classes	2,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,25	Report		Practical work	
Portfolio		Program	1,75	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Exam grade (30%) and semester work grade - program (certification/oral examination), seminar paper, colloquia and activity (min.50% - max.70%).

1.10. Compulsory literature

1. Bjelanović, Adriana; Rajčić, Vlatka: "WOODEN STRUCTURES ACCORDING TO EUROPEAN STANDARDS", Croatian University Press, Faculty of Civil Engineering, University of Zagreb and Zagora-Zagorje d.o.o., Zagreb, Reissue 2007, ed. J. Radić, (p.p. 1 – 458), 1 – 458, ISBN 978-953-169-115-4; electronic edition / repository of the Library of Materials. faculties in Rijeka and Zagreb

1.11. Supplementary literature

1. Werner, Herzog at all: HolzbauAtlas, 2004
2. HRN EN 1995-1-1:2013

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Bjelanović, Adriana; Rajčić, Vlatka: "WOODEN STRUCTURES ACCORDING TO EUROPEAN STANDARDS", Croatian University Press, Faculty of Civil Engineering, University of Zagreb and Zagora-Zagorje d.o.o., Zagreb, reissue 2007, ed. J. Radić, (p.p. 1 – 458), 1 – 458, ISBN 978-953-169-115-4; electronic edition / repository of the Library of Materials. faculty in Rijeka and Zagreb	12 / available online	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Ivana Štimac Grandić, Ph.D.**	
Course	SOLID BRIDGES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Analysis and calculation of various load-bearing structures of concrete bridges, their supports and equipment (bearings, transitional devices, ...). Acquiring the necessary knowledge to participate in the design of concrete bridges, which is the basis for future professional and scientific education in the field of load-bearing structures of concrete bridges.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Definition of loads on pedestrian, road and railway bridges and applications in bridge calculation.
2. Definition of seismic load and calculation
3. Dimensioning of reinforced concrete or prestressed span assembly.
4. Dimensioning of bridge supports (pillars and abutments)
5. Calculation of constructive details (bearings, transition devices,...)
6. Preparation of detailed drawings for a simple bridge.

1.4. Content of the course

Lectures:
Bridges and their main components: slabs, beams, crates, frames, arches, suspension and suspension bridges. Methods analysis - upper and lower structure. Numerical techniques and finite element techniques and solutions: static, dynamic, earthquake, wind and shock effects. Analysis of prestressed concrete bridges: slabs, slabs and beams, concreted at the construction site of multi-cell box girders, concreted at the construction site of the box beam bridge. Prefabricated segmented box girder. Incremental pushing of box beam girders.

Exercises:
The gateway calculates the characteristic system in the program in accordance with the material, concept and method construction.

1.5. Types of execution teaching		
	☒ Class	☒ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Preparation and submission of the programme task according to the deadlines stipulated in the Implementation Programme. Attendance in accordance with the Study Regulations. Attendance at colloquiums. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,2	Report		Practical work	
Portfolio		Program	1,3				

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

70% of the total grade in the course of classes (examination of the profession and program task) and 30% of the total grade in the exam.

1.10. Compulsory literature

1. Radić, J., Mandić, A., Puž, G.: Constructing Bridges, Croatian University Press, Faculty of Civil Engineering, Andris, 2005.
2. Radić, J.: Massive Bridges, Croatian University Press, Faculty of Civil Engineering, Andris, Zagreb, 2007.

1.11. Supplementary literature

1. Tonković, K.: Massive Bridges – General Chapters, Školska knjiga, Zagreb, 1977.
2. Tonković, K.: Massive Bridges – Construction, Školska knjiga, Zagreb, 1989.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Radić, J., Mandić, A., Puž, G.: Constructing Bridges, Croatian University Press, Faculty of Civil Engineering, Andris, 2005.	2	20
Radić, J.: Massive Bridges, Croatian University Publisher, Faculty of Civil Engineering, Andris, Zagreb, 2007.	6	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Mladen Bulić, Ph.D.**	
Course	FUNDAMENTALS OF COMPOSITE STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquire knowledge about the concepts and peculiarities of coupling of structural systems made of materials of different physico-mechanical properties. Acquire basic knowledge and competencies in the field of design and execution of composite structures. To create a knowledge base as a basis for continuing professional and scientific education in this field.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the concepts and bases of coupled action, advantages, disadvantages and areas of application, and specialties in the construction of buildings and bridges
2. Explain the properties and interactions of materials, the influence of rheology, the concept of elastic and plastic analysis resistance.
3. Define complete, partial and elastic coupling.
4. Calculate composite supports, composite columns, composite boards.
5. Determine and calculate joints in composite structures and calculate the means of coupling.

1.4. Content of the course

General about composite structures and their development, advantages and applications. Modern technical regulations associated with this type of construction. Basic assumptions about coupling. Characteristics of materials for the manufacture of composite structures: structural steel and steel for reinforcement, normally heavy and light aggregate concretes, joining agents, steel profiled sheets, fasteners. The concept of reliability and boundary states. Important factors for the analysis of composite structures including system and element imperfections, effective width as a result of shear lag, rotational cross-sectional ability, and methods of calculating the effects of the action. Different types of coupling agents. Elastic and plastic resistance of composite cross-sections. Full and partial coupling. Behavior and resistance of coupled beams, coupled plates, and coupled columns for relevant boundary conditions. Elementary Connection Considerations.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Attending classes, taking colloquiums (continuous written examinations) and the final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

70% during classes, 30% on the exam.

1.10. Compulsory literature

1. Androić, B.; Dujmović, D.; Džeba, I.: Steel Structures 1, IA Design, 2009.

1.11. Supplementary literature

1. EN 1994-1-1 - Composite structures made of steel and concrete
2. Vayas, I.: Composite constructions based on Eurocode 4, Ernst and Sohn, 1999.
3. Horvatić, D.: Coupled Steel-Concrete Structures, Masmedia d.o.o., Zagreb, 2003.
4. Androić, B.; Čaušević, M.; Dujmović, D.; Jeba, I.; Markulak, D.; Peroš, B.: Steel and Composite Bridges, IA design, 2006.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Androić, B.; Dujmović, D.; Jeba, I.: Steel Structures 1, Ia design, 2009.	21	20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Željko Smolčić, Ph.D.**	
Course	**PRESTRESSED CONCRETE STRUCTURES**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquire knowledge of the concept of operation and properties of various load-bearing prestressed concrete structures and independent design ability. It is the basis for future professional and scientific education in the field of load-bearing prestressed concrete structures and load-bearing structures in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Describe the principles of prestressing and distinguish prestressing methods
2. Calculate prestressing force losses
3. Cross-sectional analysis and calculation for the ultimate limit state
4. Cross-sectional analysis and calculation for the serviceability limit state
5. Apply equivalent load and load balancing method
6. Calculation of the prestressed bracket

1.4. Content of the course

The principle of prestressing. Prestressing methods. Analysis of the concrete section under payload. Formatting for a shear state of serviceability. Analysis and design for the boundary state. Partial preloading. Preload losses. Formation of the anchoring zone.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending lectures and exercises, creating a program, passing two colloquia and a final exam. During classes through the program and colloquium, the student acquires a maximum of 70% of the grade. On the exam, the student acquires a maximum of 30% of the grade. The condition for taking the final exam is the acquired 35% of the grade during classes.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. J.Radić: Concrete Constructions-Manual, Andris, Zagreb, 2005.
2. J.Radić: Concrete Structures – Solved Examples, Andris, Zagreb, 2006.
3. Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.

1.11. Supplementary literature

1. Nilson A.H., Winter G.: Design of concrete structures, McGrau-Hill, Inc., 1987.
2. Leonhardt, V.: Vorlesungen über Massivbau, Fünfter Teil, Springer-Verlag, Berlin, Heidelberg, New York, 1979.
3. Tomičić, I.: Concrete Structures – Selected Chapters, DHGK, Zagreb, 1990.
4. Tomičić, I.: Manual for the Calculation of Reinforced Concrete Structures, DHGK, Zagreb, 1993.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
J.Radić: Concrete Constructions-Manual, Andris, Zagreb, 2005.	2	20
J.Radić: Concrete Structures – Solved Examples, Andris, Zagreb, 2006.	2	
Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.	13	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Davor Grandić, Ph.D.**	
Course	CONCRETE AND MASONRY STRUCTURES 2	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+5+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Students must acquire new and expand the already acquired knowledge about the rules of construction and construction design and calculation, dimensioning of concrete and masonry structures in such a way that they are able to independently design and participate in the execution of reinforced concrete and masonry structures of all levels of complexity. The acquired knowledge is also the basis for future professional and scientific training in the field of load-bearing concrete structures and load-bearing structures in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Calculate reinforced concrete elements and structures made of high-strength concrete and concrete reinforced with fibers.
2. Calculate and size reinforced concrete structures according to the theory of plasticity, including linear construction systems and application of rod models
3. To size and structurally design the areas of plastic joints of reinforced concrete elements of buildings and piers of bridges, applying stress-strain diagrams of rolled concrete.
4. Explain the basic concepts and methods of calculation of engineering structures and thin-walled roof structures design.
5. Carry out a calculation of the fire resistance of reinforced concrete elements.
6. Describe the investigation works on existing masonry buildings and the procedures for reinforcement and repair.
7. Define the types of stone masonry and the properties of masonry materials.

1.4. Content of the course

Reinforced concrete structures made of high-strength concrete. Structures made of fiber-reinforced concrete. Design of concrete structures using rod models. Calculation according to the theory of plasticity. Engineering structures: tanks and water towers, bunkers, silos. Thin-walled roof structures: shells, tents and stacks. Reinforcement and repair of concrete structures. Calculation of the fire resistance of concrete structures. Stress-strain diagrams of reinforcing steel and rolled concrete. Dimensioning and structural design of the area of plastic joints of reinforced concrete elements of buildings and bridge pillars. Architectural heritage. Reinforcement and repair of masonry buildings. The stone is built.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending classes, writing a seminar paper, taking colloquia and final exams.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	1,0	Experimental work	
Written exam	0,8	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,7	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester (continuous examination of knowledge through colloquia, preparation of a seminar paper) 70% of the total grade, exam 30% of the total grade.

1.10. Compulsory literature

1. Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.
2. Tomičić, I.: Concrete Structures - Selected Chapters, Zagreb, 1996.
3. Sorić, Z.: Masonry Constructions, Zagreb, 2016.
4. Hadzima-Nyarko, M.; Ademović, N.; Jeleč, M.: Structural reinforcements of masonry buildings: methods and examples, Faculty of Civil Engineering and Architecture Osijek, Osijek, 2020.

1.11. Supplementary literature

1. Fib Model Code for Concrete Structures 2010, Berlin : Ernst & Sohn, 2013.
2. Tomažević, M: Earthquake-resistant masonry buildings, Tehnis d.o.o., Ljubljana, Slovenia 2009. Slovene language)
3. Purkiss, J.A.: Fire Safety Engineering Design of Structures, Second Edition, Butterworth-Heinemann, Oxford, 2007.
4. Crnković, B.; Šarić, Lj.: Construction with Natural Stone, Institute of Civil Engineering of Croatia, Zagreb, 2003.
5. Schlaich, J.; Schäfer, K.: Constructing in Reinforced Concrete Construction, Concrete Calendar 1993, Part 2, Ernst & Sohn, Berlin, 1993.,str. 327-486.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Tomičić, I.: Concrete Structures, DHGK, Zagreb, 1996.	16	0-20
Tomičić, I.: Concrete Structures - Selected Chapters, Zagreb, 1996.	3	
Sorić, Z.: Masonry Constructions, Zagreb, 2016.	13	
Hadzima-Nyarko, M.; Ademović, N.; Jeleč, M.: Structural reinforcements of masonry buildings: methods and examples, Faculty of Civil Engineering and Architecture Osijek, Osijek, 2020.	10	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Mladen Bulić, Ph.D.**	
Course	STEEL BRIDGES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The acquired knowledge of the concepts of operation and the peculiarities of various load-bearing systems made of steel is the acquisition of competences in the independent design of steel structures and is the basis for further practical and scientific education in the field of steel structures and structural engineering in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Definition of layouts, characteristic cross-sections and structural systems of steel bridges.
2. Defining the concept of proving safety and limit state of load-bearing capacity and usability
3. Definition and calculation of grill and torsional resistance and spatial stability
4. Dimensioning of the steel span assembly (optimal dimensions, selection of main girders, pavement construction)
5. Dimensioning of bridge supports (pillars and abutments)
6. Calculation of constructive details (bearings, transition devices,...)
7. Preparation of implementation plans.

1.4. Content of the course

Historical development of steel bridge structures. Modern constructions: basic concepts, terminology, static systems, types of structures, bridge elements and division of bridges. Data for the development of the project. Actions on bridges. The concept of proof of safety. Pavement structures of road and railway bridges, orthotropic steel plates. Full-fledged heads. Girders: sheet metal and rolled girders (solution concept, dimensioning, stability assurance, calculation, performance examples). Lattice head. Carriers: types, constr. rules, ensuring stability, details, examples of performance. Box mounts. Arched, suspended and suspension bridges, movable and integral bridges. Crossed bridges. Bridges made of corrosion-resistant steels. Structural components: bearings and joints, pavement finishes, transition devices, fences, etc. Prefabricated and other joints. Systems governance. The dynamics of bridges. The effect of wind on bridges. Aerodynamic vibrations in bridges. Design, assurance and quality control.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

The development of the program is certified in phases and presented with short oral tests of knowledge and independence. Two compulsory positive theoretical colloquia and a final exam. Field teaching is included in the course schedule.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,6	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program	0,9				

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Grade - exam grade (30%) and semester work evaluation - program (certification/oral examination), colloquia and activity (max. 70%).

1.10. Compulsory literature

1. Androić, B.; Čaušević, M.; Dujmović, D.; Jeba, I.; Markulak, D.; Peroš, B.: Steel and Composite Bridges, IA design, 2006.

1.11. Supplementary literature

1. Horvatić, D.: Metal Bridges, Školska knjiga, Zagreb, 1988.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Androić, B.; Čaušević, M.; Dujmović, D.; Jeba, I.; Markulak, D.; Peroš, B.: Steel and Composite Bridges, IA design, 2006.	8	0-20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Teo Mudrić, Ph.D.**	
Course	ENERGY METHODS IN APPLIED MECHANICS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	24+0+6

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Understand basic energy principles and be trained to apply them in simple problems of mechanics of deformable bodies. Understand the essence of approximate methods based on energy principles, as well as understand the energy formulation of the finite element method in static and dynamic problems.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Prove the equivalence of equilibrium equations and energy methods on a simple mechanical Problem. 2. Solve a simple mechanical problem using the Rayleigh-Ritz method. 3. Solve a simple mechanical problem by applying the finite element method. 4. Analyze a more complex engineering problem by applying modern computer tools based on finite element method and critically evaluate the results of the budget.		
1.4. Content of the course		
An introduction to the principle of virtual operation and the principle of stationary total potential energy. The link between equilibrium equations and energy principles. Application of the principles of virtual work to grids and frames. Rayleigh-Ritz method. Introduction to the finite element method using the principle of virtual work. Shape functions for different finite elements. Stiffness matrix and load vector. Transformations between coordinate systems. Energy Methods and the Principle of Virtual Work in dynamics.		
1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at least 70%.

Satisfaction of activities that evaluate the acquisition of learning outcomes:

- Preparation and defense of the seminar paper
- Final exam

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper	1,2	Experimental work	
Written exam	0,3	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Evaluation and assessment are carried out during classes and at the final exam. During classes, it is possible to achieve 70% of points, through attendance and preparation of a seminar paper. It is possible to achieve 30% of points on the exam, and the exam consists of a written part and the defense of the seminar paper. Details of the method of monitoring and evaluating the work of students are presented in the course implementation plan.

1.10. Compulsory literature

1. Jelenić, G.: Energy Methods (course notes), Imperial College, Department of Aeronautics, London

1.11. Supplementary literature

1. Davies, G.A.O.: Virtual Work in Structural Analysis, Wiley, Chichester, 1982
2. Henwood, D.; Bonet, J.: Finite Elements. A Gentle Introduction, MacMillan, Basingstoke, 1996
3. Lanczos, C.: The Variational Principles of Mechanics, Dover, New York, 1986
4. Reddy, J.N.: Energy Principles and Variational Methods in Applied Mechanics, Wiley, Chichester, 2017.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Jelenić, G.: Energy Methods (course notes), Imperial College, Department of Aeronautics, London	1	0-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Ivana Štimac Grandić, Ph.D.**	
Course	**STRUCTURAL TESTING**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Training of students in the field of measurement and measurement technology and direct application in the field of testing of building structures. Introduction to measurement methods and appropriate norms and standards in the field of quality control during the construction and exploitation of buildings.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. To list the most famous historical examinations.
2. List the tasks of the tests and describe the types of tests and how the tests are conducted.
3. List the measuring instruments and describe their basic measurement characteristics.
4. Define static and dynamic tests and describe methods and ways of data collection in static and testing.
5. Describe the method of conducting and analyzing static and dynamic tests.
6. Evaluate individual testing methods and instrument selection depending on the object to be tested and scope of the test.
7. Design and develop a Structural Testing Program using the acquired theoretical knowledge, understanding the process of testing and processing the data measured on the structure.

1.4. Content of the course

Historical development and the task of testing structures. Legislation in the field of testing. Division of structural testing. Tensometry. Overview and types of sensors. Overview of instruments and measuring equipment for static and dynamic tests. Measurement characteristics of sensors and instruments. Overview of test methods in the laboratory and in the field. Static tests. Methods of testing and data collection, analysis and presentation measurement data. Dynamic tests. Methods. Ways of excitation of structures and elements. Methods of collecting dynamic signals. Sensors in dynamic tests. Methods of dynamic analysis in the time and frequency range. Fast Fourier transform of collected signals. Experimental modal analysis of structures and elements. Dynamic parameters of constructive systems. Analysis of deformations and stresses based on measured values. Long-term measurements on structures or monitoring. Data collection, analysis and display using a PC.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures and exercises in accordance with the Study Regulations. Creating a program assignment according to the established dynamics of auditory and constructive exercises and submitting it by a certain date. Colloquiums (knowledge tests). Final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester (continuous examination of knowledge through colloquiums, preparation of a program assignment) 70% of the total grade, exam 30% of the total grade.

1.10. Compulsory literature

1. D. Aničić: Structural Testing, GFOS, Osijek, 2002.

1.11. Supplementary literature

1. Đuranović, N: Introduction to Structural Testing with Examples, Faculty of Civil Engineering, University of Montenegro, Podgorica, 2009

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
D. Aničić: Structural Testing, GFOS, Osijek, 2002.	7	0-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Adriana Bjelanović, Ph.D.**	
Course	LIGHTWEIGHT STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+20+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquisition of basic knowledge and competencies on spatial concepts of lightweight structures, application of theoretical foundations in the procedures of modelling and calculation of such systems, design and construction of rod and flat spatial systems made of wood and metal, design and construction of aluminum structures and suspended glass-aluminum facades. Creating a basis of knowledge that is the basis for further practical and scientific education in these areas.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Understanding and application of basic knowledge about spatial concepts of structures of special geometry and low mass – load assumption and behavior, specifics of modelling, calculation and execution technology:
2. Recognize characteristic details and concepts of power transmission at the conceptual level.
3. Calculated aluminum structures
4. Define and explain the design of specific lightweight structures made of aluminum and glass (frame and panel façade systems).

1.4. Content of the course

Geodesic domes: geometry, rod and panel load-bearing systems, covers, details of connections in nodes, modelling. Pneumatic structures: balloons, cushions, beams, arches and discs, modelling. Lightweight membrane structures: types of structures, methods of membrane stabilization, support, modelling. Synergistic constructions: principles of behavior when taking over external actions, control systems (payload and stability regulation) and monitoring. Tensional Integrity systems: ultra-light spatial structures, integrated systems of pressure and tensile elements. Spatial concepts of wooden structures: domes, mesh vaults, grill systems, hippars. Design of aluminium structures according to EC9. Lightweight aluminium systems. Panel façade systems - aluminum / glass. Examples of lightweight constructions made of aluminium: load-bearing concepts, design and assembly details, calculation models and behavioural simulations.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

According to the curriculum and performance program of the course – preparation and presentation of the seminar paper, preparation and presentation of the program task, written colloquium, final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper	1,25	Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1,0	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

According to the Ordinance on Studies and Implementation Program: 70% during classes, 30% at the final exam.

1.10. Compulsory literature

1. Bjelanović, Adriana; Rajčić, Vlatka: "WOODEN STRUCTURES ACCORDING TO EUROPEAN STANDARDS", Croatian University Press, Faculty of Civil Engineering, University of Zagreb and Zagora-Zagorje d.o.o., Zagreb, Reissue 2007, ed. J. Radić, (p.p. 1 – 458), 1 – 458, ISBN 978-953-169-115-4; electronic edition / Repository of the Library of Materials. faculties in Rijeka and Zagreb
2. Technical regulation for building structures; Official Gazette 17/2017 (available on-line)
3. Boko, I.; Skejić, D.; Torić, N.: Aluminum Structures, GF Split / Zagreb, 2017.
4. Technical Regulation for Glass Structures (Official Gazette 53/2017), Ministry of Construction and Physical Planning (available on-line)

1.11. Supplementary literature

1. Herzog, T.; Natterer, J.; Schweitzer, R.; Volz, M.; Winter, W.: "Holzbau Atlas", Birkhauser Edition detail, Munich, 2004.
2. Feldman, M; Kasper, R. et all: Guidance for European Structural Design of Glass Components, Report EUR26439 EN, JRC, 2014 (dostupno on-line) (https://publications.jrc.ec.europa.eu/repository/handle/JRC86637
3. Stranghöner, N.; Uhlemann, J. et all: Prospect for European for the Structural Design of Tensile Membrane Structures, Report EUR 27716 EN, JRC, 2016. (http://eurocodes.jrc.ec.europa.eu/showpublication.php?id=540)

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Bjelanović, Adriana; Rajčić, Vlatka: "WOODEN STRUCTURES ACCORDING TO EUROPEAN STANDARDS", Croatian University Press, Faculty of Civil Engineering, University of Zagreb and Zagora-Zagorje d.o.o., Zagreb, reissue 2007, ed. J. Radić, (p.p. 1 – 458), 1 – 458, ISBN 978-953-169-115-4; electronic edition / repository of the Library of Materials. faculties in Rijeka and Zagreb	12 / available online	0-40
Boko, I.; Skejić, D.; Torić, N.: Aluminum Structures, GF Split / Zagreb, 2017.	10	
Official Gazette: https://narodne-novine.nn.hr/	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Edita Papa Dukić, Ph.D., Nina Čeh, Ph.D.**	
Course	PLATE STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	24+0+6

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Understand the basic mechanical properties of different surface supports: rocks, membranes, plates and shells. To get acquainted with the basic theories of flat carriers and the analytical and approximate solutions to which they lead. To get acquainted with the application of numerical procedures in static and dynamic analysis of surface girders.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish between types of flat girders and their application.
2. Enumerate and distinguish the basic theories of plates.
3. Compare different methods of solving the problem of boards.
4. Analyze stresses and deformations in rocks, plates and shells and argue the results of the analysis.
5. Describe the basic characteristics of osymmetric scales.
6. Apply available computer tools or create your own algorithm for the analysis of mechanical problems and critically analyze the results obtained.
7. Develop and implement a program of laboratory tests of the selected flat carrier and analyze collected data

1.4. Content of the course

Introduction to surface supports and general equations of mechanics of deformable bodies. Examples of flat supports and their equations: rock, membrane, plate, shell. Planar stress state (example: wall girders) and planar state of deformation (example: embankment structures). Kirchhoff and Mindlin-Reissner plate theory. Approximate solution of a differential equilibrium equation using the finite difference method or The Rayleigh-Ritz method is based on the finite element method. Dynamics of planar girders and solution using the finite element method.

1.5. Types of execution teaching	☒ Class	☒ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☒ Laboratories
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

Attendance at least 70%

Satisfaction of activities that evaluate the acquisition of learning outcomes: The material covered is checked during the course of the semester by drafting, presenting and defending a seminar paper.

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper	1,5	Experimental work	0,5
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Evaluation and evaluation is carried out during classes and at the final presentation of a seminar paper or experimental report. The total proportion of points that can be earned is 100% during classes. Details of the method of monitoring and evaluating the work of students are presented in the course implementation plan.

1.10. Compulsory literature

1. P.L. Gould, Analysis of Shells and Plates, Springer Verlag, 1988.
2. S. Timoshenko, Theory of Plates and Shells, McGraw--Hill, 1959.
3. R. Szilard, Theories and Applications of Plate Analysis: Classical Numerical and Engineering Methods, Wiley INDIA, 2014.

1.11. Supplementary literature

1. A.E.H. Love, A Treatise on the Mathematical Theory of Elasticity, Dover, New York, 1944.
2. T.J.R. Hughes, The Finite Element Method, Dover, New York, 2000.
3. E. Ventsel, T. Krauthammer, Thin Plates and Shells. Theory, Analysis, and Applications, CRC Press, 2001.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
P.L. Gould, Analysis of Shells and Plates, Springer Verlag, 1988.	1	0-40
S. Timoshenko, Theory of Plates and Shells, McGraw--Hill, 1959.	1	
R. Szilard, Theories and Applications of Plate Analysis: Classical Numerical and Engineering Methods, Wiley INDIA, 2014.	In procurement	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Davor Grandić, Ph.D.**	
Course	EARTHQUAKE ENGINEERING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquiring basic knowledge and understanding about earthquakes as a natural phenomenon, the response of building structures to earthquakes and methods and rules for designing earthquake resistance of building structures. Students will develop skills to apply the acquired knowledge and understanding for the design and assessment of seismic resistance of building structures.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the causes of earthquakes, ways of registering earthquakes, magnitude and intensity of earthquakes
2. Identify factors that affect the magnitude of the effects of seismic action on buildings
3. To identify the influence of foundation soil on the dynamic behavior of structures in an earthquake
4. Determine standardized seismic actions for the predicted seismic hazard
5. Calculate the effects of seismic action on structures using a response spectrum
6. Design structures applying special rules for earthquake resistance design and method load-bearing capabilities
7. Verify the seismic resistance of the structure using a nonlinear static calculation method

1.4. Content of the course

Earthquakes in general: earthquake causes, earthquake waves, registration, magnitude and intensity of earthquakes, the probability of an earthquake, the properties of soil movement; Factors influencing the magnitude of the effects of seismic action on buildings; Response of the structure to the movement of the ground in an earthquake: response spectrum, coefficient of seismic transverse force at the base; Limit states for checking the seismic resistance of structures. Determination of standardized seismic actions for the predicted seismic hazard;

Linear calculations of structures to seismic action: response spectrum method and lateral force method; Approximate value of the basic vibration period: Rayleigh method; The concept of behavioral factors; Interaction of soil and structure; Seismic insulation; Method of designing earthquake resistance according to the load-bearing capacity; Special rules for the design of seismic resistance of building structures and bridges; Nonlinear methods of seismic calculation of structures; Earthquake resistance of masonry buildings; Assessment earthquake resistance and renovation of existing structures.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures and exercises in accordance with the Study Regulations. Creating a program assignment according to the established dynamics of auditory and constructive exercises and submitting it by a certain date. Colloquiums (knowledge tests).

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	1,3	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,3	Report		Practical work	
Portfolio		Program	1,4	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester (continuous examination of knowledge through colloquiums, preparation of a program assignment) 70% of the total grade, exam 30% of the total grade.

1.10. Compulsory literature

1. Uroš, M.; Todorić, M.; Crnogorac, M.; Atalić, J.; Šavor Novak, M.; Lakušić, S. (ed.): Earthquake Engineering – Renovation of Masonry Buildings, Faculty of Civil Engineering, University of Zagreb, Zagreb, 2021.
2. Skrinar, M.: Basics of Earthquake Engineering, Textbook, University Press, University of Maribor, Maribor, Slovenia, 2021 (in Slovenian)
3. Čaušević, M.: Dynamics of Constructions, University Textbook, Golden Marketing – Technical Book, Zagreb, 2010.

1.11. Supplementary literature

1. Hadzima-Nyarko, Addemović, N.; D.; Jeleč, M.: Structural reinforcements of masonry buildings – Methods and examples, Josip Juraj Strossmayer University of Osijek, Faculty of Civil Engineering and Architecture Osijek, Osijek, 2020.
2. Hadzima-Nyarko, M.; Nikić, D.; Morić, D.: Earthquake Engineering – Damage Assessment of Buildings, Josip Juraj Strossmayer University of Osijek, Faculty of Civil Engineering Osijek, Osijek, 2018.
3. Tomažević, M: Earthquake-resistant masonry buildings, Tehnis d.o.o., Ljubljana, Slovenia 2009 (in Slovenian)
4. Bachman, H.: Seismic Conceptual Design of Buildings – Basic principles for engineers, architects, building owners, and authorities; BWG, Biel, Switzerland, 2003.
5. Chopra, A. K., DYNAMICS OF STRUCTURES – Theory and Applications to Earthquake Engineering, Second edition, Prentice Hall, New Jersey, 2001.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Uroš, M.; Todorić, M.; Crnogorac, M.; Atalić, J.; Šavor Novak, M.; Lakušić, S. (ed.): Earthquake Engineering – Renovation of Masonry Buildings, Faculty of Civil Engineering, University of Zagreb, Zagreb, 2021.	10	0-50
Skrinar, M.: Basics of Earthquake Engineering, Textbook, University publishing house, University of Maribor, Maribor, Slovenia, 2021 (in Slovenian), e-book, open access available at https://press.um.si/index.php/ump/catalog/book/460	Available online	
Čaušević, M.: Dynamics of Structures, University Textbook, Golden marketing – Tehnička knjiga, Zagreb, 2014.	7	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Mladen Bulić, Ph.D.**	
Course	**RELIABILITY OF CIVIL ENGINEERING STRUCTURES**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	24+0+6

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquiring basic knowledge about the meaning and application of reliability engineering in the field of civil engineering construction is the basis for further practical and scientific education in this field and in the field of construction construction in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Defining the Core Terms and Meanings of Reliability Engineering
2. Analyze and evaluate structural damage.
3. Identify hazards in construction and remaining risks and plan measures to eliminate them.
4. Collect and process data on structures.
5. Perform stochastic modelling of the structure, action, and resistance responses.
6. Explain the fundamental problem of the boundary state equation and the extended problem of the boundary state equation.
7. Establish a dependency between the confidence index and the probability of failure. Reliability.
8. Conduct proof of reliability with partial factors -European standards.

1.4. Content of the course

Meaning of Reliability Engineering. Definitions and basic concepts. Analysis and evaluation of structural damage. Hazards in construction and remaining risks, identification of hazards and planning of measures to eliminate them. Collection and processing of data on structures. Stochastic modelling of structure, action and resistance responses. Base variables and models. Reliability of elements. The fundamental problem of the boundary state equation. Extended problem of the boundary state equation. The dependence of the confidence index and the probability of failure. Reliability. Proof of reliability with partial factors – European standards.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☒ Seminars and workshops	☐ Multimedia & Network
	☐ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	

1.7. Obligations of students

A theoretical colloquium was positively evaluated. Preparation and presentation of the seminar paper. The final exam is mandatory. In the a maximum of 70% of the grade can be obtained.

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper	0,6	Experimental work	
Written exam	0,6	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,8	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Grade - exam grade (30%) and semester work grade - seminar paper, colloquia and activity (max. 70%).

1.10. Compulsory literature

1. Androić, B., Dujmović, D., Džeba, I.: Reliability Engineering 1, IA projektiranje, Zagreb, 2006.
2. Dujmović, D., Lukačević, I., Androić, B.: Design of structures according to EN 1990, IA projektiranje, Zagreb, 2020.

1.11. Supplementary literature

1. Ditlevsen, O.; Madsen, H.O.: Structural reliability methods, Wiley, 1996.
2. Milčić, V.; Peroš, B.: Introduction to the Theory of Safety of Load-Bearing Structures, Faculty of Civil Engineering, University of Split, Split, 2003.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Androić, B., Dujmović, D., Džeba, I.: Reliability Engineering 1, IA projektiranje, Zagreb, 2006.	7	0-20
Dujmović, D., Lukačević, I., Androić, B.: Budget construction according to EN 1990, IA projektiranje, Zagreb, 2020.	20	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Paulo Šćulac, Ph.D.**	
Course	PRECAST CONCRETE STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Acquire knowledge of the working concept and properties of various load-bearing precast concrete structures and independent design ability. It is the basis for future professional and scientific education in the field of load-bearing precast concrete structures and load-bearing structures in general.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define what precast concrete is
2. Carry out an analysis of prefabricated frame systems
3. Calculate precast ceiling structures, horizontal ceiling diagrams, and precast beams.
4. Calculate columns and load-bearing walls.
5. Calculate and draw the connection between the prefabricated column and the prefabricated beam.
6. Describe and evaluate joints in precast concrete structures.
7. Design and calculate a characteristic system in accordance with the material, concept and method of construction.

1.4. Content of the course

What is Precast Concrete. Materials used in precast concrete structures. Large-scale, framework, spatial and mixed systems. Pre-prepared framework analysis. Prefabricated ceiling structures. Prefabricated beams. Columns and load-bearing walls. Horizontal ceiling diagraphs. Connection and connection. Connection of the prefabricated column and the prefabricated beam. Joints in precast concrete structures. Limitation of damage from extraordinary actions. Design of seismic resistance of precast concrete structures.

1.5. Types of execution teaching	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attending classes, creating a program assignment, taking colloquia and final exams.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1	Laboratorj			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

During the semester (continuous examination of knowledge through the colloquium and the creation and defense of the program task) 70% of the total grade, the exam 30% of the total grade.

1.10. Compulsory literature

1. Elliott K.S.; Jolly, C.K.: Multi-storey precast concrete framed structures, Chichester-Wiley Blackwell, 2013.
2. fib Bulletin 74: Planning and design handbook on precast building structures, International Federation for Structural Concrete (fib), 2014.

1.11. Supplementary literature

1. Steinle, A.; Bachmann, H.; Tillmann, M.: Precast concrete structures, Ernst & Sohn, 2019.
2. Elliott K.S.: Precast concrete structures, CRC Press, 2017.
3. Rex., S.: Industrial Construction Part II - Prefabricated Construction, Faculty of Civil Engineering, University of Zagreb, 1983
4. Trivunić, M.R.; Dražić, J.J.: Assembly of Concrete Structures of Buildings, AGM Book, Belgrade 2009.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Elliott K.S.; Jolly, C.K.: Multi-storey precast concrete framed structures, Chichester-Wiley Blackwell, 2013.	3	0-20
fib Bulletin 74: Planning and design handbook on precast building structures, International Federation for Structural Concrete (fib), 2014.	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Iva Mrak, Ph.D.**	
Course	**BUILDING DESIGN**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	15+30+0

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
To introduce students to the methodology of designing apartment buildings and to train them to read and create part of the project documentation.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Enumerate and identify types of apartment buildings 2. Determine what are the general principles of designing multi-apartment buildings and current trends in architecture multi-apartment buildings. 3. Prepare part of the technical documentation according to the design methods. 4. Successfully manage workload and time. 5. Prepare a preliminary design and part of the detailed design.		
1.4. Content of the course		
Elements of the historical development of apartment buildings. Approach to the design of apartment buildings, analysis location, program, orientation, physics of the building. From the spatial plan to the detailed design. Technical conditions of construction, standards, regulations, fire protection, at work, conservation protection. Elements of function, construction and design of residential buildings. Staircases and elevators, installation guides, heating, cooling and ventilation. Modern facades and roofing.		
1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☒ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		
1.7. Obligations of students		
Attendance at lectures, exercises and field classes. Creating a program.		

1.8. Monitoring student work

Attending classes	1,5	Teaching activity	0,25	Seminar paper		Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,25	Report		Practical work	
Portfolio		Program	2	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Program task, colloquium.

1.10. Compulsory literature

1. G. Knežević, Multi-apartment buildings. Technical Book. Zagreb, 1984.
2. Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997
3. Neufert, E.: Architectural Design, IGH Zagreb 2002.

1.11. Supplementary literature

1. Schinder, I., Housing for Humans: A Book to Imagine, Create and Design a New Housing Model in America, Panoma Press, 2021
2. Reeves, P., An Introduction to Social Housing, Elsevier Butterworth-Heinemann, Linacre House, Jordan Hill, Oxford, Burlington, MA, 1996, 2005
3. Hagbert, P., Larsen, H. G. , Thoern, H., Wasshede, C., Contemporary Co-housing in Europe: Towards Sustainable Cities?, Taylor & Francis Ltd, 2021
4. Balchin, P., Housing Policy in Europe, Routledge, 1996
5. Scanlon, K., Whitehead, C., Arrigoitia, M. F. (Eds) Social Housing in Europe, Wiley-Blackwell, 2014
6. Production programs of construction equipment.
7. Plans and projects of implemented solutions.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
G. Knežević, Multi-apartment buildings. Technical Book. Zagreb, 1984.	5	0-20
Neufert, E.: Architectural Design, IGH Zagreb 2002.	13	
Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997	1 (13 vols.)	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Assoc. Prof. Dragan Ribarić, Ph.D.**	
Course	**STABILITY OF STRUCTURES**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+6+9

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

With the acquired knowledge from this course, the student will be able to independently prove mechanical stability and resistance for nonlinear effects of slender structures (columns, pressure rods, rocks and beams).

The acquired knowledge is a prerequisite for following the courses Concrete and Masonry Structures 2, Steel Structures, Steel Bridges and Basics of Composite Structures at the graduate study.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. List and explain the basic assumptions for the derivation of the equation of the theory of large displacements, i.e. second-order theory and recognize the differences from the first-order theory.
2. Perform solutions of the differential equation, and determine the static and deformation quantities of a flat rod of constant cross-section and constant longitudinal force according to the theory of the second order (application of the method of initial parameters, displacement method or differential procedure to stability problems).
3. Apply differential equations to a flat rod of variable moment of inertia and variable longitudinal force according to the theory of the second order (application of transfer matrices and differential procedure to stability problems).
4. Explain the concept of elastic stability, stability criteria and the concept of critical load and its analytical formulation, and apply load-bearing criteria for elastic stability of structures.
5. Evaluate the behavior of the experimental set-up.

1.4. Content of the course

Basic assumptions and basic equations of the theory of large displacements, the theory of the second order and the differences from the theory of the first order. Stability criteria, the concept of critical load and analytical formulation of critical load. Eigenvalues and eigenfunctions and properties of orthogonality for the achieved instability. Second-order theory and stability of a flat rod of constant cross-section: the method of initial parameters and transfer matrices.
Second-order theory and stability of a rod with a continuously variable cross-section: application a differential process.
Second-order theory and stability of the rod system using the deformation
method. Lateral torsional buckling stability criterion.
Second-order effects and stability of surface supports and rocks.
Experimental modelling of slender flat and flat structures in the laboratory.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at least 70% of the scheduled dates. Satisfaction of activities that evaluate the acquisition of learning outcomes: activities in class, preparation and defense of seminar paper and reports from laboratory exercises.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity	0,5	Seminar paper	1	Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Evaluation and evaluation is carried out during classes and at the final presentation of a seminar paper or experimental report. The total proportion of points that can be earned is 100% during classes. Details of the method of monitoring and evaluating the work of students are presented in the course implementation plan.

1.10. Compulsory literature

1. Čaušević, M., STATICS AND STABILITY OF STRUCTURES – Geometric nonlinearity, University textbook, Školska knjiga, Zagreb, 2003.
2. Čaušević, M., TECHNICAL MECHANICS - kinematics, University Textbook, Školska knjiga, Zagreb, 2000.

1.11. Supplementary literature

1. Timoshenko, Stephen P., and James M. Gere. Theory of elastic stability. Courier Corporation, 2009.
2. Ghali, A.; Neville, A. STRUCTURAL ANALYSIS: A Unified Classical and Matrix Approach, E & FN SPON, An Imprint of Chapman & Hall, London, 1996.
3. Thompson, J. M. T.; Hunt, G. W. A GENERAL THEORY OF ELASTIC STABILITY, John Wiley & Sons, London, 1973.
4. Čaušević, M., Bulić, M., STABILITY OF STRUCTURES, Golden marketing – Technical book, Zagreb, 2013.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Čaušević, M., STATICS AND STABILITY OF STRUCTURES – Geometric nonlinearity, University textbook, School book, Zagreb, 2003.	9	0-40
Čaušević, M., TECHNICAL MECHANICS - kinematics, University Textbook, Školska knjiga, Zagreb, 2000.	5	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	Assoc. Prof. Leo Škec, Ph.D.	
Course	INTRODUCTION TO PLASTICITY AND DAMAGE MODELLING	
Study program	University Graduate Study in Civil Engineering	
Course Status	Electoral	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	27+12+6

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of this course is to introduce students to the basic concepts of plasticity theory and fracture mechanics and their application in modelling the nonlinear behavior of engineering materials.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Understand the basic principles of the incremental theory of plasticity
2. Define different material flow criteria and material hardening rules
3. Understand the basic principles of linear-elastic and elasto-plastic fracture mechanics
4. Analyze the load-bearing capacity of elasto-plastic beams and frame beams according to the limit state method
5. Understand and apply a simple defect model in numerical simulation
6. Conduct an experiment and determine the parameters for a plasticity or damage model

1.4. Content of the course

An introduction to the theory of plasticity. Historical aspects. The basic tenets of the theory of plasticity. Basic criteria for the flow of materials. Basic rules for hardening the material. Elasto-Plastic Analysis of Beams and Frames carriers by the method of boundary states. Basic concepts of linear-elastic fracture mechanics. Basic concepts of elasto-plastic fracture mechanics. Basic settings of the mechanics of damage and application in the model of the cohesive zone. Experimental determination of parameters.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at least 70%

Satisfaction of activities that evaluate the acquisition of learning outcomes: activities in class, preparation and defense of reports from laboratory exercises.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	2	Experimental work	0,5
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Evaluation and assessment is carried out during classes. The total proportion of points that can be earned is 100% during classes. Details of the method of monitoring and evaluating the work of students are presented in the course implementation plan.

1.10. Compulsory literature

1. Jirasék, M., and Bažant, Z. P. (2001). Inelastic Analysis of Structures. John Wiley & Sons Ltd.
2. Chen, W.F. and Han D.J. (2007) Plasticity for Structural Engineers, Springer-Verlag
3. Anderson, T.L. (2005) Fracture Mechanics, Fundamentals and Application (3rd Edition), CRC Press

1.11. Supplementary literature

1. Belytschko T., Liu W.K. and Moran, M. (2001). Nonlinear Finite Elements for Continua and Structures. John Wiley & Sons Ltd.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Jirasék, M., and Bažant, Z. P. (2001). Inelastic Analysis of Structures. John Wiley & Sons Ltd.	1	0-40
Chen, W.F. and Han D.J. (2007) Plasticity for Structural Engineers, Springer-Verlag	1	
Anderson, T.L. (2005) Fracture Mechanics, Fundamentals and Application (3rd Edition), CRC Press	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	ROADBED DESIGN	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+20+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

By successfully mastering the course material, the student is qualified to design the elements of the lower road construction and the calculation of the distribution of earth masses.

1.2. Conditions for enrolment in courses

Road Design,Road Hubs

1.3. Expected learning outcomes for the subject

1. Identification of necessary investigation works in the course of road design and construction.
2. Categorizing materials according to different classifications (soils and rocks)
3. Distinguishing the method of performing basic earthworks with regard to the type of soil in which they are performed.
4. Defining slope protection measures with regard to different selection criteria.
5. Application of additional earthworks (e.g. reinforcement of weak-bearing soils, etc.)
6. Calculate the quantities of masses and the possibilities of equalizing them in the construction of roads.
7. Application of the technology of execution of works (upper and lower structure) based on valid recommendations
8. Written and graphic design of the construction solution of the elements of the lower structure.

1.4. Content of the course

Cross-section of roads (road, railway, airport) and elements. Exploration works (hydrological, geological, geotechnical). Classification of materials. Road drainage: calculation and elements. Freezing. Preparatory work on the construction of the road. Design and construction of embankments. Design and construction of notches. Techniques for strengthening poorly bearing soil. Slope protection. Geotextiles in road construction: design and implementation. Calculation and equalization of masses.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Creating a program task, attending field classes, mastering a continuous knowledge test, final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0.75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,0	Report		Practical work	0,25
Portfolio		Program	1,0	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Developed program, periodic examination, field visit report (70%), final exam (30%).

1.10. Compulsory literature

1. Dragčević, V.; Koralet, Ž: Lower Road Structure, University of Zagreb, Zagreb, 2006.
2. Korlaet, Ž., Introduction to Road Design and Construction, University of Zagreb, Zagreb, 1995.
3. General Technical Conditions for Road Works, IGH Zagreb, Zagreb, 2001 (Books I, II, III)

1.11. Supplementary literature

1. Rodrigez, A.Rico, Del Castillo, H., Sowers, G.F.: Soil Mechanics in Highway Engineering, Trans Tech publications, Clausthal Zellerfeld, p.843, 1988.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Dragčević, V.; Koralet, Ž: Lower Road Structure, University of Zagreb, Zagreb, 2006.	4	20
Korlaet, Ž., Introduction to Road Design and Construction, University of Zagreb, Zagreb, 1995.	2	
General Technical Conditions for Road Works, IGH Zagreb, Zagreb, 2001.	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	RIGID PAVEMENT STRUCTURES	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	25+10+5

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

By successfully mastering the course material, the student acquires basic knowledge for the design of rigid pavement structures and an understanding of the mechanical principles of behavior of such structures.

1.2. Conditions for enrolment in courses

Theory and technology of concrete

1.3. Expected learning outcomes for the subject

1. Define the factors necessary for the dimensioning of pavement structures (traffic load, environmental factors, material quality)
2. Categorize aerodrome pavement structures (according to international standards)
3. Calculate the thicknesses of standard layers of rigid pavement structures using known empirical methods for road pavement structures.
4. Calculate the thicknesses of standard layers of rigid pavement structures using known empirical method for airport pavement structures.
5. Check stresses in rigid pavement structures (road and airport)
6. Translation of short texts from English.

1.4. Content of the course

History of rigid pavement structures. Materials for concrete pavements. Types of rigid pavement structures. Traffic load on concrete pavements. Calculation of stresses in concrete pavements (traffic, thermal). Concrete road pavements. Industrial concrete pavements. Basics of airport concrete pavements. Construction of rigid pavement structures. Damage and maintenance of concrete pavements.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module:	

1.7. Obligations of students

Preparation of a program assignment, preparation of a seminar paper, mastering a continuous examination of knowledge (written), final exam.

1.8. Monitoring student work

Attending classes	1,3	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	0,7	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation of the program, colloquium, seminar paper (70%), final exam (30%).

1.10. Compulsory literature

1. Babić, B., Prager, A., Design of pavement road structures, Construction Yearbook, Croatian Society of Civil Engineers, Zagreb, 1997.
2. Babić, B.: Design of pavement structures, Croatian Society of Civil Engineers, Zagreb, 1997.

1.11. Supplementary literature

1. Huang, Y. H., Pavement Analysis and Design, Prentice Hall, NewJersey, 1993.
2. Croney, P., Croney, D., The Design of Road Pavements, MacGraw-Hill, 1997.
3. http://www.faa.gov/
4. AASHTO Guide for Design of Pavement Structures 1993, Published by the American Association of State Highway and Transportation Officials, 1986 & 1993, Washington, D.C. USA

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Babić, B., Prager, A., Design of pavement road structures, Construction Yearbook, Croatian Society of Civil Engineers, Zagreb, 1997.	1	20
Babić, B.: Design of pavement structures, Croatian Society of Civil Engineers, Zagreb, 1997.	8	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Sanja Šurdonja, Ph.D.**	
Course	ROAD DESIGN	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	20+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

With a successfully mastered course, students acquire theoretical and practical knowledge necessary for road design. They are trained to independently design a road with all its elements using a computer program.

1.2. Conditions for enrolment in courses

Road junctions (registered)

1.3. Expected learning outcomes for the subject

1. Recognize the conditions and select the geometric elements of the road route
2. Using numerical methods, calculate the elements of the route and stakeout
3. Define a program task based on assumed conditions using appropriate terminology in writing
4. Use computers independently while applying design rules
5. Compare solutions and choose the optimal way to solve the task
6. Oral presentation of the work

1.4. Content of the course

Road Design Theory: Road Design Methodology; horizontal, vertical line guidance and cross-sections; spatial guidance of the line; stop and overtaking visibility; methods of determining areas and earth masses; variant solutions and selection of the optimal variant.

Road design using a computer program (based on the applicable road construction regulations):
digital relief model; designing the horizontal and vertical flow of the route using a computer; elaboration of cross-sections; calculation of the volume of the road hull.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at exercises and lectures (more than 70%). Colloquium. Creating a road project using a computer and presenting the solution. Submission of the program by the end of the semester is a prerequisite for admission to the final exam.

1.8. Monitoring student work

Attending classes	1,7	Teaching activity		Seminar paper		Experimental work	
Written exam	1,3	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	1,25	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, program, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Ordinance on the basic conditions that public roads outside settlements and their elements must meet with the traffic safety positions
2. Korlaet, Ž., Introduction to Road Design and Construction, University of Zagreb, Zagreb, 1995.
3. Korlaet, Željko; Dragčević, Vesna, Road Design and Construction. Zagreb: University of Zagreb, Faculty of Civil Engineering, 2018
4. General Technical Conditions for Road Works, IGH Zagreb, Zagreb, 2001 (available on-line)

1.11. Supplementary literature

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Ordinance on the basic conditions for public roads outside settlements and their elements must comply from the point of view of traffic safety Official Gazette: https://narodne-novine.nn.hr/	Available online	20-40
Korlaet, Ž., Introduction to Road Design and Construction, University of Zagreb, Zagreb, 1995.	2	
Korlaet, Željko; Dragčević, Vesna, Road Design and Construction. Zagreb: University of Zagreb, Faculty of Civil Engineering, 2018	3	
General Technical Conditions for Road Works, IGH Zagreb, Zagreb, 2001	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	URBAN TRAFFIC	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

By mastering the foreseen material, the student acquires basic knowledge about the design of city roads and different types of traffic and their laws. He is capable of independent design elements of city traffic areas (parking lots, etc.) and make smaller traffic studies.

1.2. Conditions for enrolment in courses

Road junctions (registered)

1.3. Expected learning outcomes for the subject

1. Identifying traffic conditions in cities with different characteristics
2. Defining the basic properties of city roads and selecting the cross-section of a city road under defined conditions
3. Preparation of the project of the city intersection in line with all elements (calculation of the level of service, proposing measures for improvement, graphic representation of the solution)
4. Addressing the conditions for non-motorized traffic in cities
5. Analytical processing and presentation of the traffic problem
6. Argumentative oral and written presentation of the traffic problem

1.4. Content of the course

City and traffic. Planning traffic in the city. Transport projects. Categorization of city roads. Design elements of city roads: transverse profile, horizontal course of the route, longitudinal course of the route. City hubs: types, design, traffic management. Non-motorized traffic in cities: pedestrian, bicycle. Parking areas. The role and significance of public transport. Modes of public transport. Road public transport. Routes, stations and terminals. Equipment and installations on city roads. Selected topics from transport areas in cities.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentorski Rad ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Periodic examinations of knowledge, creation of a program assignment, passing colloquiums.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam		Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program	2,5				

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

The student acquires 100% of the grade in the course during the semester.

1.10. Compulsory literature

1. Ivan Legac and authors: City Roads, University of Zagreb Faculty of Transport and Traffic Engineering, Zagreb, 2011
2. Mihailo Maletin: Planning and Design of Roads in Cities, Faculty of Civil Engineering, Belgrade, Belgrade, 2009
3. Guidelines for the design of roundabouts on state roads, Hrvatske ceste d.d., 2014
4. Ordinance on Cycling Infrastructure, (Official Gazette 028/2016)

1.11. Supplementary literature

1. Urban Street design Guide, National Association of City Transportation Officials, New York, 2013
2. Tumlin, J.: Sustainable Transportation Planning, Willey, New Jersey, 2012.
3. Cerovac, Vesna: Traffic Technology and Safety, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, 2001.
4. Maletin, Mihailo: Gradske saobraćajnice, Građevinski fakultet Beograd, Beograd 1996.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Ivan Legac and authors: City Roads, University of Zagreb Faculty of Transport and Traffic Engineering, Zagreb, 2011.	20	20-40
Mihailo Maletin: Planning and Design of Roads in Cities, Faculty of Civil Engineering, Belgrade, 2009.	5	
Guidelines for the design of roundabouts on state roads	Available online	
Official Gazette: https://narodne-novine.nn.hr/	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	TRAFFIC ENGINEERING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introduction to traffic demand, starting from the planning of the traffic system as a whole to specific sections of roads, junctions/intersections. To achieve that students can face these problems, define possible variant solutions, recognize the optimal solution and define it as a demanding element for building design. Defining the traffic situation and finding the optimal solution.

1.2. Conditions for enrolment in courses

Road junctions (registered)

1.3. Expected learning outcomes for the subject

1. Identify and define traffic problems on a concrete (real) example
2. Define a spatial traffic problem for a specific given situation
3. Compare classic unsignaled and signaled intersections in terms of capacity, level of service and shape elements
4. Analyze a specific solution for a specific segment of the transport system
5. To present an analysis of a concrete solution of the transport segment in an argumentative, oral and written manner system

1.4. Content of the course

The problem of traffic; the relationship between transport supply and demand. Traffic planning; level of planning. The relationship between individual and public transport. Traffic research. Traffic load, variations. Traffic forecasts. Vehicle movement and traffic safety. Traffic flows; management of traffic flows. Transport network; resistance on the network. Theory of vehicle sequence and time gaps. Traffic on road sections. Safety, throughput (service levels), economy, ambience. Sizing of roads.
Traffic flow conflicts. Intersections and junctions. Principles of traffic regulation. Traffic characteristics of intersection types; designing intersections. Standard traffic signals; horizontal, vertical, dynamic.
Traffic lights; mode; A plan of phases in space and time. Coordination of traffic light work; Line, network. Signposts and non-standard traffic signage; transport equipment. Stationing of the vehicle; the relevant vehicle; parking plan, technology of work in the parking lot. Throughput power of roads and junctions.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Urban Engineering	

1.7. Obligations of students

Program task. Independent tasks. Seminar paper. Written exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay	0,5	Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Program tasks, individual assignments, written periodic examination, colloquia (70%), final exam 30%.

1.10. Compulsory literature

1. Cerovac, V.: Traffic Technology and Safety; Faculty of Transport and Traffic Sciences, Zagreb 2001.
2. Padjen, J.: Spatial and Traffic Planning, Informator Zagreb
3. Legac, I. et al., City Roads, University of Zagreb, Zagreb, 2011.

1.11. Supplementary literature

1. Road Traffic Safety Act, (OG 42/2020)

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Cerovac, V.: Traffic Technology and Safety; Faculty of Transport and Traffic Sciences, Zagreb 2001.	5	20-40
Padjen, J.: Spatial and Traffic Planning, Informator Zagreb	5	
Legac, I. and others, City Roads, University of Zagreb, Zagreb, 2011.	20	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.; Marijana Cuculić, senior lectorer**	
Course	**FLEXIBLE PAVEMENT STRUCTURES**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Develop skills in analyzing pavement structures and the methodology of designing these structures, taking into account the advantages and disadvantages. It is especially important for students to recognize the relationship between the design options of the pavement structure and the subsequent needs of maintenance and management of pavements.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Explain the factors needed in the design of pavement structures
2. Analyze and select appropriate types and types of pavement structures and methods of their design in accordance with the purpose of the traffic area.
3. Explain stresses in different types of pavement structures
4. Design pavement structures in accordance with domestic and international design practice.
5. Calculate stresses and deformations in one of the specialized computer programs.
6. Manage the performance and/or monitor the quality of performance of all layers of the pavement structure.
7. To effectively use regulations, guidelines and professional and scientific domestic and foreign literature in the field of pavement structure design.
8. Carry out laboratory tests of asphalt mixtures

1.4. Content of the course

General about asphalt pavement structures. Structural pavement design: an empirical and theoretical approach. The relationship between pavement design options and pavement management. Road construction materials. Physical and mechanical properties of asphalt mixtures. Production, transport and installation of asphalt mixtures. Rehabilitation of pavement structures. Surface properties of the pavement.

1.5. Types of execution teaching	☒ Class	☒ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☒ Laboratories
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments	Elective on the module: Urban Engineering

1.7. Obligations of students

Preparation of the program task, implementation of laboratory tests, written examinations

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	1,0	Laboratory	1,5		

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

70% during classes, 30% at the final exam.

1.10. Compulsory literature

1. Babić, B.; Design of pavement structures, 1997
2. Sršen, M.: Introduction of Modern Measuring Devices in Road Condition Assessment - Croatian and International experience, Construction Yearbook, HSGI, Zagreb, 1999
3. Roberts, F.L., Kandhal, P.S., Brown, E.R., Lee, D-Y and Kennedy, T.W.: Hot Asphalt Mixes – Materials, Design and Installation (translation from English), HSGI and IGH, Zagreb, 2003.
4. Relevantni propisi – HRN EN
5. Technical regulation for asphalt pavements

1.11. Supplementary literature

1. Lavin, P.G.: Asphalt pavements: A practical guide to design, production and maintenance for engineers and architects; Taylor and Francis 2009

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Roberts, F.L., Kandhal, P.S., Brown, E.R., Lee, D-Y and Kennedy, T.W.: Hot Asphalt Mixes-Materials, Design and Installation (translation from English), HSGI and IGH, Zagreb, 2003.	6	20-40
Babić, B.; Design of pavement structures, 1997	8	
Sršen, M.: Introduction of Modern Measuring Devices in Road Condition Assessment - Croatian and International Experiences, Construction Yearbook, HSGI, Zagreb, 1999	5	
Relevantni propisi – HRN EN	1	
Technical regulation for asphalt pavements	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D.**	
Course	AIRPORTS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	20+10+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

By successfully mastering the course material, the student acquires basic knowledge and competencies for design aerodrome traffic surfaces and their pavement structures.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Recognition of airport categories (according to applicable international regulations).
2. Analysis of the conditions for selecting the location of the aerodrome (meteorological conditions, space restrictions, etc.).
3. Elaboration of the design of the manoeuvring areas of a small aerodrome with respect to the applicable international regulative.
4. Defining the basic requirements for the design of heliports.
5. Preparation of the design of the airport pavement structure (rigid or flexible).
6. Translation of short texts from English.

1.4. Content of the course

History of Flying and Aviation. Air traffic system, aerodrome classifications. Categories and code groups Airport. Airport maneuvering areas: layout and properties. A Sign of the Airport surface. Obstacle restrictions in the aerodrome area. Traffic load on airport pavement surfaces. Methods for the calculation of flexible airport pavement surfaces. Methods for the calculation of rigid aerodrome pavement surfaces. Maintenance and restoration of the airport.

1.5. Types of execution teaching		
	☒ Class	☐ Independent tasks
	☐ Seminars and workshops	☐ Multimedia & Network
	☒ Exercises	☐ Laboratory
	☐ Distance education	☐ Mentor work
	☐ Field Teaching	☐ Other _____

1.6. Comments

1.7. Obligations of students

Creating a program assignment, mastering a written exam, final exam.

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation of the program, colloquia (70%), final exam (30%).

1.10. Compulsory literature

1. Pavlin, S., "Aerodromi I", Faculty of Transport and Traffic Sciences, Zagreb, 2002.
2. Horvat, Z., "Aerodromi I", Civil Engineering Institute Zagreb, Zagreb, 1990.
3. Relevant regulations - http://www.icao.int/
4. Relevant rules - http://www.faa.gov/

1.11. Supplementary literature

1. Babić, B., Design of pavement structures, HDGI, Zagreb, 1997.
2. Building Yearbook '97, Croatian Society of Civil Engineers, Zagreb

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Pavlin, S., "Aerodromi I", Faculty of Transport and Traffic Sciences, Zagreb, 2002.	8	0-20
Horvat, Z., "Aerodromi I", Civil Engineering Institute Zagreb, Zagreb, 1990.	1	
http://www.icao.int/	Available online	
http://www.faa.gov/	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Diana Car-Pušić, Ph.D.**	
Course	CONSTRUCTION MACHINERY AND EQUIPMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+30+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of this course is to acquire the knowledge necessary for planning the time and costs of work, and the use of construction machinery.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Interpret basic and specific terms related to construction machinery
2. Interpret the basic concepts related to the effects of construction machinery
3. Interpret basic concepts related to the effects of standard cyclic construction machinery
4. Interpret basic concepts related to construction plants
5. Calculated performance of standard machines
6. Select and size the number of machines on a specific construction site
7. Elaborate in writing and orally a problem in a specific area of construction machinery using appropriate terminology

1.4. Content of the course

Selection and planning of the operation of construction machinery. The effect of construction machinery and means of transport in construction. Cost of machine labor in construction. Reliability and efficiency. Construction machinery in terms of use.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at least 70%. Creating a program. Colloquium. Final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	0,75	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation and submission of programs, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Slunjski, E.: Machines in Construction, HDGI, Zagreb, 1998.
2. Linarić, Z.: Lexicon of Machinery and Equipment for the Production of Building Materials, Business Media Croatia, Zagreb, 2007.

1.11. Supplementary literature

1. Bučar, G.: Carpentry, Reinforcement and Concrete Works on the Construction Site, J.J. Strossmayer Faculty of Civil Engineering, Osijek, 1997
2. Trbojević, B.: Građevinske mašine, Beograd,1985.
3. Trbojević, B.: Organization of Construction Works, Scientific Book, Belgrade, 1992.
4. Linarić, Z.: Plants for the Production of Bulk and Related Mineral Materials, Business Media Croatia, Zagreb, 2009

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Slunjski, E.: Machines in Construction, HDGI, Zagreb, 1998.	6	0-20
Linarić, Z.: Lexicon of Machinery and Equipment for Production Building Materials, Business Media Croatia, Zagreb, 2007.	5	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Prof. Aleksandra Deluka-Tibljaš, Ph.D., Marijana Cuculić, senior lecturer**	
Course	MAINTENANCE AND REPAIR OF ROADS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The main goal of this course is to educate future engineers about the need for systematic maintenance and rehabilitation of roads, because such activities are of particular importance for comfortable, economical and safer road transport. Students will gain basic knowledge of technical procedures for maintenance, rehabilitation and rehabilitation of asphalt and concrete pavement structures.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Identify factors that affect the condition of the pavement structure.
2. Distinguish the types of damage to pavement structures (asphalt, concrete, paved).
3. Describe methods and devices for collecting data on the condition of the pavement structure.
4. Choose the method of repairing the damaged pavement structure, taking into account the possible harmful impact on the environment
5. Explain the structure and elements of the pavement management system and the importance of system application.
6. Carry out laboratory tests of installed asphalt mixtures

1.4. Content of the course

General about road maintenance. Assessment of road conditions. Basics for maintenance planning. Maintenance of asphalt roads. Maintenance of concrete pavements. Design of pavement reinforcement.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☐ Multimedia & Network ☒ Laboratories ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Preparation of the program task, implementation of laboratory field tests, written knowledge tests.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	0,25	Laboratory	0,25		

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

70% during classes, 30% at the final exam.

1.10. Compulsory literature

1. Babić, B.; Design of pavement structures, 1997
2. Sršen, M.: Introduction of Modern Measuring Devices in Road Condition Assessment - Croatian and International Experiences, Construction Yearbook, HSGI, Zagreb, 1999.
3. Sršen, M.: Road Maintenance, Construction Yearbook, HSGI, Zagreb, 2000.
4. Relevantni propisi – HRN EN
5. Technical regulation for asphalt pavements

1.11. Supplementary literature

1. Roberts, F.L., Kandhal, P.S., Brown, E.R., Lee, D-Y and Kennedy, T.W.: Hot Asphalt Mixes – Materials, Design and Installation (translation from English), HSGI and IGH, Zagreb, 2003.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Babić, B.; Design of pavement structures, 1997	8	0-40
Sršen, M.: Introduction of Modern Measuring Devices in Road Condition Assessment - Croatian and International Experiences, Construction Yearbook, HSGI, Zagreb, 1999.	1	
Sršen, M.: Road Maintenance, Construction Yearbook, HSGI, Zagreb, 2000	1	
Relevantni propisi – HRN EN	1	
Technical regulation for asphalt pavements	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader		
Course	TRANSPORT, SPACE AND ENVIRONMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	30+0+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to the essential aspects of different and very complex impacts between transport infrastructure, space and environmental effects. Furthermore, students should develop the ability to objectively evaluate different starting points and arguments in the integral decision-making process on the future of spatial units, in accordance with the principles of sustainable development.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish between types and features of standard spatial planning, traffic and environmental documentation.
2. To notice, analyze and present the peculiarities and problems in space and transport systems and to find appropriate solutions while taking into account the possibilities and modalities of implementing solutions or planning concepts.
3. Evaluate and present planning variants regarding space and traffic, taking into account primarily the principles of sustainable development, and other important criteria, e.g. the criteria of polycentric development, the system of central places and development axes, etc.

1.4. Content of the course

Plans, programs, strategic documents related to transport, space and environmental impact: characteristics, types, components, methodology of development, adoption and implementation. Laws, regulations (conventions), institutions (organizations), participation of the public and other entities in the process of drafting and implementing plans and other important documents: the level of the municipality, the region, the state, the international level - especially the European Union. Elaboration of certain important chapters related to the mutual impact of transport, space and the environment: transport infrastructure, i.e. the design of transport networks in relation to the character and goals of spatial planning and planning, - policy instruments for spatial planning, transport (mobility) and environmental impact with respect to the principles of sustainable development; economic, social and other issues. Treatment of individual thematic areas. Overview and examples of the application of assessment methods in the process of evaluating alternatives and plans.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☐ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Participation of students in all forms of teaching, including the preparation and presentation of seminar papers, colloquiums and the final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, seminar, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Golubić J.: "Traffic and Environment", Faculty of Transport and Traffic Sciences, Zagreb, (1999)

1.11. Supplementary literature

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Golubić J.: "Transport and Environment", Faculty of Transport and Traffic Science, Zagreb, (1999)	1	0-40

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Iva Mrak, Ph.D.**	
Course	**TRAFFIC INFRASTURCTURE BUILDINGS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	15+20+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to the design methodology and to train them to use and develop project documentation.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish between the basic types of traffic buildings and traffic facilities and their basic characteristics. Basic types:
2. Garage and parking facilities
3. Def stations and terminals (bus, rail, airport, ferry...)
4. Traffic facilities (airports, heliports, gas stations, service facilities, info points, etc.)
5. Intermodal systems
6. Analyze the principles of designing traffic buildings (function, construction, design, safety and other aspects)
7. To develop a conceptual design and a characteristic part of the detailed design of a traffic building and facility

1.4. Content of the course

City and Traffic, Historical Overview of Development, Traffic Buildings in the Urban Environment and Called Her. Principles of designing traffic buildings . From the spatial plan to the detailed design. Individual and collective garages, public garages and parking facilities, ramp and mechanized. Gas stations, typology, function, construction, design. Service centers, function, construction, design. Public transport stations, taxi stop. Bus stations and terminals. Railway stations and terminals. Truck terminals. intermodal systems. Traffic in the function of tourism. Environmental impact. Structure as a design carrier in the design of airport buildings. Waterfront - ferry terminals.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☐ Independent tasks ☒ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

The presence continues. Preparation of seminars and programs. Passing the final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper	0,5	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Creation of a program task, periodic examination of knowledge (70%), final exam (30%).

1.10. Compulsory literature

1. Neufert, E.: Architectural Design, IGH Zagreb 2002.
2. Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997

1.11. Supplementary literature

1. Production programs of construction equipment
2. Plans and projects of implemented solutions.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Neufert, E.: Architectural Design, IGH Zagreb 2002.	13	0-40
Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997	1 (13 vols.)	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Sanja Šurdonja, Ph.D.**	
Course	**TRAFFIC SAFETY**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The basic goal of the course is to familiarize students with the traffic safety system in general. Analytically process relevant numerical applications in the analysis of road traffic safety, and introduce them to the current methods of control and regulation technology in all branches of traffic.

1.2. Conditions for enrolment in courses

Road junctions (registered)

1.3. Expected learning outcomes for the subject

1. Define and explain the influence of various factors on traffic safety (correlation in the human-vehicle-road relationship)
2. Define the features and analyze the possibility of applying intelligent transport systems (in the city and outside the city)
3. Analyze the applicability of certain control systems
4. Analyze data and propose a solution to improve security for specific input parameters

1.4. Content of the course

Development and task of safer traffic flow. Traffic safety factors (correlations in the human-vehicle-road relationship). Dynamics of vehicle movement (numerical application). Collisions of traffic flows in relation to safety. Traffic signalization in the function of safer traffic flow. Control control systems.
Intelligent Transport Systems (ITS).

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Submission of the program by a predetermined date.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1,25	laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, program, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Cerovac, V.: Traffic Technology and Safety; Faculty of Transport and Traffic Sciences, Zagreb 2001.
2. Maletin, M.: Planning and Design of Traffic in Cities, Orion Art, Belgrade 2005.
3. Road Traffic Safety Act

1.11. Supplementary literature

1. CROW-Road Safety Manual 2009 – dostupno on-line
2. PIARC – Road Safety Manual, 2019 – dostupno on-line

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Cerovac, V.: Traffic Technology and Safety; Faculty of Transport and Traffic Sciences, Zagreb 2001.	5	0-40
Maletin, M.: Planning and Designing Traffic in gradovima, Orion Art, Beograd 2005.	5	
Road Traffic Safety Act	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	TECHNOLOGY OF TRAFFIC BUILDINGS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Planning of traffic facilities in space/city, traffic design, traffic technology within the objects and dimensions of individual contents and spaces. Definition of possible variant solutions and optimal solution of traffic technology in buildings.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the basic types and functional features/differences between different types of the same object type (GPO, terminals dr.)
2. Define the basic principles of designing traffic facilities
3. Dimensioning of traffic facilities (for different types of traffic needs)
4. Selection of the optimal type of traffic facility according to technological and traffic criteria

1.4. Content of the course

Traffic access to traffic facilities. Traffic facilities: garage-parking, service, public transport terminals Traffic. Basic principles of planning and location elements. Traffic and traffic forecasts; traffic demand. Functional aspects. Typing; A different solution. Traffic facilities - Basic principles of design. Sizing and capacity. Accompanying traffic facilities. Traffic technology and how to use it.

1.5. Types of execution teaching	☒ Class ☐ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☒ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Preparation of the program task, participation in the periodic examination of knowledge (written), final exam

1.8. Monitoring student work							
Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	0,75	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	1,25	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation of a seminar paper, presentation, colloquies (70%), final exam 30%.

1.10. Compulsory literature

1. Legac, I.: City Roads, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, 2011.
2. Maršanić, R.: Parking Organization in Urban Areas, University North, Koprivnica, 2019.

1.11. Supplementary literature

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Legac, I.: City Roads	20	0-20
Maršanić, R.: Organization of Parking in Urban Areas	4	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

Back to the list of courses

General information		
Course leader	**Asst. Prof. Sanja Šurdonja, Ph.D.**	
Course	RAILWAY DESIGN	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim of the course is to train students to work on the development of projects related to railway infrastructure and the calculation of individual elements.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define the stages of railway development
2. Distinguish between tracks and trains and define the basic properties of different types of
3. Define the elements of the upper and lower structure of the line
4. Design elements of a railway line

1.4. Content of the course

Railway as a means of transport. Historical overview of the railway and development. Division of tracks and trains. Cross-section of the track. Upper and lower structure of the railway. Track construction, rails, sleepers. Stress calculation, sizing of rails, sleepers, curtains and planes. Railway design, laying of the track route, laying of the zero line, technical elements. Elements of the railway project: situation, longitudinal profile, transverse profiles, technical description. Management and maintenance of railway infrastructure. Stations. Track plants: switches, turntables, expansion joints...

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Creation of program tasks. Periodic examinations. The presence continues. Final exam

1.8. Monitoring student work							
Attending classes	2	Teaching activity		Seminar paper	0,25	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,75	Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation of the program, colloquia (70%), final exam (30%).

1.10. Compulsory literature

1. Marušić, D., Design and construction of railway lines, GF Split, Split, 1994.

1.11. Supplementary literature

1. Scientific and professional articles in the field of railways

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Marušić, D., Design and Construction of Railway Lines, GF Split, Split, 1994.	8	0-20

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Bojana Horvat, Ph.D.**	
Course	**GIS AND BASICS OF SPATIAL ANALYSIS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Introduction to the concept of GIS and the basics of spatial analysis. Training in searching spatial databases and analyzing spatial data and solving basic engineering tasks using GIS software. Training in the application of basic techniques of visualization of spatial data and spatial analysis results.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Define and explain the basic principles of a geographic information system and its components
2. Explain and apply the concepts of collecting and managing spatial data and downloading data from spatial databases
3. Define spatial data reference systems
4. Apply appropriate spatial analysis operations in order to effectively solve the spatial problem
5. Apply basic visualization techniques for the purpose of displaying and interpreting spatial data and spatial analysis results

1.4. Content of the course

Introduction to Geographic Information System (GIS): Definition, History, Data Types, Components, Software, data layers. Spatial data: vector and raster. Positioning in space: reference surfaces, coordinate systems and projections. Data collection, entry and storage: spatial and attribute data, data sources and quality, data preparation, spatial databases. Data search: application search function, spatial data interrelationships. Spatial analysis and application of basic analytical function: measurement and classification of spatial data, overlapping of data layers, analysis characteristic of the immediate vicinity of the observed location, network analysis. Visualization: basic techniques presentation of data and results of spatial analysis.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the modules: Geotechnics, Hydrotenihka and Roads.	

1.7. Obligations of students

Attending lectures and exercises according to the standards of the faculty. Preparation and submission of seminars. Production and submission of tasks from assigned exercises. Passing the colloquium and final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity	0,5	Seminar paper	1,5	Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Preparation of seminar papers, exercises, periodic examination of knowledge (70%), final exam (30%).

1.10. Compulsory literature

1. Bohnam-Carter, G.F.: Geographic Information Systems For Geoscientists, Pergamon, 1994

1.11. Supplementary literature

1. Meijerink, A. M. J. et al: Introduction to the Use of Geographic Information Systems for Practical Hydrology: IHP-IV M 2.3, ITC, Enschede, 1994.
2. Molenaar, M. An introduction to the theory object modelling for GIS. Taylor & Francis, 1998.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Bohnam-Carter, G.F.: Geographic Information Systems For Geoscientists, Pergamon, 1994	1	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	Assoc. Prof. Iva Mrak, Ph.D.	
Course	PUBLIC BUILDINGS AND SPACES	
Study program	University Graduate Study in Civil Engineering	
Course Status	Mandatory	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+20+10

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To introduce students to the design methodology and to train them to read and create part of the project documentation.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Distinguish between public spaces and public buildings, their origin and changes throughout history.
2. Enumerate and describe the characteristics of public spaces - streets and squares, gardens, parks and parks.
3. List and describe the characteristics of public buildings - communal, administrative, school and social.
4. Enumerate and describe the characteristics of public buildings - health, commercial, catering, cultural, traffic, sports and sacred.
5. To recognize significant public buildings and spaces in Croatia and the world.
6. Write a Seminar paper on the topic of public space: explore and analyze public space, valorize, propose treatment.
7. Develop a part of the preliminary and detailed design of the public space and building for public purposes.

1.4. Content of the course

Landscaping of pedestrian areas in an urban environment, historical overview. Design approach. From the spatial plan to the detailed design. Streets and squares, business and commercial pedestrian zones, shop windows, terraces, canopies. Traffic solution. Arrangement of parking areas and public garages. Public transport stations. Traffic buildings, bus and train stations, terminals. Administrative, commercial and commercial buildings. Buildings for education, social purposes, culture and cult. Markets, shopping malls, public toilets. Green areas and recreation areas, children's playgrounds, promenades and parks. Sports fields and halls. Gas stations in urban areas and beyond, info-centers. Acoustic insulation of road noise and traffic corridors. Landscaping of public areas outside the urban environment, roads, bridges, tunnels and their accompanying facilities.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☒ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at lectures. Preparation of the seminar: the given topic from the domain of public buildings should be covered according to the given model (introduction, historical context, analysis of the existing situation, valorization from the point of view of architectural theory, function, construction, design, world references, conclusion, literature). development of the program. Passing the colloquium and final exam.

1.8. Monitoring student work

Attending classes	2	Teaching activity	0,5	Seminar paper	0,5	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,5	Report		Practical work	
Portfolio		Program	2	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance, seminar paper, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997
2. Knežević, G.; Kordiš, I.: Residential and Public Buildings, Tehnička knjiga, Zagreb, 1987.
3. Neufert, E.: Architectural Design, IGH Zagreb 2002.

1.11. Supplementary literature

1. Ching, F.D.K.; Eckler, J.F. Introduction to Architecture, Wiley, 2012
2. Chattopadhyay, S., White, J., City Halls and Civic Materialism. Towards a Global History of Urban Public Space, Routledge, 2014.
3. Ching, F.D.K.; Eckler, J.F. Architecture: Form, Space, & Order, Wiley, 2014
4. Gehl, J., Life Between Buildings: Using Public Space, Island Press, 2011.
5. Carmona, M., Public Places Urban Spaces. The Dimensions of Urban Design, Routledge, 2021
6. Lynch, K., The Image of a City, Construction Book, 1974
7. Adjaye , D., David Adjaye: Making Public Buildings, Thames & Hudson, London, 2006
8. Alexander, C., Ishikawa, S., Silverstein, M., A Pattern Language: Towns, Buildings, Construction, Oxford University Press, USA, 1977.
9. National Association of City Transportation Officials, Urban Street Design Guide, Island Press, 2013.
10. Dovey, K., Becoming Places, Urbanism / Architecture / Identity / Power, Routledge, 2010

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Technical Encyclopedia, Miroslav Krleža Institute of Lexicography, Zagreb, 1963-1997	1 (13 vols.)	20
Knežević, G.; Kordiš, I.: Residential and Public Buildings, Technical book, Zagreb, 1987.	6	
Neufert, E.: Architectural Design, IGH Zagreb 2002.	13	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Bojan Bilić, senior lecturer**	
Course	SPATIAL PLANNING	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	5
	Number of hours (L+E+S)	20+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

To train the student to be able to work on solving the problem in an appropriate way, and from the position of a civil engineer. Spatial planning and similar problems and participate in the preparation of spatial planning documentation.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Describe the culture of space in the EU and world cities.
2. Analyze the basic principles of spatial planning with the application of regulations
3. Distinguish between historical aspects of urban development and spatial planning
4. Describe in detail the characteristics of individual aspects of planning (public participation, governance) protection of the public interest, urban economy, information systems...)
5. To create a certain segment of the spatial plan while respecting positive regulations and to graphically process the solution

1.4. Content of the course

Spatial and development plans. Laws and regulations in the process of adopting and implementing plans. History Urban Planning and Urban Planning. Geographical, functional and other factors in the development and life of cities and regions. Analysis, planning (protection and restoration) of content in space, especially infrastructure: Methods and techniques of planning and decision-making: theory and implementation. Aspects of international spatial planning, especially in the European Union. Basic sociological, economic and ecological components of spatial planning. Examples of ready-made spatial plans, discussion.

1.5. Types of teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☒ Terrain Occurs	☒ Independent tasks ☒ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Roads	

1.7. Obligations of students

Regular participation in classes, preparation of seminars and solving program tasks. Colloquium and final exam.

1.8. Monitoring student work

Attending classes	1,7	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	0,3	Report		Practical work	
Portfolio		Program	1,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, seminar, program, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Marinović-Uzelac, A.: Spatial Planning. - Zagreb: Home and World, 2001.
2. Milić, B.: The Development of Cities Through the Centuries I (1994), II (1994) and III (2002) - Zagreb: Školska knjiga.
3. Štimac, M., Spatial Planning in Practice, Gloss, 2010.
4. Ambruš, D., Mechanical City, STRAND, 2020.
5. Marinović-Uzelac, A.: Settlements, Cities and Spaces. - Zagreb: Technical Book, 1986.
6. Črnjar, M.: Economics and Environmental Protection. - Zagreb: Školska knjiga and Rijeka: Glosa, 1997.
7. Laws and regulations related to spatial planning and physical planning and construction. - Zagreb: Official Gazette of the Republic of Croatia.

1.11. Supplementary literature

1. Prinz, D.: Staedtebau. - Stuttgart: Kohlhammer, 1988. i 1992.
2. Mumford, L.: The City in History. - Zagreb: Forward, 1968.
3. Šćitaroci, M.-O.: Croatian Park Heritage. - Zagreb: Školska knjiga, 1992.
4. Marinović-Uzelac, A.: Theory of Surface Use in Urbanism. - Zagreb: Technical Book, 1989.
5. Meise, J., Volwahsen, A.: Urban and Regional Planning. - Vieweg and Son, 1980.
6. Marinović-Uzelac, A.: Social Space of the City. - Zagreb: SN Liber, 1986.
7. Maksimović, B.: Urbanism. - Belgrade: Scientific Book, 1980.
8. Spatial planning documentation (municipality, city, county, macro-region, country, European Union).

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Marinović-Uzelac, A.: Spatial Planning. - Zagreb: Home and World, 2001.	8	20-40
Milić, B.: The Development of Cities Through the Centuries I (1994) - Zagreb: Školska knjiga.	6	
Milić, B.: The Development of Cities Through the Centuries II (1994) - Zagreb: Školska knjiga.	7	
Milić, B.: The Development of Cities Through the Centuries III (2002) - Zagreb: Školska knjiga.	1	
Štimac, M., Spatial Planning in Practice, Gloss, 2010.	16	
Ambruš, D., Mechanical City, STRAND, 2020.	1	
Marinović-Uzelac, A.: Settlements, Cities and Spaces. -Zagreb: Technical Book, 1986.	3	
Official Gazette: https://narodne-novine.nn.hr/	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Asst. Prof. Nino Krvavica, Ph.D.**	
Course	URBAN WATER SYSTEMS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory / Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	6
	Number of hours (L+E+S)	30+15+15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

Development of knowledge related to the issue of water management in urban areas. Development methodological approach to analyses of water quantity and quality in urban areas. Training to solve tasks in the field of planning, design and management of urban water systems.

1.2. Conditions for enrolment in courses

1.3. Expected learning outcomes for the subject

1. Recognize the specifics of water resources management in urban areas
2. To carry out a hydrological-hydraulic calculation of rainwater runoff from urbanized areas.
3. Plan and manage the stormwater drainage system in accordance with a sustainable urban drainage.
4. Size and select the appropriate solution for blue-green infrastructure elements.
5. Assess the burden of rainwater pollution and the efficiency of rainwater treatment through blue-green infrastructure.
6. Assess flood hazards and risks in urban areas and propose mitigation measures consequences of floods in the context of spatial planning considerations.

1.4. Content of the course

Dynamics of the hydrological cycle in urban areas and the impact of urbanization on hydrological processes. Infrastructure municipal water systems – wastewater drainage systems, rainwater drainage systems. Hydrological-hydraulic analysis of rainwater runoff in urban areas. Concepts and models of urban basins. Specifics of surface water drainage from urbanized areas and roads – gutters, drains, open canals, road culverts, retention basins. Quality and burden of rainwater pollution, procedures for assessing the reception capacity of wastewater receivers. A sustainable approach to urban management drainage. Blue-green infrastructure and their impact on the quantity and quality of rainwater. Collection and reuse of rainwater. Floods in urban areas, flood hazards, flood risks, flood risk management plans. The impact of climate change on urban water systems. Urban water facilities and spatial plans. The concept of blue-green cities. Revitalization of watercourses in urban areas environments. Specifics of coastal urban areas, the impact of the sea on communal infrastructure systems.

1.5. Types of execution teaching	☒ Class ☒ Seminars and workshops ☒ Exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ Laboratory ☐ Mentor work ☐ Other _____
1.6. Comments	Elective on the module: Hydraulic Engineering.	

1.7. Obligations of students

Attending lectures, exercises and seminars according to the standards of the faculty. Creation of program tasks. Preparation and presentation of a seminar paper. Passing periodic examinations. Passing the final exam.

1.8. Monitoring student work

Attending classes	2,0	Teaching activity		Seminar paper	1,5	Experimental work	
Written exam	1,0	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,0	Report		Practical work	
Portfolio		Program	0,5	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Evaluation of program tasks, evaluation of seminar papers, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Margeta, J. (1992.): Basics of Water Management. University of Split, Faculty of Civil Engineering and Architecture. Split.
2. Margeta, J (2007): Rainwater and wastewater: pollution burden, protection measures. University of Split, Faculty of Civil Engineering and Architecture. Split.
3. Margeta J (2009): Sewerage of settlements: drainage and disposal of wastewater and rainwater. University of Split, Faculty of Civil Engineering and Architecture. Split.

1.11. Supplementary literature

1. Butler D, Davies JW (2004.): Urban Drainage, 2nd Edition. Spon Press, Taylor & Francis Group. London, UK.
2. University of Arkansas Community Design Center (2010.): LID – Low Impact Development: a design manual for urban areas. University of Arkansas Press, Arkansas, USA.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the subject

Title	*Number of copies*	*Number of students*
Margeta J (1992): Basics of Water Management. University of Split, Faculty of Civil Engineering and Architecture. Split.	10	20-40
Margeta J (2009): Sewerage of settlements: drainage and disposal of waste and rainwater. University of Split, Faculty of Civil Engineering and Architecture. Split.	10	
Margeta, J (2007): Rainwater and wastewater: pollution burden, protection measures. University of Split, Faculty of Civil Engineering and Architecture. Split.	2	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Ivan Marović, Prof. Diana Car-Pušić**	
Course	**CONSTRUCTION REGULATIONS**	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Other	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+0+0

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
It is necessary for students of future civil engineers to master the basic concepts, categories, institutes and legal relations in construction in a broad sense.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Interpret the basic legal concepts. 2. Interpret specific concepts of building regulations 3. Apply the adopted terms in the interpretation of legal problems in construction 4. Make appropriate use of the available applicable technical regulations.		
1.4. Content of the course		
Introduction to Law: Concepts, Categories, Institutes, Legal Relations. Construction regulations. Companies in the building materials industry, in design and construction. attitude towards the state. Procedures. Surveillance. Inspection. Individual legal acts. Court proceedings.		
1.5. Types of execution teaching	☒ Class ☐ seminars and workshops ☐ exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ laboratory ☐ Mentorski Rad ☐ Other _____
1.6. Comments		
1.7. Obligations of students		
Attendance min 70%, colloquium, exam		

1.8. Monitoring student work

Attending classes	1	Teaching activity		Seminar paper		Experimental work	
Written exam	1,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment	1,5	Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Colloquiums – 70%, exam – 30%.

1.10. Compulsory literature

1. Construction Act, Official Gazette 153/13, 20/17, 39/19, 125/19.
2. Physical Planning Act, OG 153/13, 65/17, 114/18, 39/19, 98/19.
3. Act on Physical Planning and Construction Activities and Activities, Official Gazette 78/15, 118/18, 110/19.
4. Occupational Safety and Health Act, Official Gazette 71/14, 118/14, 154/14, 94/18, 96/18.
5. Civil Obligations Act, OG 35/05, 41/08, 125/11, 78/15, 29/18, 126/21
6. Special Customs on Construction, Official Gazette 137/21

1.11. Supplementary literature

1. FIDIC: Conditions of Contract for Construction, FIDIC, Geneva, 1999.
2. FIDIC: Conditions of Contract for Plant and Design Build, FIDIC, Geneva, 1999.
3. FIDIC: Conditions of Contract for EPC/Turnkey Projects, FIDIC, Geneva, 1999.
4. Rajčić, D., Nikšić, S.: Introduction to Construction Law, Croatian University Publishing and Zagora-Zagorje, Zagreb, 2008.
5. Vukmir, B.: Contracts on Construction and Services of Consulting Engineers, RRIF-Plus, Zagreb, 2009.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the
Subject

Title	*Number of copies*	*Number of students*
Official Gazette: https://narodne-novine.nn.hr/	online	0-50

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	INVESTMENT POLICY	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Acquisition of basic knowledge in the field of investment policy of the company.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Interpret the basic concepts of the company's investment policy 2. Interpret specific terms of the company's investment policy 3. Recognize the stages of making an investment decision 4. Differentiate between calculations in market operations and recognize risks in construction processes 5. Develop an investment program for a smaller construction company		
1.4. Content of the course		
Investment policy of the company. Investment program, analysis of factors and conditions. Investment decision. Sources of financing. Investment dynamics. Cost analysis. Calculations in the market. The relationship between calculation and risk in the construction process. Cost planning. Cost control. Efficiency of investment - evaluation of the investment project. Cost-benefit analysis.		
1.5. Types of execution teaching	☒ Class ☐ seminars and workshops ☒ exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ laboratory ☐ Mentorski Rad ☐ Other _____
1.6. Comments		
1.7. Obligations of students		
Attendance at lectures and exercises according to the applicable Regulations. Actively participate in lectures and exercises. Preparation of independent work as a prerequisite for taking the exam. Final exam		

1.8. Monitoring student work							
Attending classes	1,5	Teaching activity		Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report	0,5	Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance and activity in class, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Lončarić, R., Organization of Construction Projects, HGDI, Zagreb, 1995.

1.11. Supplementary literature

1. Skendrović, V., Execution of Investment Works Abroad, Civil Engineering Institute, Zagreb, 1983.
2. Francis, J.C., Investment, Analysis and Management, McGraw-Hill Inetrnational Editions, New York, , 1987.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the
Subject

Title	*Number of copies*	*Number of students*
Lončarić, R., Organization of Construction projects, HGDI, Zagreb, 1995.	2	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Assoc. Prof. Dr. Ivan Marović**	
Course	CONSTRUCTION MANAGEMENT	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	First	
Credit Value and Course Delivery	ECTS coefficient of student workload	3
	Number of hours (L+E+S)	30+0+15

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Acquiring basic knowledge about the business of construction companies.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Interpret the basic concepts of management and management in construction 2. Interpret and apply management methods in construction organizational systems 3. Recognize the stages of managing an organization on a practical example.		
1.4. Content of the course		
Concept, types and objectives of enterprises. Characteristics and elements of the investment. Results of the process of reproduction of construction companies. Economy of funds. Costs. General management settings. The role and significance of management in the business of construction companies. Formation of the company's business policy. Influencing factors. Fundamentals market operations. The Law of Supply and Demand. Product planning and development. Prices policy. Elasticity in consumption. Business decision-making. Decision-making methods. Business communication and control system.		
1.5. Types of execution teaching	☒ Class ☒ seminars and workshops ☐ exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ laboratory ☐ Mentorski Rad ☐ Other _____
1.6. Comments		
1.7. Obligations of students		
Attendance at lectures according to the applicable Regulations. Active participation in lectures. Passing the colloquium and final exam.		

1.8. Monitoring student work							
Attending classes	1,5	Teaching activity		Seminar paper	1	Experimental work	
Written exam	0,5	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program		Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Attendance at classes, colloquia – 70%, exam – 30%.

1.10. Compulsory literature

1. Zekić, Z.: Management – Entrepreneurial Technology, Faculty of Economics, Rijeka, 2007.

1.11. Supplementary literature

1. Bidgoli, H.: Modern Information Systems for Managers, Academic Press, San Diego, 1997.
2. De George R. T.: Business Ethics, Prentice Hall, New Yersey, 1999.
3. Harry, M., Schroeder, R.: Six Sigma,Doubleday, New York, 2000.
4. Hill, C.W.L.: International Business, McGraw-Hill, New York, 2003.
5. Miles, R.E.: Theories of Management, McGraw - Hill, 1975.
6. Wagner, H.M.: Principles of Management Science, Eaglewood Cliffs, N.J., Prentice-Hall, 1975.
7. Stacey, R.D.: Strategic Management and Organizational Dynamics, Mate, Zagreb, 1997.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the Subject

Title	*Number of copies*	*Number of students*
Zekić, Z.: Management – Entrepreneurial Technology, Faculty of Economics, Rijeka, 2007.	5 (MOTHER-in-LAW)	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader	**Rosanda Ivetić Salopek, pred.**	
Course	BUILDING MAINTENANCE	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Electoral**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	4
	Number of hours (L+E+S)	30+15+0

1. DESCRIPTION OF THE COURSE		
1.1. Course objectives		
Acquiring the knowledge necessary to manage and manage building maintenance projects.		
1.2. Conditions for enrolment in courses		
1.3. Expected learning outcomes for the subject		
1. Interpretation of basic and specific concepts related to the maintenance of buildings 2. Appropriate use of positive legislation 3. Recognize the required level of maintenance of the building (regular maintenance, reconstructions, repairs and emergency interventions) and priorities in the maintenance of buildings 4. Plan, organize and manage the execution of maintenance works on buildings taking into account the specifics of buildings protected by law 5. Develop a project for the maintenance of a simpler building with cost calculation		
1.4. Content of the course		
Introduction and general terms. The state of regulations in the field of building maintenance. Regular maintenance, reconstructions, repairs and emergency interventions. Structure of maintenance costs. Maintenance of buildings in the context of the entire construction process. Managing the maintenance of buildings. Maintenance project. Planning and organizing the execution of maintenance works. Maintenance of old and legally protected buildings. Models for prioritizing the maintenance of buildings. Information system to support decision-making in determining maintenance priorities.		
1.5. Types of execution teaching	☒ Class ☐ seminars and workshops ☒ exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ laboratory ☐ Mentorski Rad ☐ Other _____
1.6. Comments		

1.7. Obligations of students

Attendance at classes 70%, accepted program before the exam. Passing the final exam.

1.8. Monitoring student work

Attending classes	1,5	Teaching activity	0,5	Seminar paper		Experimental work	
Written exam	1	Viva voce		Assay		Research	
Project		Continuous Knowledge Assessment		Report		Practical work	
Portfolio		Program	1	Laboratory			

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

Creation and submission of the program, attendance and activity in class – 70%, exam – 30%.

1.10. Compulsory literature

1. Marenjak, S.; Krstić, H.: Maintenance of Public Buildings, Faculty of Civil Engineering and Architecture Osijek, 2021.
2. Ordinance on Maintenance of Buildings, Official Gazette 122/2014-2343
3. Regulation on the maintenance of buildings, OG 64/1997

1.11. Supplementary literature

1. Wood, B.: Building maintenance, Blackwell Publishing, 2009.
2. Spedding A.: CIOB Handbook of Facilities Management, Longman Scientific & Technical, 1994.
3. Aničić, D.: Planning of the Useful Life of a Building, Construction Yearbook 03/04, Zagreb, 2004.
4. The Royal Academy of Engineering: The long term costs of owning and using buildings, The Royal Academy of Engineering, London, 1998.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the Subject

Title	*Number of copies*	*Number of students*
Marenjak, S.; Krstić, H.: Maintenance of Public Buildings, Faculty of Civil Engineering and Architecture Osijek, 2021.	4	0-20
Official Gazette: https://narodne-novine.nn.hr/	Available online	

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

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General information		
Course leader		
Course	MASTER'S THESIS	
Study program	**University Graduate Study in Civil Engineering**	
Course Status	**Mandatory**	
Year	Second	
Credit Value and Course Delivery	ECTS coefficient of student workload	30
	Number of hours (L+E+S)	

1. DESCRIPTION OF THE COURSE
1.1. Course objectives
A successful completion of the final thesis exam is proof that the student is independently trained during the study analyze, research, solve and present a solution to a complex construction problem. The student is able to create a work taking into account positive technical regulations and scientific knowledge in a certain field Construction.
1.2. Conditions for enrolment in courses
1.3. Expected learning outcomes for the subject
1.4. Content of the course
The graduate thesis is prepared by the student during the planned 120 hours of active teaching at the Faculty and the total A maximum of 30 ECTS credits. The student can write a diploma thesis on a practical or theoretical topic related to construction and similar in content to existing subjects. The student chooses the topic of the diploma thesis, and the committee for the award of the diploma thesis approves it during the third semester, and no later than the beginning of the fourth semester of the current academic year. Part of the work on the diploma thesis can be done by the student as practical classes (total workload up to 15 ECTS credits). The thesis can be based on: - making a computer model of a building structure or building - Numerical modelling of materials and processes in materials - analysis of a more complex mechanical problem that requires additional theoretical processing and presentation of an analytical or numerical solution procedure - static and dynamic analysis (calculation) of structures in concrete, metal and wood - analysis and development of projects, studies or part of a study of the transport system or part of that system - traffic analysis and design solution of the road and/or intersection with all elements - analysis of design solutions for hydraulic structures and systems - preparation of studies related to water management - Analysis of design solutions for geotechnical objects - design and analysis of projects related to urban areas (transport projects, spatial planning studies, water management facilities in urban areas) - other topics related to the design, analysis and execution of more complex construction facilities and system

In the preparation of the diploma thesis, the student actively cooperates with the teacher-mentor, as a rule, it is the teacher of the subject whose content is related to the selected topic. A teacher-commentator can also participate in the preparation of the diploma thesis if the content of the thesis requires it.		
1.5. Types of execution teaching	☐ lectures ☐ seminars and workshops ☐ exercises ☐ Distance education ☐ Field Teaching	☐ Independent tasks ☐ Multimedia & Network ☐ laboratory ☒ Mentorski Rad ☐ Other _____
1.6. Comments		

1.7. Obligations of students

The student is obliged to submit the written part of the work (in working form) to the teacher-mentor as a confirmation of execution
obligation in the semester in which the topic was assigned, and according to the deadlines that are adopted for each academic year. year.

The student is obliged to submit the graduate thesis (in the final written and digital form) to the student office within the deadlines for the defense of the thesis that are adopted for each academic year. year.

1.8. Monitoring student work

Attending classes		Teaching activity		Seminar paper	0-22,5	Experimental work	0 – 22,5
Written exam		Viva voce	7,5	Assay		Research	0 – 22,5
Project		Continuous Knowledge Assessment		Report		Practical work	0 – 22,5
Portfolio		Program	0 – 22,5	Laboratory	0-22,5		

1.9. Procedure and examples of assessment of learning outcomes during classes and at the final exam

80% written part of the thesis + 20% defense of the diploma thesis.

1.10. Compulsory literature

Depending on the topic.

1.11. Supplementary literature

Depending on the topic.

1.12. Number of copies of compulsory literature in relation to the number of students currently attending classes at the Subject

Title	*Number of copies*	*Number of students*

1.13. Methods of quality assurance that ensure the acquisition of learning outcomes, skills, and competencies

Quality monitoring procedures prescribed by the Faculty Quality Manual are carried out.

3.2.2. Explanation of ECTS credits

The number of hours of active teaching is calculated for all proposed courses with regard to the assumption of an average duration of one semester of 15 (fifteen) weeks (academic year with an average duration of 30 weeks). Program of three regular exam periods lasting 4 (four) weeks each.

In total, it is envisaged that the academic year has 42 working weeks: 2x15 weeks of classes and 3x4 weeks of exams.
Deadlines.

During the academic year, the student achieves a minimum of 60 ECTS credits in all proposed programs. The calculation of the number of hours that make up one ECTS credit, according to the above, would be:

1 ECTS = 42 (weekly) x 40 (working hours per week) / 60 ECTS = 1,680 hours / 60 ECTS = 28 hours

1 ECTS credit is equivalent to 28 hours of study load of a student.

The number of ECTS credits of individual courses is calculated in such a way that the complexity of the material (content) is taken into account
courses and all general and specific obligations of students related to mastering the course:

- General obligations include: the time required to attend classes, prepare for exams, conduct exams, consultations and the scope of literature that the student uses as mandatory for exam preparation.
- Under specific obligations, the following are estimated: time required for colloquiums, program development, preparation of seminar papers, laboratory exercises, field exercises, site visits, etc.

The course load coefficient is determined in accordance with the share of courses in the workload of each semester, in such a way that in each semester the student achieves 30 ECTS credits.

3.2.3. Method of monitoring the quality and success of course/module performance

It is planned to continuously monitor the quality of the implementation of all subjects through various forms of evaluation and self-evaluation of teachers and students.

Conducting evaluations of teaching and teachers will be carried out by the Course leaders (teachers), and organized by the body
The Faculty is responsible for monitoring and promoting the quality of the study program.

Different methods and procedures will be used to monitor and verify the quality of teaching and the success of course delivery:

- Researching and surveying students on all aspects of teaching:
    - regularity and organization of classes,
    - Literature
    - methods of improving teaching,
    - exams
    - communication and cooperation with teachers,
    - The content and methodology of teaching
    - Workload – ECTS
- public presentation of research results and student surveys
- by analyzing exam performance (performance, transparency, objectivity, etc.)

The quality of teaching of individual courses will be checked twice during the semester: the first time 3-4 weeks after the start of classes and the second time in the last week of classes. The results of the first examination can directly affect the improvement of the teaching process in the current semester.

All research and surveys will be conducted on pre-prepared forms in which subject teachers will be able to adapt the questions to the content of the course, the methodology of the course and other specific requirements related to each subject.

The subject teacher will, independently and/or in coordination with the responsible persons at the Faculty (and the competent bodies for monitoring and promoting quality), adopt a plan of measures to improve learning in a particular subject.

3.3. STRUCTURE OF STUDY, RHYTHM OF STUDY, OBLIGATIONS OF STUDENTS

3.3.1. Structure of the study (by semesters)

The curriculum of the graduate study consists of a compulsory and an elective part. The student creates his study program by choosing a module from a specific field of civil engineering, the student chooses a field of study – specialization within civil engineering.

In the first semester, the student enrolls in four (3) compulsory courses and three (3) elective courses. The selection of some elective courses is conditioned by the selected modules (major).

Courses organized through modules are attended by the student in the II and III semesters, and the fourth semester is reserved for the preparation of the diploma thesis and, if necessary, practical classes. (*Table view below*).

The modules are composed of a compulsory and an elective part, and each module allows the student to achieve a minimum of 30 ECTS credits. In all modules there are 3 compulsory subjects and several elective subjects.

I semester	II semester	III semester	IV semester
COMMON PART PROGRAM 3 (four) compulsory subjects 1 (one) elective course, regardless of enrolment modules - field of study 2 (two) elective courses, depending on the enrolled modules – field of study	COMPULSORY AND ELECTIVE COURSES OF MODULE 1 (Geotechnical Enginering, Hydraulic Engineering, Engineering Modelling of Structures, Structures, Transportation Engineering, Urban Engineering).	COMPULSORY AND ELECTIVE COURSES OF THE MODULE (Geotechnical Enginering, Hydraulic Engineering, Engineering Modelling of Structures, Structures, Transportation Engineering, Urban Engineering).	DIPLOMSKI RAD (15-30 ECTS) PRACTICAL CLASSES (0-15 ECTS)
30 ECTS	30 ECTS	30 ECTS	30 ECTS

The structure of the modules with compulsory and elective courses is presented in point 3.3.1.2.

3.3.1.1. A common part of the graduate study program

I semester

COMPULSORY SUBJECTS:

	COURSE	Total number of hours (L+E+S)	ECTS
1.	Theory and Technology of Concrete	30+15+15	5
2.	Project Management	30+15+15	5
3.	Probability and Statistics	30+30+0	4
Elective Course Group I - Students choose one of these two subjects			
4.	Computational Modelling	30+30+0	6
	Programming in Modelling	30+30+0	6

ELECTIVE – COMPULSORY COURSES OF THE FIRST SEMESTER:

The student chooses 2 courses depending on the course or a combination of modules of the two courses he has enrolled in

	COURSE	Total number of hours (L+E+S)	ECTS
1.	Concrete and Masonry Structures 1	45+30+0	6
2.	Road Intersections	20+15+15	5
3.	Engineering Rock Mechanics	30+30+0	5
4.	Computational Hydraulics	45+15+0	5
5.	Theory of Elasticity	35+0+10	4
6.	Theoretical Soil Mechanics	40+15+20	6

By enrolling in the course, the student is automatically obliged to enroll in an elective course as follows:

- Geotechnical Engineering: Engineering Rock Mechanics, Theoretical Soil Mechanics
- Hydraulic Engineering: Engineering Rock Mechanics, Computational Hydraulics
- Structures/Engineering Modelling of Structures: Concrete and Masonry Structures 1, Theory of Elasticity
- Transportation Engineering: Road Junctions, Engineering Rock Mechanics
- Urban Engineering: Road Hubs, Engineering Rock Mechanics, Computational Hydraulics, Theoretical Soil Mechanics

3.3.1.2. **Course structure by modules**

The student achieves at least 30 ECTS credits in each semester.

A list of all envisaged modules with courses and the structure of ECTS credits is given below.

In each module, in addition to courses closely related to the field from which the module was formed, there are also elective courses from other modules-fields of civil engineering in order to offer students the possibility of flexible creation of the study program.

In agreement with the Vice-Dean for Teaching and Students and the subject teacher, the student may exceptionally

allow, within the quota of elective courses, the enrolment and taking of courses in the graduate study programme outside of those offered in the course/module if it proves to be justified. In this case, students receive these ECTS within the planned 120 ECTS credits.

During the study, the Committee for Academic Evaluation and Evaluation of the Period of Study may allow a student to enrol in and take an elective course at another constituent of the University of Rijeka from the list of common courses up to 6 ECTS credits.

In brackets, next to the name of the subject, the prerequisite to be fulfilled for that subject shall be indicated, if The prerequisite exists.

MODULES – MAJOR: GEOTECHNICAL ENGINEERING

Geotechnical Module 1: BASIC GEOTECHNICS — 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Soil Dynamics	30+30+0	6
2.	Numerical Modelling in Geotechnics	30+30+0	6
3.	Foundations	30+15+15	5
	ELECTIVE COURSES		12*
	ALTOGETHER		30

** Students enroll in 31 ECTS credits in the first semester*

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Testing and Monitoring in Geotechnics	20+45+0	4
2.	Soil and Rock Reinforcement	30+15+15	4
3.	Environmental Protection	15+0+30	4
4.	*Waste Management**	30+10+5	4
5.	*Hydraulic Structures**	30+30+0	6
6.	*Operational Research and Linear Programming**	30+0+30	6

** Elective courses of other areas (modules)*

Geotechnical Module 2: GEOTECHNICAL ENGINEERING — 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Geotechnical Structures *(Theoretical Soil Mechanics)*	30+30+5	6
2.	Underground Structures and Tunnels *(Engineering Rock Mechanics)*	30+30+0	6
3.	Slope Stability *(Theoretical Soil Mechanics)*	30+30+0	6
	ELECTIVE COURSES		12
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Geohazards	20+10+15	4
2.	Geotechnics of Transportation Structures	25+20+0	4
3.	Seepage and Consolidation in the Soil *(Theoretical Soil Mechanics)*	30+15+15	4
4.	*Construction Regulations**	30+0+0	4
5.	*GIS and the Basics of Spatial Analysis**	30+15+15	6
6.	*Coastal Engineering**	30+15+15	6
7.	*Earthquake Engineering**	30+30+0	6

** Elective courses of other areas (modules)*

MODULES – MAJOR: HYDRAULIC ENGINEERING

Hydrotechnical Module 1: SANITARY HYDRAULIC ENGINEERING 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Hydraulic Structures	30+30+0	6
2.	Drainage and Wastewater Treatment *(Computational Hydraulics)*	30+30+0	6
3.	Water Supply and Water Treatment *(Computational Hydraulics)*	30+30+0	6
	ELECTIVE COURSES		12
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Experimental Hydraulics *(Computational Hydraulics)*	30+30+0	4
2.	Waste Management	30+10+5	4
3.	Water Resources Management	30+0+30	4
4.	Karst Hydrosystems	30+0+30	4
5.	*Operational Research and Linear Programming**	30+0+30	6

** Elective courses of other areas (modules)*

Hydrotechnical Module 2: COMMERCIAL HYDRAULIC ENGINEERING 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Engineering Hydrology	30+30+0	6
2.	Coastal Engineering	30+15+15	6
3.	Hydraulic Regulations and Meliorations *(Computational Hydraulics)*	30+30+0	6
	ELECTIVE COURSES		12
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Water Power Development *(Hydaulic Structures)*	*30+30+0*	*4*
2.	Hydraulic Modelling	*30+30+0*	*4*
3.	Computational Hydrodynamics	*30+30+0*	*4*
4.	*GIS and the Basics of Spatial Analysis**	*30+15+15*	*6*
5.	*Urban Water Systems**	30+15+15	6
6.	*Geohazards**	20+10+15	4
7.	*Construction Regulations**	30+0+0	4
8.	*Underground Structures and Tunnels** *(Engineering Rock Mechanics)*	30+30+0	6
9.	*Slope Stability** *(Theoretical Soil Mechanics)*	30+30+0	6
10.	*Soil Flow and Consolidation** *(Theoretical Soil Mechanics)*	30+15+15	4
11.	*Urban Water Systems**	30+15+15	6

** Elective courses of other areas (modules)*

MODULES – MAJOR: ENGINEERING MODELLING OF STRUCTURES

Engineering Modelling of Structures - Module 1 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Structural Modelling	30+0+30	6
2.	Numerical Modelling in Materials Engineering	30+0+30	4
3.	Operational Research and Linear Programming	30+0+30	6
	ELECTIVE COURSES		14
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Building Physics	20+0+10	2
2.	*Dynamics of Structures**	30+6+9	4
3.	*Energy Methods in Applied Mechanics**	24+0+6	3
4.	*Testing od Structures**	30+15+0	4
5.	*Plate Structures**	24+0+6	3
6.	*Stability of Structures**	30+6+9	4
7.	*Introduction to Plasticity and Damage Modelling**	27+12+6	4

** Elective courses of other areas (modules)*

Engineering Modelling of Structures - Module 2 — 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Inverse Modelling in Structural Assessment	30+0+30	6
2.	Finite Element Method	30+0+30	6
3.	Computer Aided Design	30+0+30	4
	ELECTIVE COURSES		14
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Geometric Modelling of Surfaces	30+0+30	4
2.	Computational Durability Mechanics	30+30+0	5
3.	Computer Systems Engineering	15+0+15	4
4.	*Hydraulic Modelling**	30+30+0	4
5.	*Lightweight Structures**	30+20+10	5
6.	*Earthquake Engineering**	30+30+0	6

** Elective courses of other areas (modules)*

MODULES – MAJOR: STRUCTURES

Constructor Module 1: — 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Steel Structures	45+30+0	6
2.	Dynamics of Structures	30+6+9	4
3.	Timber Structures	45+30+0	6
	ELECTIVE COURSES		14
	ALTOGETHER		30

	ELECTIVE SUBJECTS - Group 1	Total number of hours (L+E+S)	ECTS
1.	Energy Methods in Applied Mechanics	24+0+6	3
2.	Plate Structures	24+0+6	3
3.	Stability of Structures	30+6+9	4
4.	Introduction to Plasticity and Damage Modelling	27+12+6	4

	ELECTIVE COURSES - Group 2	Total number of hours (L+E+S)	ECTS
5.	Concrete and Masonry Structures 2	30+5+10	4
6.	Testing of Structures	30+15+0	4
7.	Building Design	15+30+0	4
8.	*Foundations**	30+15+15	5

** Elective courses of other areas (modules)*

Constructor Module 2: 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Solid Bridges	30+30+0	5
2.	Fundamentals of Composite Structures	30+15+0	4
3.	Prestressed Concrete Structures	30+15+0	4
	ELECTIVE COURSES		17
	ALTOGETHER		30

	ELECTIVE SUBJECTS - Group 1	Total number of hours (L+E+S)	ECTS
1.	Steel Bridges	30+15+0	4
2.	Lightweight Structures	30+20+10	5
3.	Earthquake Engineering	30+30+0	6
4.	Reliability of Civil Enigineering Structures	24+0+6	3
5.	Precast Concrete Structures	30+15+0	4
	ELECTIVE COURSES - Group 2	Total number of hours (L+E+S)	ECTS
6.	*Geotechnical Structures* (Theoretical Soil Mechanics)*	30+30+5	6
7.	*Coastal Engineering**	30+15+15	6
8.	*Finite Element Method**	30+0+30	6

** Elective courses of other areas (modules)*

MODULES – MAJOR: TRANSPORTATION ENGINEERING

Traffic Module 1: TRAFFIC AND ROAD DESIGN — 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Road Design *(Road Intersections)*	20+30+0	5
2.	Urban Traffic *(Road Intersections)*	30+30+0	6
3.	Traffic technology *(Road Intersections)*	30+15+15	5
	ELECTIVE COURSES		14
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Transport, Space and Environment	30+0+15	3
2.	Transport Infrastructure Buildings	15+20+10	4
3.	Traffic Safety	30+15+0	3
4.	Technology of Traffic Buildings	30+15+0	3
5.	Railway Design	30+15+15	5
6.	*Soil and Rock Reinforcement**	30+15+15	4
7.	*Operational Research and Linear Programming**	30+0+30	6
8.	*Spatial Planning**	20+15+15	5
9.	*Technology of Traffic Buildings***		

** Elective courses of other areas (modules)*

*** Course that students can take at the Faculty of Maritime Studies*

Traffic Module 2: PAVEMENT STRUCTURES — 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	Roadbed Design *(Road Intersections, Road Design)*	30+20+10	5
2.	Rigid Pavement Structures *(Theory and Technology of Concrete)*	25+10+5	4
3.	Flexible pavement structures	30+30+0	6
	ELECTIVE COURSES		15
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Airports	20+10+0	3
2.	Construction Machinery and Equipment	30+30+0	4
3.	Maintenance and Repair of Roads	30+15+0	3
4.	*Geotechnics of Transportation Structures**	25+20+0	4
5.	*GIS and the Basics of Spatial Analysis**	30+15+15	6
6.	*Construction Regulations**	30+0+0	4
7.	*Finite Element Method**	30+0+30	6
8.	*Underground Structures and Tunnels** *(Engineering Rock Mechanics)*	30+30+0	6

** Elective courses of other areas (modules)*

MODULES – MAJOR: URBAN ENGINEERING – interdisciplinary module

Urban Engineering Module 1: 2. SEMESTER (SUMMER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	*Waste Management**	30+10+5	4
2.	*Urban Traffic** *(Road Intersections)*	30+30+0	6
3.	Spatial Planning	20+15+15	5
	ELECTIVE COURSES		15
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Investment Policy	30+15+0	3
2.	Construction Management	30+0+15	3
3.	*Water Resources Management***	30+0+30	4
4.	*Drainage and Wastewater Treatment*** *(Computational Hydraulics)*	30+30+0	6
5.	*Operational Research and Linear Programming***	30+0+30	6
6.	*Road Design*** *(Road hubs)*	20+30+0	5
7.	*Transport, Space and Environment***	30+0+15	3
8.	*Traffic Engineering*** *(Road Intersections)*	30+15+15	5
9.	*Traffic Infrastructure Buildings***	15+20+10	4
10.	*Foundations***	30+15+15	5
11.	*Water Supply and Water Treatment*** *(Computational Hydraulics)*	30+30+0	6

** COMPULSORY subjects of other areas (modules); ** Elective courses of other fields (modules)*

Urban Engineering Module 2: 3. SEMESTER (WINTER)

	COMPULSORY SUBJECT	Total number of hours (L+E+S)	ECTS
1.	GIS and the Basics of Spatial Analysis	30+15+15	6
2.	Public Buildings and Spaces	30+20+10	6
3.	Urban Water Systems	30+15+15	6
	ELECTIVE COURSES		12
	ALTOGETHER		30

	ELECTIVE COURSES	Total number of hours (L+E+S)	ECTS
1.	Construction Regulations	30+0+0	4
2.	Building Maintenance	30+15+0	4
3.	*Geohazards**	20+10+15	4
4.	*Geotechnical Structures* (Theoretical Soil Mechanics)*	30+30+5	6
5.	*Engineering Hydrology**	30+30+0	6
6.	*Coastal Engineering**	30+15+15	6
7.	*Maintenance and Repair of Roads**	30+15+0	3
8.	*Underground Structures and Tunnels* (Engineering Rock Mechanics)*	30+30+0	6
9.	*Hydraulic Regulations and Meliorations* (Computational Hydraulics)*	30+30+0	6
10.	*Flexible Pavement Structures**	30+30+0	6

** Elective courses of other areas (modules)*

A student who chooses the Urban Engineering module can choose courses up to a load of 5 ECTS credits at the graduate study of the Faculty of Economics and Business of the University of Rijeka, majoring in Economics of Sustainable Development and Public Sector Economics.

IV semester

In the final (IV) semester, the student writes a diploma thesis.

	COURSE	ECTS
1.	PROFESSIONAL PRACTICE	0-15
2.	MASTER'S THESIS	15-30

Preparation of work during the semester with individual work with a mentor who is usually the course leader, the content of which is related to the selected topic. Practical classes can be envisaged as part of the thesis work. The student's workload of practical classes can be up to 15 ECTS credits.

During the study, a student may enrol in any course taught in the graduate study if he or she assesses that the enrolment in additional courses will not interfere with the course of his or her studies. All successfully mastered additional enrolled courses will be enrolled in the student's supplementary document of study.

3.4. LIST OF COURSES THAT STUDENTS CAN ENROLL IN FROM OTHER STUDIES

Students can enrol in courses from other studies at the Faculty of Civil Engineering in Rijeka or another higher education institution. The acquired ECTS credits will be recognized on the basis of point 3.6 of this study program.

During the study, the Committee for Academic Evaluation and Evaluation of the Period of Study may allow a student to enrol in and take an elective course at another constituent unit of the University of Rijeka from the list of joint courses up to 5 ECTS credits.

3.5. LIST OF COURSES THAT CAN BE TAUGHT IN A FOREIGN LANGUAGE

According to the implementation plan of the course that is adopted for each academic year.

3.6. CRITERIA AND CONDITIONS FOR THE TRANSFER OF ECTS CREDITS

ECTS credits that a student acquires by choosing a course at another higher education institution of the University of Rijeka or another University during the study of this study, and which are not identical to the courses envisaged by this study, will be enrolled in the student's diploma supplement *(Diploma supllementu).*

A special decision is not required for the transcription of the achieved points of equivalent courses (difference in content up to 30%) at faculties of civil engineering in Croatia (Faculty of Civil Engineering of the University of Zagreb, Split or Osijek), higher education institutions of the University of Rijeka and those faculties with which the faculty has signed a cooperation agreement.

The recognition of exams is regulated by the Ordinance on Studies of the Faculty of Civil Engineering of the University of Rijeka.

3.7. METHOD OF COMPLETING STUDIES

The study is completed by successfully passing all the programs prescribed by the exams, having fulfilled all other obligations in the study, and by drafting and oral defense (presentation) of the diploma thesis in front of the committee. The committee consists of a mentor and at least two members (teachers), one of whom is also the president of the committee. It is desirable that other teachers and students attend the defense of the thesis.

3.8. CONDITIONS FOR CONTINUING STUDIES FOR STUDENTS WHO HAVE INTERRUPTED THEIR STUDIES

Students who have interrupted their graduate university studies may re-enrol in the next five (5) academic years. By re-enrolling, they accept all changes to the study program that occurred during their absence from the study. They are recognized for all passed exams and courses that are identical to those according to the current program.

4. CONDITIONS FOR THE IMPLEMENTATION OF THE STUDY

4.1. PLACES OF STUDY

Since October 24, 2011, the Faculty has been operating in a new building at Radmile Matejčić 3, within the University campus in Trsat.

The building is the property of the University of Rijeka, while the Faculty is its user. The Faculty has a total of 8870 m2 of net usable area for the performance of its teaching, scientific and professional activities and accompanying business functions, which is 11.76 m2 of total area per student. The Faculty also has five new laboratories with a total net usable area of 969.62 m2, the equipment of which is in progress.

4.2. SPACE AND EQUIPMENT INFORMATION

The new building of the Faculty on the University Campus enables the complete conduct of all teaching activities at the same location, students and teachers have at their disposal 21 (23 if partition movable panels are used) lecture rooms and practicums, 3 rooms for student activities (for independent work of students, graduates and demonstrations), and 5 laboratories. The two largest lecture halls, G-003 and G-004 with 165 seats each, are used for lectures and are equipped with state-of-the-art multimedia equipment that enables synchronized interpretation and videoconferencing. Lecture rooms G-206 and G-207 (with equipment cabin G-208) form one lecture hall with 72 seats equipped with multimedia equipment, but by using a movable partition they can be used as two separate rooms. Practicums G-109, G-110, G-111 and G-213 are IT classrooms equipped with a total of 70 computers (workstations for students) and a projector. Five lecture rooms/practicums (G-108, G-205, G-209, G-210, G-212, G-307, G-309 and G-312) have from 30 to 60 seats and are equipped with a projector and a portable computer. In these spaces, mobile projectors are used as needed. All classrooms have the possibility of connecting computers to the Internet network and are equipped with a cooling system.

The faculty has a library with a spacious and networked computer equipped reading room.

A photocopying service is also available to students and teachers.

The faculty has the necessary sanitary facilities and a student canteen, which allows students to stay at the faculty undisturbed. In the new building, in addition to the reading room with 30 seats, students have at their disposal: a room for independent work of students with about 20 seats, a room for graduates with about 20 seats and a room for holding demonstrations with about 10 seats.

By moving to the new building, the spatial conditions for teaching were significantly improved. The newly equipped classrooms and their greater number compared to the conditions in the old building contribute to the improvement of the quality of teaching (holding exercises and seminars in smaller groups, more flexible schedule of classes and written tests), and the greatest progress is expected to be achieved by holding classes in 5 laboratories that are in the phase of equipping (hydrotechnical laboratory, geotechnical laboratory, road laboratory, construction laboratory and materials laboratory) since the old building students did not have any laboratory within the Faculty at their disposal, and laboratory exercises were held in other teaching bases (primarily in the IGH laboratory, the hydrotechnical laboratory of the Faculty of Civil Engineering of the University of Zagreb, etc.). Laboratory exercises in the subject of Material Testing were held at the Institute of Civil Engineering of Croatia (current name: Institut IGH), which deals with research and development in construction.

4.3. DATA ON WORK SITES FOR PRACTICAL TRAINING

In the university graduate study, practical classes are envisaged as part of the work on the final-graduate thesis if required by the topic of the graduate thesis. Practical classes are organized by a mentor on the topic of the diploma thesis, and practical classes take place to the extent that the work on the diploma thesis requires (up to 15 ECTS credits workload of the student).

The Faculty will sign contracts with institutes and private and public institutions in which practical classes for the purpose of writing the final thesis will take place.

4.4. OPTIMAL NUMBER OF STUDENTS

The optimal number of students who can enroll in the university graduate study of civil engineering, given the space, equipment and number of teachers, is 80 students, and the largest number is 100 students.

4.5. METHOD OF MONITORING THE QUALITY AND SUCCESS OF THE STUDY PROGRAMME

Continuous monitoring of the quality of the implementation of study programmes and all subjects through various forms of evaluation and self-evaluation of teachers, students and supporting services by the provider of study programmes, the Faculty of Civil Engineering of the University of Rijeka, is planned.

The Contractor shall, through his/her teachers, manage the organized implementation of the evaluation of teaching and teachers through his/her teachers, organized by the bodies of the Faculty responsible for monitoring and promoting quality (the existing Quality Monitoring and Promotion Team or another body authorized by the Council).

Different methods and procedures described in point 3.2.3 will be used to monitor and verify the quality of teaching and the success of the course.

The body of the contractor in charge of monitoring and promoting quality will carry out the following activities in terms of monitoring and promoting quality:

- public presentation of research results and surveys of students and teachers on all aspects of teaching Teachers and students and, if necessary, the Senate
- Keeping documentation on teachers – teachers' portfolio (students' opinions, work on improving teaching, additional teacher education, etc.)
- Analyzing exam performance (performance, transparency, objectivity, etc.)
- analysis of the success of studying in the study in general (passing by years of study, etc.)
- conducting the evaluation of professional (offices, accounting) and supporting services at the Faculty

The body of the contractor, in coordination with the responsible persons at the Faculty, will adopt a plan of measures to improve learning in a particular program, module or subject, as well as a plan of measures for better study in general. The contractor will strive to improve the teaching process by providing additional education of teachers, ensuring satisfactory material conditions for teaching, and the like.

It is planned that the existing Office for Student Relations (consisting of the Vice-Dean for Education, one teacher and one student) will continue with continuous work with student representatives, through which students can articulate current issues and problems related to the study.

The body in charge of monitoring and promoting quality will actively cooperate on all programs and projects related to quality, which will be implemented at the University of Rijeka.