GRAĐEVINSKI FAKULTET SVEUČILIŠTA U MOSTARU
FACULTY OF CIVIL ENGINEERING UNIVERSITY OF MOSTAR

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CIVIL ENGINEERING STUDY PROGRAMME

SECOND CYCLE

UNIVERSITY GRADUATE STUDY IN CIVIL ENGINEERING

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CURRICULUM

University **graduate** study in civil engineering

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◊ 1. INTRODUCTION

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1.1 Historical overview

Mostar is cultural, political, economic and university center of Herzegovina and southern part of Bosnia and Herzegovina. It has been at the crossroads of cultures and civilizations for centuries. The oldest written documents on Mostar date from the first half of the 15th century, and the city was founded by Duke Stjepan Kosača.

The Faculty of Civil Engineering University of Mostar was founded in 1978 as a result of a joint initiative of the region's leading professional and business factors arising from the growing demand for education of university-level professionals in civil engineering and development of scientific research in the field of civil engineering.

It started working on 1 September 1978 and it was officially registered by the Decision of the Business Court in Mostar on 11 May 1979. In a very short time, the Faculty established its reputation and justified its establishment and existence. It became and to this day remained the holder of research activities in the fields of engineering structures, transportation facilities, hydraulic engineering, geotechnics and architectural urban engineering for the region.

1.2 Tasks of the Faculty

Tasks of the Faculty are:

- organising and carrying out scientific and educational work for education of staff with university qualifications for the needs of business and other public activities in the field of civil engineering with titles:
    * Bachelor of Science in Civil Engineering and
    * Master of Science in Civil Engineering, the programme ...
- organising and carrying out scientific and research work for acquisition of the scientific degree of Doctor of Philosophy.
- organising systematic monitoring and use of scientific achievements, and preparing personnel for independent scientific research.
- providing conditions for production of textbooks and manuals for the needs of scientific and teaching process.
- aligning, directly or through other institutions, the needs of the economy with modern scientific and technical development.

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- cooperating with other scientific and research institutions and institutions of higher education in the country and abroad in organising and promoting joint scientific and research projects as well as in the scientific and educational process.

Since the beginning of its operation, the Faculty strives in every respect to become part of the unified European Higher Education System and Area, for which in 2005 it matured and sufficiently aligned its work with the principles of the Bologna Declaration.

1.3 Curriculum 2005 - 2013

The 78th session of the Faculty Council held on 27 September 2005 adopted the Curriculum of the Civil Engineering Study Programme, which is divided into two cycles:

- 1. cycle: University **undergraduate** studies in civil engineering for a period of **three years** or **six semesters** (**180 ECTS** credits) and
- 2. cycle: University **graduate** studies in civil engineering for a period of **two years** or **four semesters** (**120 ECTS** credits).

This Curriculum was implemented from the academic year 2005/2006.

Within the project ESABIH (European Union standards for accreditation of study programmes on BiH universities), which is primarily aimed at introducing European standards in the procedures of evaluation and accreditation of study programmes at Bosnian and Herzegovinian universities, an expert team, acting as an evaluation board, visited our Faculty in January 2012. The document underlying the visit of the expert team was the *Civil Engineering Study Programme Self-Evaluation Report* drawn up by a working team of the Faculty in October 2011.

In june 2012, this board drafted a positive *Quality Evaluation Report of undergraduate and graduate studies of the civil engineering study programme at the Faculty of Civil Engineering, University of Mostar*.

Seven years of implementation of the curriculum and the aforementioned external evaluation of the civil engineering study programme showed that it is generally well conceived and balanced. But also, deficiencies identified during its implementation as well as comments and recommendations from the report of the evaluation board showed that the time was ripe for its amendment.

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Pursuant to Article 24 of the Statute of the Faculty of Civil Engineering, University of Mostar, the Faculty Council adopted the Decision on appointment of the Commission for amendment of the Curriculum at the Faculty of Civil Engineering, University of Mostar, at its 124th session held on 29 September 2012. In fact, the commission was entrusted with the task of drafting a specific update of the Curriculum, which would start to be implemented from the academic year 2013/2014.

The amendments to the Curriculum of the Faculty of Civil Engineering, University of Mostar, were made in a way that they were incorporated into the full text that was adopted as such at the 134th session of the Scientific and Teaching Council held on 17 September 2013.

1.4 Curriculum 2014 and 2015

Considering the needs of the labour market, the launch of the university graduate civil engineering study proved to be very purposeful because in Mostar and the wider region there is a need for personnel with the kind of competences that are acquired at this study.

Namely, in the wider region there are a number of institutions that can employ this type of personnel such as:

- large construction companies engaged in design, construction, supervision or in production and sales of construction materials.
- city, county, entity and state level institutions and agencies.
- small construction companies or private enterprises.

The studies are based on modern scientific findings conveyed by the teachers to the students through lectures, exercises and other forms of teaching activities (seminar and/or programme works, laboratory exercises, study visits, graduation thesis, etc.). Namely, a significant number of teaching staff are engaged in scientific research, working on a larger number of research projects and a certain number of international projects funded by the European Union or through international bilateral cooperation.

This curriculum of graduate studies is very similar to the curriculum at the Faculty of Civil Engineering, Architecture and Geodesy, University of Split, in the Republic of Croatia. Namely, the graduate studies at both universities last two years (120 ECTS credits), and the curricula as well as the numbers of credits for each course/modulus, or group of courses/moduli, are very similar.

Therefore, we consider the Faculty of Civil Engineering, Architecture and Geodesy, University of Split, to be our reference faculty.

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The 135th session of the Scientific and Teaching Council of the Faculty of Civil Engineering University of Mostar, held on 30 October 2013, founded the Committee for development of the curriculum for the new programme "Architectural and Urban Engineering" at the university graduate studies in civil engineering.

The main reason to launch the new programme was a part of the field of civil engineering and architecture being extremely deficient in our immediate and wider area. The profession simply requires new profiles of professionals in architectural and urban engineering, but neither the Faculty of Civil Engineering University of Mostar nor universities in the neighbouring area can offer specialists in this branch. State, entity, and particularly county and municipal institutions need these personnel, which consequently often results in compromise solutions, or employing personnel that are not qualified to solve the problems of architectural and urban engineering.

In formal and legal terms, the second cycle of the civil engineering study programme is treated by:

- the Statute of the University of Mostar,
- the Rulebook on studies and the study system at the Faculty of Civil Engineering University of Mostar, and
- the Rulebook on organization and operation of the quality assurance and improvement system of the Faculty of Civil Engineering University of Mostar,

web page: www.gfmo.ba/akti_fakulteta.htm.

1.5 Educational goals

The Faculty of Civil Engineering, University of Mostar, has excellence as the guiding principle in its activity, with the primary aim of educating young people. Efforts are made to provide all the necessary conditions in order for them to become high-quality professional and scientific staff, who can properly respond to challenges and demands of the modern civil engineering. Since it was established until now, the Faculty has been building its identity on enviable moral and professional grounds taking account of the criteria important for the civil engineering profession.

The basic determinants in defining educational goals are:

- previous experience in higher education,
- modern requirements of new technologies,
- education system defined through cycles.

In the second cycle, the materials that acknowledge the multidisciplinary character of engineering problems and their solutions are implemented in the curriculum.

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In this way, a study cycle is established with three programmes:

1. GENERAL
2. STRUCTURAL ENGINEERING
3. ARCHITECTURAL AND URBAN ENGINEERING

All three programmes consists of core and elective courses classified by groups:

- Basic: courses of mathematical, information and natural sciences,
- Theoretical: theoretical subjects in the profession-related fields,
- Professional: courses in the field of civil engineering (structures, hydraulic engineering, transportation facilities, geotechnics, construction management etc.),
- Architectural: courses in the fields of architecture, urban planning and urban engineering,

as well as additional and/or extracurricular activities.

In addition to gaining the necessary professional knowledge, common educational goals for both cycles are also to enable students for:

- continuation of education,
- good team and individual work, which is achieved through various forms of learning and work with students (lectures, auditory, laboratory and design exercises, seminar and/or programme works, consultations and independent student work, fieldwork and professional visits to construction sites of major structures).

From the academic year of 2015/2016, the curriculum is chronologically updated and harmonised.

1.6 Specific requirements in the field of civil engineering

The objectives and competences of the university graduate studies correspond to the European Qualifications Framework to the extent possible. Their international dimension is taken into account and aligned in particular with the neighbouring countries. Considering that this is an area of technical sciences, the field of civil engineering, there is not a big risk of overlapping within courses. In this curriculum, attention was paid to possible overlapping within particular professional branches, as well as properly set chronological structure of all the courses.

When it comes to harmonization of educational objectives with professional regulations or legislation, local regulations and standards in the field of civil engineering in our country either do not exist or exist in part. A kind of transitional phase is still in progress, with a disorganized mixture of regulations and standards inherited from the former state being in force as regulations.

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Therefore, the basic principle is to introduce the regulations that exist at the level of the European Union and implement them in teaching. For example, EUROCODEs are especially important for structures.

1.7 Organizational context

The Faculty management consists of: Dean, Assistant Dean for Science, Assistant Dean for Academic Affairs and Secretary.

The Student Union has a direct communication with Faculty Management and participate in the work of the Faculty Council through their representatives.

Students elect their representatives by study years and programmes directly in student elections, after which they independently elect leadership of the Student Union.

For the purpose of better organization and coordination of activities of the Faculty, and consideration of issues of common interest for performance of the scientific and teaching work, the following departments operate at the Faculty:

- for Mechanics, Materials and Structures,
- for Hydraulic Engineering and Geotechnics,
- for Transportation Facilities and Construction Management.

The administrative part of the Faculty organization consists of: assistant for academic affairs, assistant for international cooperation, UIS coordinator, ECTS commissioner, student's office, accounting office, library and support staff (doorman, cleaners, custodian, ...).

The Faculty uses the University Information System (UIS) as technical and digital support. Rules of use of UIS, which all teachers and students are obliged to adhere to, are adopted by the Faculty Council of the Faculty of Civil Engineering, University of Mostar.

The Association "Alumni of the Faculty of Civil Engineering University of Mostar" was established in May 2014 as a voluntary association of all those who have completed some of the studies (the study degree VII/1, university graduate study), earned master's degree or doctorate at our Faculty.

1.8 Student mobility scheme

Already with its first Curriculum in 2005, the civil engineering study programme declared itself an international programme, so the openness of studies and student mobility has been a target maintaining the past practice of the Faculty, where dozens of foreign students have successfully completed the studies.

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The Faculty is a full member of the "Association of Croatian Faculties of Civil Engineering".

This membership provides the first degree of student mobility by an agreement on mutual alignment and recognition of the curricula of all Croatian civil engineering faculties, while the alignment of curricula with respect to European standards gives a mobility perspective at the European level.

In addition to the alignment of curricula, the mobility is also supported by the possibility of performing a part of the teaching in a foreign language.

In terms of one of the underlying principles of the Bologna Process, mobility of students and teaching staff, the Faculty cooperates with faculties of civil engineering in Bosnia and Herzegovina, Republic of Croatia and some faculties in Europe.

Part of the teaching staff of the Faculty is engaged in teaching at other faculties of the University of Mostar, as well as at other universities in Bosnia and Herzegovina.

1.9 Other elements

It has been shown in the previous practice that there will be an ever-growing demand for experts in the field of civil engineering. The interest shown by the economy and the public sector confirm our belief that this Curriculum offers a foundation of modern education in the field of civil engineering adequate for both high-quality engineering practice and further education at the university postgraduate studies in civil engineering.

Student workload, assignment of ECTS credits and tasks of ECTS commissioners are regulated by the act "Rulebook on studies and the study system at the Faculty of Civil Engineering, University of Mostar," website: www.gfmo.ba/akti_fakulteta.htm.

At the beginning of an academic year, we guarantee to students:

- full access to all their rights and obligations,
- consistent application of the "Rulebook on studies and the studying system"
- curriculum of each subject
- schedule of examination periods for the entire academic year.

In August 2012, the University of Mostar issued the "Manual for preparation of curricula based on learning outcomes and competences."

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Based on of this manual, an annex to the curriculum titled "Learning outcomes and competences of the university graduate studies of civil engineering" will be prepared as a separate document, by which the following will actually be integrated in the curriculum:

- General learning outcomes that describe the level of academic achievements that correspond to the Bologna principles, elaborated by *Dublin Descriptors*.
- Specific learning outcomes for the field of civil engineering, which determine achievement of the level of general descriptors through the study programme.
- Specific learning outcomes for the study programme of civil engineering (EUA Tuning project).
- Specific course learning outcomes that also include student performance criteria.

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◊ 2. GENERAL INFORMATION

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2.1 General information on the study

Title of the study programme

CIVIL ENGINEERING

Study programme cycle

2nd (second)

Title of the study cycle

UNIVERSITY GRADUATE STUDIES IN CIVIL ENGINEERING

Institution

Proposed by: Faculty of Civil Engineering University of Mostar

Participating institutions: Faculty of Civil Engineering University of Mostar

Study duration

2 (two) YEARS

Number of ECTS credits

120 (one hundred and twenty)

Study admission requirements

- Completed undergraduate university studies in civil engineering at the Faculty of Civil Engineering University of Mostar, or undergraduate university studies in civil engineering at other universities in Bosnia and Herzegovina or in the world.
- Completed professional studies in civil engineering at the institutions that organise such studies in Bosnia and Herzegovina or in the world, with previously passed differential exams.
- Completed undergraduate university study programme in other technical sciences, whether in Bosnia and Herzegovina or abroad, with previously passed differential exams.

Study system

Organised and performed by semesters as full-time studies.

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The acquired competences and skills for which the studies qualify graduates

Personal competences (in addition to those from the 1st cycle of the study programme)

- ability to adopt the analytical approach to work based on a wider understanding of science,
- ability to take a leading role in companies and research organizations and institutions,
- ability to contribute to innovation,
- ability to plan, supervise and perform professional, development and scientific projects,
- ability to interpret his/her own ideas and projects to associates,
- ability to find solutions to technical and human problems in the working environment,
- ability to apply the acquired knowledge in a creative manner when making decisions at responsible positions,
- ability to work at an international level, taking into account cultural, linguistic, social and economic influences,
- ability to accept responsibility for his/her own decisions,
- ability to accept demands of other professions and readiness to participate in interdisciplinary activities.

Academic competences (in addition to those from the 1st cycle of the study programme)

- ability to comprehensively understand general phenomena and problems of civil engineering, especially in the civil engineering field in which s/he specialises
- ability to apply the acquired knowledge and skills in planning, design, construction, supervision and maintenance of complex engineering structures, interventions and systems in his/her specialization field in terms of stability, safety, usability, environmental protection and costs,
- ability to apply the acquired knowledge and skills to identify, formulate and analyse problems and to find one or more acceptable solutions in the field of civil engineering in which s/he specialises,
- ability to help develop the civil engineering field in which s/he specialises, taking into consideration the knowledge from other scientific fields,

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- ability to interpret the social aspect and social context of the construction projects s/he is involved in
- ability to exercise a high level of professional judgement and conduct in civil engineering,
- ability to integrate the knowledge in civil engineering with architectural and urban planning fields,
- ability to participate in the development of spatial plans, particularly sections based on civil engineering in correlation with infrastructure planning,
- ability to identify and analyse the factors that are essential to urban space and functional needs in it.
- ability to constantly follow up the profession and keep improving.

Criteria and conditions for transfer of ECTS credits

It is possible to transfer to this study programme from a study programme of the same type at another institution of higher education in Bosnia and Herzegovina and abroad, and so before the beginning of classes in the winter semester. In that case, it is mandatory to submit the curriculum of the completed study programme in order to determine the differential courses.

The number of students transferring to this study programme is limited by the capacity of the study programme.

Students allowed to transfer to this study programme register as full-time students according to their personal needs.

Qualification awarded

MASTER OF SCIENCE IN CIVIL ENGINEERING, THE PROGRAMME . . .

Documents on completed studies

- Diploma certifying the completion of studies or degree awarded
- The additional document or Diploma Supplement of the study programme certifying which exams the student has passed, with what grades, and how many ECTS credits s/he has earned, as well as how many additional ECTS credits s/he has earned through extracurricular activities.

Access to further studies

UNIVERSITY POSTGRADUATE STUDIES

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◊ 3. CURRICULUM

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3.1 Programme structure with credits

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The GENERAL programme - I. (first) study year - I. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1-4.		E l e c t i v e		minimum	19.0
5.	DHID01	Hydraulics	3 + 2	45 + 30	6.0
6.	DHID03	Engineering hydrology	2 + 2	30 + 30	5.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises
NOTE: Student must register the remaining 4 (four) elective courses (**min. 19 ECTS**) not selected at the university undergraduate studies of civil engineering (regardless of the selected programme). The list of elective courses is given on the page 19 of the Curriculum of the university undergraduate studies in civil engineering.					

The GENERAL programme - I. (first) study year - II. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
7.	DPRO01	Pavement of roads and railways	2 + 2	30 + 30	5.0
8.	DGEO01	Rock mechanics	2 + 2	30 + 30	5.0
9.	DPRI01	Operational research in civil engineering	2 + 2	30 + 30	5.0
10.	DPRO02	Traffic engineering	2 + 2	30 + 30	5.0
11.	DHID12	River training	2 + 2	30 + 30	5.0
12.	DARH01	Building construction	2 + 2	30 + 30	5.0
		TOTAL:	**12 + 12**	**180 + 180**	**30.0**
					L = lectures, E = exercises

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The GENERAL programme - II. (second) study year - III. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DHID04	Water resources management	2 + 2	30 + 30	5.0
2.	DORG01	Business and investments in civil engineering	2 + 2	30 + 30	5.0
3-5.		Elective courses - in collaboration with mentor		minimum	15.0
6.		Elective courses - free choice		minimum	5.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises

The GENERAL programme - II. (second) study year - IV. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DZAV01	Diploma work	(0 + 15)*		30.0
		TOTAL:			**30.0**
					L = lectures, E = exercises
					*** Lecturer's time spent for each student. Not included in TOTAL.**

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The STRUCTURAL ENGINEERING programme - I. (first) study year - I. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1-4.		E l e c t i v e		minimum	19.0
5.	DKON02	Metal structures I	3 + 2	45 + 30	6.0
6.	DKON01	Stability of structures	2 + 2	30 + 30	5.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises
NOTE: Student must register the remaining 4 (four) elective courses (**min. 19 ECTS**) not selected at the university undergraduate studies of civil engineering (regardless of the selected programme). The list of elective courses is given on the page 19 of the Curriculum of the university undergraduate studies in civil engineering.					

The GENERAL programme - I. (first) study year - II. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
7.	DKON04	Concrete structures II	2 + 2	30 + 30	5.0
8.	DKON07	Prestressed concrete	2 + 2	30 + 30	5.0
9.	DMEH01	Dynamic models of earthquake engineering	2 + 2	30 + 30	5.0
10.	DKON05	Metal structures II	2 + 2	30 + 30	5.0
11.	DKON03	Surface structures	2 + 2	30 + 30	5.0
12.	DARH01	Building construction	2 + 2	30 + 30	5.0
		TOTAL:	**12 + 12**	**180 + 180**	**30.0**
					L = lectures, E = exercises

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The GENERAL programme - II. (second) study year - III. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DORG01	Business and investments in civil engineering	2 + 2	30 + 30	5.0
2.	DKON06	Concrete bridges	2 + 2	30 + 30	5.0
3-5.		Elective courses - in collaboration with mentor		minimum	15.0
6.		Elective courses - free choice		minimum	5.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises

The GENERAL programme - II. (second) study year - IV. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DZAV01	Diploma work	(0 + 15)*		30.0
		TOTAL:			**30.0**
					L = lectures, E = exercises
					*** Lecturer's time spent for each student. Not included in TOTAL.**

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The ARCHITECTURAL AND URBAN ENGINEERING programme I. (first) study year - I. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1-4.		E l e c t i v e		minimum	19.0
5.	DARH06	Fundamentals of urban planning	2 + 2	30 + 30	5.0
6.	DARH07	Spatial planning	3 + 2	45 + 30	6.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises
NOTE: Student must register the remaining 4 (four) elective courses (**min. 19 ECTS**) not selected at the university undergraduate studies of civil engineering (regardless of the selected programme). The list of elective courses is given on the page 19 of the Curriculum of the university undergraduate studies in civil engineering.					

The ARCHITECTURAL AND URBAN ENGINEERING programme I. (first) study year - II. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
7.	DPRI01	Operational research in civil engineering	2 + 2	30 + 30	5.0
8.	DPRO02	Traffic engineering	2 + 2	30 + 30	5.0
9.	DHID11	Urban water systems	2 + 2	30 + 30	5.0
10.	DARH05	Environmental protection and energy efficiency	2 + 2	30 + 30	5.0
11.	DHID10	Wastewater and solid waste management	2 + 2	30 + 30	5.0
12.	DARH01	Building construction	2 + 2	30 + 30	5.0
		TOTAL:	**12 + 12**	**180 + 180**	**30.0**
					L = lectures, E = exercises

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The ARCHITECTURAL AND URBAN ENGINEERING programme II. (second) study year - III. (winter) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DORG01	Business and investments in civil engineering	2 + 2	30 + 30	5.0
2.	DARH08	Urban planning and design	2 + 2	30 + 30	5.0
3-5.		Elective courses - in collaboration with mentor		minimum	15.0
6.		Elective courses - free choice		minimum	5.0
		TOTAL:		minimum	**30.0**
					L = lectures, E = exercises

The ARCHITECTURAL AND URBAN ENGINEERING programme II. (second) study year - IV. (summer) semester					
No.	**Course code**	**Course title**	**Course structure**		**ECTS**
			Per week L + E	**Per semester L + E**	
1.	DZAV01	Diploma work	(0 + 15)*		30.0
		TOTAL:			**30.0**
					L = lectures, E = exercises
					*** Lecturer's time spent for each student. Not included in TOTAL.**

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3.2 Course information

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3.2.1 List of core courses

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N O T E S

COMMON COURSES FOR PROGRAMMES: GENERAL AND ARCHITECTURAL AND URBAN ENGINEERING

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N O T E

COMMON COURSES FOR ALL PROGRAMMES

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N O T E S

COMMON COURSES FOR PROGRAMMES: GENERAL AND ARCHITECTURAL AND URBAN ENGINEERING

COMMON COURSES FOR ALL PROGRAMMES

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3.2.2 List of elective courses

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Serial no.	COURSE TITLE	Code	Page
36.	APPLIED STOCHASTIC METHODS	DPRI03	98
37.	APPLIED GEOLOGY	DGEO05	99
38.	ROAD DESIGN	DPRO08	100
39.	TRANSPORTATION FACILITIES AND ENVIRONMENT	DPRO05	101
40.	TRANSPORTATION FACILITIES - SELECTED CHAPTERS	DPRO09	102
41.	NUMERICAL PROGRAMMING	DINF03	103
42.	COMPLEX FOUNDATIONS	DGEO06	104
43.	COMPOSITE STRUCTURES	DKON13	105
44.	DECISION SYSTEMS IN CIVIL ENGINEERING	DORG03	106
45.	DURABILITY OF STRUCTURES	DKON14	107
46.	TUNNELS AND UNDERGROUND STRUCTURES	DGEO07	108
47.	PROJECT MANAGEMENT	DORG04	109
48.	**URBAN WATER SYSTEMS ****	**DHID11**	**53**
49.	**ENVIRONMENTAL PROTECTION AND ENERGY EFFICIENCY ****	**DARH05**	**55**
50.	WATER POLLUTION CONTROL AND ENVIRONMENTAL ENGINEERING	DHID09	110
51.	**WASTEWATER AND SOLID WASTE MANAGEMENT ****	**DHID10**	**56**
52.	SOIL IN CONSTRUCTION	DGEO08	111
53.	MASONRY STRUCTURES	DKON16	112
54.	AIRPORTS	DPRO06	113

**** Core courses of the ARCHITECTURAL AND URBAN ENGINEERING programme**

ALL PROGRAMMES
Programmes: **GENERAL** and **STRUCTURAL ENGINEERING**
Programmes: **GENERAL** and **ARCHITECTURAL AND URBAN ENGINEERING**
The **GENERAL** programme
The **STRUCTURAL ENGINEERING** programme
The **ARCHITECTURAL AND URBAN ENGINEERING** programme

Selection recommendations - LEGEND

NOTE: *Regardless of the registered programme, student is entitled to choose any elective course from the list from number 9 to number 54. Therefore, the recommendation of choice does not overrule the student's right to a free choice.*

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3.2.3 List of additional and/or extracurricular activities

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Serial no.	TITLE OF ADDITIONAL/EXTRACURRICULAR ACTIVITIES	Number of ECTS credits
1.	President of the Student Union	2.0
3.	Editor of the student journal "(Ne)stabilnost"	2.0
3.	Student assistant in a course**	2.0
4.	Vice President of the Student Union	1.5
5.	Elected representative of the study year	1.0
6.	Organiser of sports events*	1.0
7.	Organiser of cultural events*	1.0
8.	Organiser of humanitarian events*	1.0
9.	Blood donor more than once during the study	1.0
10.	Founder of international student organizations at the Faculty	1.0
11.	Head of international student organizations at the Faculty	1.0
12.	Representative of the Faculty in domestic and international symposia, competitions, fora, round tables etc.	1.0

** Pursuant to the "Rulebook on the appointment of student assistants of the Faculty of Civil Engineering University of Mostar", a course teacher may engage student(s) assistant(s).

* Five-a-side football contests, evening film parties, blood donation campaigns, humanitarian aid collection campaigns, regional civil engineering students' gatherings etc.

NOTE: *ECTS credits earned for additional and/or extracurricular activities shall be verified by the ECTS commissioner. These ECTS credits are registered separately in the diploma supplement, as additional credits.*

Additional credits for activities that are not in this list may be awarded exclusively by the ECTS commissioner, subject to prior consultation with the Dean and/or Vice Dean for Academic Affairs.

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3.2.4 Description of the curriculum

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3.2.4.1 Description of the curriculum of core courses

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Course title	**PAVEMENT OF ROADS AND RAILWAYS**	Programme	**GENERAL**
Course code	**DPRO01**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Ivan Lovrić, PhD, associate professor	ECTS	**5.0**

Course contents	Modern flexible and rigid pavements. Traffic loading conditions. Ambient conditions. Design procedures and techniques of rigid and flexible pavements (empirical and theoretical methods). Reinforcement of existing pavements. Pavement surface characteristics. Pavement maintenance. Pavement management. Subgrade and pre-overlay design. Geotextil. Asphalt pavement layers. Rigid pavement structures. Deterioration and maintenance of pavements. Track elements for forcefully driven vehicles: rails, sleepers, fastening elements, ballast. Special construction on the track: turnouts, travelling platform, turntable. Permanent way estimation and. dimension Maintenance work of track level and track direction; track closure. A track closure in continuous welded rails. Special railway: cable railway, funicular, monorail. Construction site visit.
Recommended reading	(1) B. Babić: Projektiranje kolničkih konstrukcija, Hrvatsko društvo građevinskih inženjera, Zagreb 1997.; (2) Babić, B., Horvat, Z.: Građenje i održavanje kolničkih konstrukcija, Fakultet građevinskih znanosti, Zagreb 1984.; (3) Lakušić, S, Polak, B.: Gornji ustroj željeznica (Predavanja za studente), Građevinski fakultet Zagreb, 2006.
Supplementary reading	(1) Marušić, D.: Efektivnost rekonstrukcije trasa željezničkih pruga. U: Zbornik referata IX. jugoslavenskog simpozija o elektronici u prometu, Ljubljana, oktobar 1987.; (2) Marušić, D.: Rekonstrukcija pruga za veće brzine. Disertacija, Građevinski fakultet Sveučilišta u Zagrebu, Zagreb, 1988.; (3) Marušić, D.; Čatlak, Z.: Izbor radijusa horizontalnih krivina pri rekonstrukciji pruga, Građevinar 43 (1991.); (4) Zavada, J.: Željeznička vozila i vuča vlakova, Fakultet prometnih znanosti sveučilišta u Zagrebu, 1991.; (5) Smjernice za projektiranje, građenje, održavanje i nadzor na cestama, Sarajevo/Banja Luka, 2005.
Teaching methods	Lectures, using a projector and blackboard. Exercises: auditory + design. Programme work: design exercises + independent work + defence of work.

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exam
	1st assessment	**1.0**	**0.5**	**1.0**/3.0
1.5	2nd assessment	**1.0**		

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 0.5 ECTS credits (requirement for admission to the make-up exam). Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.0 ECTS credit. A student who passes both assessments is required to take a short make-up exam in order for his/her final grade to be determined, and a student who does not pass both assessment is required to take a make-up exam of a longer duration with the scope of questions at the teacher's discretion. Make-up exam: Oral, 1.0/3.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to develop a pavement structure design.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**HYDRAULICS**	Programme	**GENERAL**
Course code	**DHID01**	Year of study	**I. (first)**
Group	Theoretical	Semester	**I. (winter)**
Teaching form	Lectures (L), Exercises (E)	Hours per week	**3L + 2E**
Name of lecturer	Zoran Milašinović, PhD, full professor	ECTS	**6.0**
Course contents	Hydraulic short systems: objects for evacuation of high water, flow over spillways, crest shape of overflow spillways, discharge over spillways, aeration, small and large cascades, hydraulic jump and stilling basin. Hydraulics of pressurized systems: Characteristics of centrifugal engines, pumps and turbines, speed regulation, frequency regulation, and hydraulics of pumping stations. Hydrodynamic equations of non steady flow in pipes, steady, quasi non steady analysis of water supply networks, slow time changes – mass oscillations, surge tanks, rapidly varied time changes, water hammer, protection of dangerous pressure states, fundamentals of unsteady flow modelling. Hydraulics of open channel flow: Saint-Venant equations of non steady flow, characteristic form of non steady flow equations. Kinematics of elementary waves, wave propagation in sub critical, critical and super critical flow. Sharp changes: waves of finite height, velocity and height in relative motion, positive and negative waves, dam break problems. Fundamentals of modelling of non steady flow in channels. Hydrodynamics of groundwater: generalization of Darcy low, 2D and 3D steady seepage problems, seepage equations, boundary conditions, methods of solution, electro analogy, viscose analogy, numerical methods, pressure and lift on structures, seepage gradients and forces, drainage, unsteady groundwater flow, Bousinesq equation, non steady well flow, determination of transmissibility and effective porosity by pumping tests, radius of well influence.		
Recommended reading	(1) H. Rouse: Fluid mechanics for hydraulic engineers, Dover Pub. Inc, New York, (2) V. L. Streeter: Fluid mechanics, McGraw-Hill Book Co. Inc, New York; (3) V. T. Chow: Open channel hydraulics, McGraw-Hill Book Co. Inc, New York, (4) J. Bear: Dynamics of fluids in porous media, Am. Elsevier Pub. Co.		
Supplementary reading	(1) K. Urumović: Fizikalne osnove dinamike podzemnih voda, Sveučilište u Zagrebu, 2003.		
Teaching methods	Lectures ex-cathedra supplied with projector, overhead projector and blackboard. Exercises by solving problems using the blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.8**/4.2	Written	**1.8**
1.8	2nd assessment		Oral	**2.4**

Course requirements and evaluation methods	Regular attendance of classes, 1.8 ECTS credits. Assessments: The two assessments are worth 100 points each, 200 in total. Requirement for admission to the 2nd assessment is at least 50 points earned at the 1st assessment. A student who earns up to 100 points at both assessments is required to take the make-up exam (written and oral part). A student who earns 100-140 points at both assessments is required to take the make-up exam (oral part). A student who earns 140-160 points at both assessments is assessed with the grade GOOD (3), 160-180 points with the grade VERY GOOD (4) and 180-200 points with the grade EXCELLENT (5). Make-up exams: Written part, 1.8 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 2.4 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes.
Learning outcomes	The student is able independently or in team to solve standard problems in design and construction of hydraulic structures, water supply, sewerage, hydropower and other water control systems.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**WATER RESOURCES MANAGEMENT**	Programme	**GENERAL**
Course code	**DHID04**	Year of study	**II. (second)**
Group	Professional	Semester	**III. (winter)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Željko Rozić, PhD, senior lecturer	ECTS	**5.0**
Course contents	Water resources elements and characteristics; water balance and characteristics flows; water and society; water functions; management of water use, pollution, floods and droughts; integrated concept of water resource management; water resources planning; reservoirs design and operation; application of systems analysis and techniques in water resources planning and management.		
Recommended reading	(1) Margeta, J.: Osnove gospodarenja vodama, G.F. Split, 1992.; (2) Margeta J.:Smjernice za integralni pristup razvoju, gospodarenju i korištenju vodnih resursa, 1999.; (3) Margeta, J., Uvod u sistemsko inženjerstvo u projektiranju i upravljanju akumulacijama, Split, 1988.		
Supplementary reading	(1) Kos, Z., Hidrotehničke melioracije - odvodnja, Zagreb, 1982.; (2) Kos, Z., Hidrotehničke melioracije - navodnjavanje, Zagreb, 1987.; (3) Stojić, P., Hidroenergetika, G.F. Split, 1993.; (4) Bonacci, O., Karst Hydrology, Springler Verlag, Heidelberg, 1987.		
Teaching methods	Lectures and exercises using a projector and blackboard. Programme works: independent work + defence of work.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme works	Make-up exams	
	1st assessment	**1.0**	**1.5**	Written	**1.0**
1.5	2nd assessment	**1.0**		Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit (requirement for admission to the 2nd assessment). A student who does not pass the 1st assessment is required to take the make-up exam. 2nd assessment passed, 1.0 ECTS credit. A student who does not pass the 2nd assessment is required to take the make-up exam. Programme works: 1st programme work (0.3 ECTS credits) is the requirement for admission to the 1st assessment; 2nd programme work (0.3 ECTS credits) is the requirement for admission to the 1st assessment; 3rd programme work (0.3 ECTS credits) is the requirement for admission to the 2nd assessment; 4th programme work (0.3 ECTS credits) is the requirement for admission to the 2nd assessment; 5th programme work (0.3 ECTS credits) is the requirement for admission to the 2nd assessment. Make-up exams: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of programme works.
Learning outcomes	Student acquires the basic theoretical knowledge in the field of water management systems, and practical calculation methods to solve problems in this field: optimization methods, multi-criteria methods and economic methods for optimization of use, management and planning of water resources.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**ENGINEERING HYDROLOGY**	Programme	**GENERAL**
Course code	**DHID03**	Year of study	**I. (first)**
Group	Professional	Semester	**I. (winter)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Gordan Prskalo, PhD, senior lecturer	ECTS	**5.0**

Course contents	Water budget. Effective rainfalls. Runoff coefficient. Hydrograph form analysis and flow separation methods. Infiltration and evapotranspiration as hydrological processes. Catchment as a system. Characteristics of linear and nonlinear systems. Rainfall-runoff relationships. Theory of the unit hydrograph. Unit hydrograph estimation. Impact of nonlinearity and nonstationarity to the form of unit hydrograph. Synthetic unit hydrograph. SCS method. The unit hydrograph application for the estimation of high flows. Hydrologic methods for flood rooting. Hydrologic data analysis, homogeneity and independency of data series and data series extrapolation. Determination of extreme flows. Application of time series analysis in hydrology.
Recommended reading	(1) O. Bonacci: Meteorološke i hidrološke podloge, Priručnik za hidrotehničke melioracije, I kolo; (2) S. Prohaska: Hidrologija kroz teoriju i praksu, Univerzitet u Beogradu, Beograd, 2002.; (3) R. L. Bras: Hydrology - An Introduction to Hydrologic Science. Addison-Wesley Publishing Company, USA, 1990.
Supplementary reading	(1) V.P. Singh, Hydrologic Systems, Rainfall-Runoff Modeling, Prentice Hall, 1988.; (2) D. Srebrenović, Primijenjena hidrologija, Tehnička knjiga, Zagreb, 1986.
Teaching methods	Lectures and exercises using a projector and blackboard. Programme work independently with consultations.

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exams	
	1st assessment	**1.0**	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.5**		Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit (requirement for admission to the 2nd assessment). A student who does not pass the 1st assessment is required to take the make-up exam. 2nd assessment passed, 1.5 ECTS credits. A student who does not pass the 2nd assessment is required to take the make-up exam, oral part. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the 1st assessment and the written part of the make-up exam). Make-up exams: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to analyse distribution of rainfall in space and time and time variations of short storms, develop simple linear and nonlinear runoff models, develop simple design storm models, define multiple distribution functions of measured hydrological parameters, develop hydrological forecasts and multiple regression models, apply a simple generation of synthetic time series of data to forecast individual events, make a simple regionalization of stochastic features of hydrological phenomena in a catchment.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**ROCK MECHANICS**	Programme	**GENERAL**
Course code	**DGEO01**	Year of study	**I. (first)**
Group	Theoretical	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Amira Galić, PhD, senior lecturer	ECTS	**5.0**
Course contents	Physical and structural properties of intact rock, discontinuities and rock mass. Deformability and strength of intact rock, discontinuities and rock mass. Index properties of rock mass. Classification of the rock mass. Soft rocks. Initial stresses in rock masses. Stereographic projection. Block theory. Rock slope stability. Bearing capacity of foundation on rock. Stress and strain analysis around underground excavations. Support of the underground excavation. Ground response curve and available support line. Excavation principles. Monitoring in the underground openings.		
Recommended reading	(1) P. Miščević: Uvod u inženjersku mehaniku stijena, Građevinsko-arhitektonski fakultet Split, 2004.		
Supplementary reading	(1) Programski paketi FLAC 3.05 i Z_SOIL 2001; (2) Goodman R. E. (1989.), Introduction to Rock Mechanics (second edition), John Wiley & Sons; (3) Hoek E. & Bray J. W. (1974.), Rock slope engineering, The Institution of Mining and Metallurgy, E & FN Spon; (4) Hoek E. & Brown E.T. (1980.), Underground Excavations in Rock, Institut of Mining and Metallurgy, London; (5) Hudson J. A. & Harrison J. P. (1997.), Engineering rock mechanics, an introduction to the principles, Pergamon.		
Teaching methods	Lectures and exercises using a projector and blackboard. Laboratory exercises and fieldwork. Programme work: independent work + defence of work.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exam
	1st assessment	**1.0**	**1.0**	**1.5**/2.5
1.5	2nd assessment	**1.5**		

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the make-up exam). Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.5 ECTS credits. A student who does not pass both assessments is required to take the make-up exam. Make-up exam: Oral, 1.5/2.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student acquires the knowledge on determination of characteristics of rock, discontinuities and rock mass, and their use in design of foundations on rock, the rock slope stability and stability of the underground excavations. The student is able to determine index indicators, classify rock, solve some of the problems of foundation engineering and stability in rock mass.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**RIVER TRAINING**	Programme	**GENERAL**
Course code	**DHID12**	Year of study	**II. (second)**
Group	Professional	Semester	**III. (winter)**
Teaching form	Lectures (L), Exercises (E), Seminar paper	Hours per week	**2L + 2E**
Name of lecturer	Zoran Milašinović, PhD, full professor	ECTS	**5.0**
Course contents	The purpose, problems and tasks of training. Morphology of a riverbed. Hydrological properties of natural watercourses. Hydraulic calculations of natural watercourses. Training works in watercourse bed. Water regime training. Flood control. Structures on watercourses. Torrent training. Watercourse maintenance.		
Recommended reading	(1) Gjurović, M.: Regulacije rijeka; (2) Jovanović, M.: Regulacija reka, Rečna hidraulika i morfologija; (3) Kuspilić, N: Regulacija rijeka-predavanja		
Supplementary reading	(1) Vuković, Ž: Osnove hidrotehnike; (2) Svetličić, E.: Otvoreni vodotoci-regulacije; (3) Barbalić, Z.: Riječna hidrotehnika; (4) Kurpjel. B: Osnovi hidrotehnike		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. <u>Seminar paper:</u> Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). <u>Examination:</u> Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to engage in systematic monitoring of river flow and its training.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**CONCRETE STRUCTURES II**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON04**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E)	Hours per week	**2L + 2E**
Name of lecturer	Mladen Glibić, PhD, associate professor	ECTS	**5.0**
Course contents	Details of reinforced concrete structure calculations according to limit states of bearing capacity and exploitation (slender compression elements; deflection, cracks; simultaneous bending, shear and torsion; dimension complex composite cross-section of arbitrary shape). Impact of concrete shrinkage and creep on internal forces and concrete structure safety. Impact of construction method on concrete structure calculations. Crack width calculation of complex composite concrete elements. Reinforcement details. Fiber-reinforced concrete structures. Ferrocement structures. Lightweight concrete and high-strength concrete. Concrete structures in extreme climate conditions and aggressive environment. Very high concrete buildings. Water towers. Concrete wall girders with openings. Structural solutions and principles of seismic-resistant concrete structures. Structural design of ductile structures. Complex spatial reinforced concrete structures. Prefabricated reinforced concrete structures. Examples of reinforced concrete structures remediation. Quality control in design and construction. Basic numerical modelling of reinforced concrete structures. Field visits to structures under construction and already constructed ones.		
Recommended reading	(1) Tomičić I.: Betonske konstrukcije (Concrete structures), Školska knjiga, Zagreb 1988; (2) Tomičić I.: Betonske konstrukcije - odabrana poglavlja (Concrete structures - selected chapters), DHGK, Zagreb 1993; (3) Eurocode 2.; Eurocode 4.; Eurocode 6.; Eurocode 8.		
Supplementary reading	(1) Bresler B.: Reinforced concrete engineering, John Wiley and Sons, 1974; (2) Nawy E.G.: Reinforced concrete, Prentice-Hall, 1985.		
Teaching methods	Lectures, using a projector and blackboard. Exercises, using a projector, by directly solving problems on the blackboard, through fieldwork.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.5**	Written	**2.0**
1.5	2nd assessment	**2.0**	Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.5 ECTS credits (requirement for admission to the 2nd assessment). 2nd assessment passed, 2.0 ECTS credits. A student who does not pass both assessments is required to take the make-up exam. Make-up exams: Written, 2.0 ECTS credits (requirement for admission to the oral part of the exam). Oral, 1.5 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student gains knowledge of complex problems of reinforced concrete structures design and calculations. S/he is able to calculate deflections, dimension deep girders, short cantilever elements, shallow foundations, foundations of prefabricated columns and solve frame structure nodes.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer

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Course title	**CONCRETE BRIDGES**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON06**	Year of study	**II. (second)**
Group	Professional	Semester	**III. (winter)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Mladen Glibić, PhD, associate professor	ECTS	**5.0**
Course contents	State-of-the-art design solution and construction methods for concrete underpasses, overpasses and viaducts on roads and motorways. Slab bridges. Concrete girder bridges with prefabricated longitudinal girders (continuous and with continuous slabs). Concrete girder bridges of box cross-section. Bridge design and construction by launching. Arch bridges. Cable-stayed concrete bridges. Integral concrete bridges. Pylons of cable-stayed bridges. Bridge external prestressing. Bridge loads. Bridge calculation and design in seismic areas. Bridge bearings. Concrete bridge substructure (columns and abutments). Shallow and deep foundations. Construction details (cables, anchoring, prestressing protocol, railing, cornice, drainage, transition devices, aseismic blocks and devices). Common concrete bridge construction procedures. Well-known bridges in Croatia. Field visits to concrete bridges under construction and some already constructed ones. Regulations.		
Recommended reading	(1) K. Tonković, Mostovi (Bridges), SNL, Zagreb, 1981; (2) K. Tonković, Masivni mostovi-opća poglavlja (Massive bridges - general chapters), Školska knjiga, Zagreb, 1977; (3) K. Tonković, Masivni mostovi-građenje (Massive bridges - construction), Školska knjiga, Zagreb, 1979;		
Supplementary reading	(1) Hewson R. N.: Prestressed concrete bridges, Thomas Telford, 2003; (2) Walther R. and all: Cable stayed bridges, Thomas Telford,1999; (3) Rayall M. J. and all: Manual of bridge engineering, Thomas Telford, 2000; (4) Trojano L. F.: Bridge Engineering, Thomas Telford, 2003.		
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)	Programme work	Examination
		1.5	**2.0**
1.5			

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: (requirement for admission to the exam) Preparation and defence of the programme work, 1.5 ECTS credits. Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes. Preparation and defence of the programme work
Learning outcomes	The student is able to design and participate in the construction of concrete bridges.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer

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Course title	**DYNAMIC MODELS OF EARTHQUAKE ENGINEERING**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DMEH01**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Mladen Kožul, PhD, senior lecturer	ECTS	**5.0**
Course contents	Dynamics analysis of structures subjected to seismic action: linear analysis, non-linear analysis, simplified non-linear analysis. Dynamics modelling of trusses, frames, plane structures, plates and shells, structural systems, structure-soil-fluid interaction. Dynamics calculation and modelling of earthquake resistant structures: - Buildings: computational methods, specific requirements for concrete, steel, timber and masonry buildings, modelling of buildings (regular and non-regular in plan and elevation), computation of building resistance, repair and strengthening of exist buildings. - Bridges: basic rules and methods of dynamics computation, details, bridges with special isolating devices, special bridges. - Towers, masts and chimneys: modelling of seismic action and structure, methods of analysis. - Silos and tanks: modelling of seismic action and structure, methods of analysis.		
Recommended reading	(1) A. Mihanović: Dinamika konstrukcija, Građevinski fakultet Sveučilišta u Splitu, Split, 1995.; (2) J.L. Humar: Dynamic of structures, Prentice Hall, New Jersey, 1990.; (3) Eurocode 8 - Design provisions for earthquake resistance of structures.; (4) D. Aničić, P. Fajfar, B. Petrović, A. Szavits-Nossan, M. Tomažević: Zemljotresno inženjerstvo, Građevinska knjiga, Beograd, 1990.		
Supplementary reading	(1) M. Čaušević: Potresno inženjerstvo (odabrana poglavlja), Školska knjiga, Zagreb, 2001.; (2) A. K. Chopra: Dynamic of structures – Theory and Applications to Earthquake Engineering, Prentice Hall, New Jersey, 1995.; (3) P. Fajfar: Dinamika gradbenih konstrukcij, Fakultet za arhitekturo, gradbeništvo in geodezijo, Ljubljana, 1984.		
Teaching methods	Lectures by using computers. Movies showing earthquake effects on structures. Development of individual programme work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)	Programme work	Examination
		1.0	**2.5**
1.5			
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work (requirement for admission to the exam): Preparation and defence of the programme work, 1.0 ECTS credit. Examination: Oral, 2.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.		
Learning outcomes	The student is able to carry out a dynamic analysis of buildings, bridges and other structures according to European standards.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**METAL STRUCTURES I**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON02**	Year of study	**I. (first)**
Group	Professional	Semester	**I. (winter)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**3L + 2E**
Name of lecturer	Vlaho Akmadžić, PhD, senior lecturer	ECTS	**6.0**
Course contents	Methods of elastic and plastic global analysis of metal structure. Problems of stability of elastic and plastic global analysis in metal structures. Stability problems (buckling, lateral torsion buckling, local buckling). Theory of plasticity – application in steel structures. Theorem of the lower and upper limit, dimensioning, stability requirement. Multi-component compression/pressure elements. Fatigue – general dimensioning principles – new concept. Computation of thin profiles. Design of frame systems – frame classification, global imperfections, computation of joints. Plate girders – the stability problem. Truss supporters and columns – structural formation, joints. Design of a steel production hall – dimensioning and structural formation of elements (purlins, roof girders, crane supporters, columns, wind bracings, etc.).		
Recommended reading	(1) B. Peroš: Metalne konstrukcije II - skripta, Građevinsko - arhitektonski fakultet, Split, 2004.; (2) B. Androić, D. Dujmović, I. Džeba: Metalne konstrukcije I, II, III, IV i Modeliranje konstrukcija prema EC 3, IGH, Zagreb, 1994.; (3) A. Vukov: Uvod u metalne konstrukcije, GF, Split, 1988.		
Supplementary reading	(1) A. Vukov, B. Peroš, B. Gotovac, P. Marović, A. Meštrović: Upustvo za projektiranje, izvedbu i ugradbu šipkastih čeličnih nosača, GF, Split, 1980.; (2) A. Mihanović: Stabilnost konstrukcija, DHGK, Zagreb, 1993.; (3) Eurocode 3 i 4; Stahal im Hochbau, 14 Auflage.		
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)	Programme work	Examinations	
		1.2	Written	**1.5**
1.8			Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.8 ECTS credits. Programme work: (requirement for admission to the exam) Preparation and defence of the programme work, 1.2 ECTS credits. Examinations: Written part, 1.5 ECTS credits. (requirement for admission to the oral part of the exam) Oral part, 1.5 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes. Preparation and defence of the programme work
Learning outcomes	The student acquires advanced theoretical knowledge in the field of stability of metal structures and is able to dimension more complex metal structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**METAL STRUCTURES II**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON04**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Vlaho Akmadžić, PhD, senior lecturer	ECTS	**5.0**
Course contents	Analysis of complex supporting systems in steel structures. Computational methods and concepts (elastic and plastic global analysis). Interaction between the supporting structures and extreme loads. Analysis of the influence of structural and geometric imperfections. Multy-storey steel skeletons. Linear light grid metal structures with large spans. Cable structures-suspended bearing/supporting systems. Shell bearing systems, corrugated shell structures. Metal structure in hydrotechnical projects (steel pressure pipelines, water-towers, reservoirs, dams, gates). Application of the reliability theory model in computation of complex supporting systems in metal structures.		
Recommended reading	(1) R. Englekirk: Steel structures, John Wiley & sons, Inc., New York, 1994.; (2) B. Peroš: Napisi za predavanja, Građevinsko - arhitektonski fakultet, Split, 2004.; (3) B. Androić, D. Dujmović, I. Džeba: Metalne konstrukcije I, II, III i IV, IGH, Zagreb, 1994.		
Supplementary reading	(1) V. Milčić, B. Peroš: Uvod u teoriju sigurnosti nosivih konstrukcija, G-AF, Split, 2003.; (2) Mihanović: Stabilnost konstrukcija, DHGK, Zagreb, 1993.; (3) A. Vukov: Uvod u metalne konstrukcije, GF, Split, 1988.; (4) EUROCODE 1, 3, 4, 8.		
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)	Programme work	Examination
		1.5	**2.0**
1.5			

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: (requirement for admission to the exam) Preparation and defence of the programme work, 1.5 ECTS credits. Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes. Preparation and defence of the programme work
Learning outcomes	The student is able to design and calculate highly complex metal structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**SURFACE STRUCTURES**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON03**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E)	Hours per week	**2L + 2E**
Name of lecturer	Ivo Čolak, PhD, full professor	ECTS	**5.0**
Course contents	Membrane stress state, equation and boundary conditions. Plate bending. Thin and thick plates, equation and boundary conditions. Contribution of shear and bending, comparison to linear models. General formulation of the finite element method in theory of plates and shells. Degenerated 3D isoparametric elements. Co-ordinate systems and geometry of elements. Fields of displacements, strains and stresses. Constitutive law. Shell structures. Cylindrical and rotational shells – known solutions. Numerical solution of shell structures, particularly folded shell structures, pipes, tunnels, channels, structures composed of shells and beams (halls, sport structures, cooling towers, bins etc.). Numerical examples of reinforced concrete and metal plates and shells. Reference to stress state around openings and curved borders of shell structure. Connection of shell and beam element, problem of sixth degree of freedom.		
Recommended reading	(1) Kostrenčić Z.: Theory of Elasticity, Školska knjiga, Zagreb 1982; (2) B. Gotovac; V. Kozulić; I. Čolak: Introduction to numerical modelling of spatial structures, Mostar, 2001; (3) Hinton E., Owen D. R. J.: Finite element software for plates and shells, Pineridge press, Swansea, U.K., 1984; (4) Jović V.: Introduction to Engineering Numerical Modelling, Aquarius Engineering, Split, 1993		
Supplementary reading	(1) Girkman K.: Surface Girder Systems (translation from German), Građevinska knjiga, Beograd, 1965; (2) Timoshenko, S. P.; Woinowsky-Kriger, S.: Theory of Plates and Shells, 2nd edn, McGraw-Hill, New York, 1959; (3) D. R. J. Owen and E. Hinton, Finite Elements in Plasticity: Theory and Practice, Pineridge Press, Swansea, U.K., 1980.		
Teaching methods	Lectures, using a projector and blackboard. Exercises, by solving problems directly on the blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	assessment	**1.5**	Written	**1.5**
1.5			Oral	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: Assessment passed, 1.5 ECTS credits. A student who passes the assessment is required to take the make-up exam (oral part). A student who does not pass the assessment is required to take the make-up exam (written and oral part). Make-up exams: Written, 2.0 ECTS credits (requirement for admission to the oral part of the exam). Oral, 1.5 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student is able to create on his/her own a numerical model of engineering structures composed of plane and linear parts; explain the obtained results in elements such as: beam, plane girder, plate, shell element; describe stress state due to concentrated effects and at border of openings and curved boundary.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**PRESTRESSED CONCRETE**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON07**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Programme work	Hours per week	**2L + 2E**
Name of lecturer	Mladen Glibić, PhD, associate professor	ECTS	**5.0**
Course contents	Detail analyses of prefabricated subsequently prestressed concrete girders (cross-section selection; prestressing force calculations; prestressing force loss calculation; cross-section stress state for exploitation loads; ultimate bearing capacity; prestressing system selection; cable and anchor selection; cable plan; cable holders; prestressing protocol; calculations and design of conventional and prestressed reinforcement; prestressing girder edge; girder calculations to shear; elements for girder extraction from moulds and transport; girder grouting; girder construction). Details of prefabricated preliminary/adhesion prestressed girders. Continuous prestressed girders. Prestressed box girders. Cables outside concrete cross-section (external prestressing). Partial prestressing. Cable jointing and anchoring. Prestressed slabs. Prestressed membranes and cables. Prestressed complex spatial structures. Examples of prestressed structures. Details of some cable prestressing and anchoring systems. Basics of prestressed structures durability. Regulations. Field visits to prestressed concrete structure - constructed and under construction.		
Recommended reading	(1) Tomičić I.: Betonske konstrukcije (Concrete structures), Školska knjiga, Zagreb 1988; (2) Tomičić I.: Betonske konstrukcije - odabrana poglavlja (Concrete structures - selected chapters), DHGK, Zagreb 1993; (3) Eurocode 2.; (4) Eurocode 4.; (5) Eurocode 6.; (6) Eurocode 8.; (7) Kos V.: Prenapregnuti beton (Prestressed concrete), Zagreb 1974; (8) Romić S.: Prednapeti beton u teorijskoj i arhitektonskoj praksi (Prestressed concrete in theory and architectural practice), Građevinska knjiga Beograd 1978; (9) Jeftić D.: Prenapregnuti beton (Prestressed concrete), Građevinska knjiga Beograd 1979.		
Supplementary reading	(1) Nilson A. H.: Design of prestressed concrete, John Wiley and Sons, 1987.		
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)	Programme work	Examination
		1.5	**2.0**
1.5			

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: (requirement for admission to the exam) Preparation and defence of the programme work, 1.5 ECTS credits. Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes. Preparation and defence of the programme work
Learning outcomes	The student is able to design and participate in the construction of prestressed structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**STABILITY OF STRUCTURES**	Programme	**STRUCTURAL ENGINEERING**
Course code	**DKON01**	Year of study	**I. (first)**
Group	Professional	Semester	**I. (winter)**
Teaching form	Lectures (L), Exercises (E)	Hours per week	**2L + 2E**
Name of lecturer	Mladen Kožul, PhD, senior lecturer	ECTS	**5.0**
Course contents	The tasks of structural stability. Determining stability. General methods. Equilibrium branching. Geometrical stiffness. Mechanical models of stability of single levelled and multi levelled systems. Small and large displacements. Perfect and imperfect structures. Linear-elastic bending stability of columns, bearers and arches. Lateral buckling stability of bearers. Stability of rings and arches. Stability of frames. Stability of material and geometrical non-linear line structures with numerical and analytical methods. Factor of critical load. Bulging of plates and shells with small and large displacements. Introduction of numerical methods to plate and shell stability. Use of Stability Theory on Ferro concrete, steel and wooden constructions. Bearer local stability. General considerations about stability according to European standards.		
Recommended reading	(1) A. Mihanović: Stabilnost konstrukcija, DHGK, Zagreb, 1993.		
Supplementary reading	(1) Bažant Z. P. and Cedolin L., STABILITY OF STRUCTURES: Elastic, Inelastic, Fracture and Damage Theories, Dover Publications, Inc., New York, 2003.		
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)	Examinations	
		Written	**1.5**
1.5		Oral	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Examinations: Written, 1.5 ECTS credits (requirement for admission to the oral part of the exam). Oral, 2.0 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student acquires full knowledge of the structural stability problem (columns, frames, slabs, shells) in both linear and nonlinear field of behaviour of materials. The student is able to recognize and understand structural stability problems and consequently apply the knowledge in static analysis of structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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<table>
<tr><td>Course title</td><td colspan="3">FUNDAMENTALS OF URBAN PLANNING</td><td>Programme</td><td colspan="2">Architectural and urban engineering</td></tr>
<tr><td>Course code</td><td colspan="3">DARH07</td><td>Year of study</td><td colspan="2">I. (first)</td></tr>
<tr><td>Group</td><td colspan="3">Architectural</td><td>Semester</td><td colspan="2">I. (winter)</td></tr>
<tr><td>Teaching form</td><td colspan="3">Lectures (L), Exercises (E),
Programme work</td><td>Hours per week</td><td colspan="2">2L + 2E</td></tr>
<tr><td>Name of lecturer</td><td colspan="3">Dina Stober, PhD, senior lecturer</td><td>ECTS</td><td colspan="2">5.0</td></tr>
<tr><td>Course contents</td><td colspan="6">Basic concepts of urban planning and urbanization. Historical overview of urban and public space development. Cartographic base of urban planning documents. Urban planning instruments. Urban planning stages: data collection, analyses, scenarios, conceptual design of settlements. Urban planning stages: public participation, implementation. Users and uses of space: housing, central facilities, industry and business zones, transport infrastructure, utility installations. Users and uses of space: leisure, sports facilities, urban greenery, visual values, cultural valuation. Urban public space and the concept of "genius loci". New trends in changes of urban centers.</td></tr>
<tr><td>Recommended reading</td><td colspan="6">(1) Marinović-Uzelac, A.: Prostorno planiranje, Dom i svijet, Zagreb, 2001.
(2) Prinz, D.: Urbanizam I - Urbanističko planiranje, GMTK - AF, Zagreb, 2006.</td></tr>
<tr><td>Supplementary reading</td><td colspan="6">(1) Mumford, L.: Grad u historiji, Naprijed - Zagreb, 1986.
(2) Milić, B.: Razvoj grada kroz stoljeća I, II, III; Školska knjiga, Zagreb</td></tr>
<tr><td>Teaching methods</td><td colspan="6">Lectures, using a projector and blackboard. Exercises: auditory + design.
Programme work: design exercises + independent work + defence of work.</td></tr>
<tr><td colspan="7">Distribution of ECTS credits</td></tr>
<tr><td rowspan="3">Regular attendance of classes</td><td colspan="3">Programme work</td><td colspan="2">Examination</td><td></td></tr>
<tr><td rowspan="2">Preparation</td><td rowspan="2">1.5</td><td rowspan="2">written</td><td rowspan="2">2.0</td></tr>
<tr><td>1.5</td><td>Defence</td></tr>
<tr><td>Course requirements and evaluation methods</td><td colspan="6">Regular attendance of classes, 1.5 ECTS credits.
Programme work: Preparation and defence of the programme work,
1.5 ECTS credits (requirement for admission to the exam).
Exam: Written, 2.0 ECTS credits.</td></tr>
<tr><td>Requirement(s) for admission to the make-up exam</td><td colspan="6">Regular attendance of classes. Preparation and defence of the programme work.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">The student comprehends and distinguishes the roles of different disciplines and entities in the process of developing urban planning documents. Linking the knowledge of civil engineering with architectural and urban-planning courses for analysis of urban planning documents. Identifying and interpreting the state in urban space. The student is able to critically evaluate the organization of urban spaces. S/he is able to participate in development of documents at the location level.</td></tr>
<tr><td>Language of instruction</td><td colspan="6">Croatian.</td></tr>
<tr><td>Quality assurance methods</td><td colspan="6">(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.</td></tr>
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Course title	**SPATIAL PLANNING**	Programme	**Architectural urban engineering**
Course code	**DARH06**	Year of study	**I. (first)**
Group	Architectural	Semester	**I. (winter)**
Teaching form	Lectures (L), Exercises (E), Prog. work	Hours per week	**3L + 2E**
Name of lecturer	Borislav Puljić, PhD, senior lecturer	ECTS	**6.0**
Course contents	Introduction to spatial planning, historical overview, definition and world experiences. Spatial plan development methodologies, world and local experiences, levels and contents of plans. Zoning and land use. Urban and rural areas, towns and settlements. The basis of a plan: preexisting and created conditions. Demography and economy. Agriculture and forestry. Social infrastructure, settlement system and network. Physical infrastructure: traffic, power supply, communications, water supply and drainage. Utility infrastructure: cemeteries, landfills, utility systems. Vulnerability of space and environmental protection. Spatial systems and spatial projections. Plan as a projection of sustainable development of space. Public consultations, adjustment of actors and plans, space rights. GIS - tools, analyses and databases.		
Recommended reading	(1) Marinović-Uzelac, A. : Prostorno planiranje, Dom i svijet, Zagreb, 2001.; (2) Marinović-Uzelac, A. : Naselja, gradovi, prostori, Tehnička knjiga, Zagreb, 1986.; (3) Marinović-Uzelac, A. : Teorija namjene površina u urbanizmu, Tehnička knjiga, Zagreb,1989.		
Supplementary reading	(1) Vresk M.: Razvoj urbanih sistema u svijetu, Školska knjiga, Zagreb, 2002.; (2) Vresk M.: Osnove urbane geografije, Zagreb, 2002.; (3) Pegan, S.: Osnove urbanističkog i graditeljskog zakonodavstva s tumačem stručnih pojmova, Sveučilište u Zagrebu, Arhitektonski fakultet, Zagreb, 2006.; (4) Piha, B.: Prostorno planiranje, Novinska ustanova Službeni list, Beograd, 1973.; (5) Stojkov, B.: Metode prostornog planiranja, Beograd, 1999.		
Teaching methods	Lectures, using a projector and blackboard. Exercises: auditory + design. Programme work: design exercises + independent work + defence of work.		

Distribution of ECTS credits				
Regular attendance of classes	Programme work		Examination	
	preparation	**1.5**	oral	**2.0**
1.5	defence			

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 1.5 ECTS credits (requirement for admission to the exam). Exam: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student comprehends reasons and objectives of spatial planning. S/he is able to participate in the development of spatial plans as whole documents, and in particular of sections based on civil engineering, and primarily infrastructure planning. The student is familiar with methods of spatial planning for sustainable development of space. S/he is actively involved in the plan development and adoption process as the leader of preparations. S/he knows modern trends and methods of spatial planning. S/he uses modern spatial planning tools.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**URBAN WATER SYSTEMS**	Programme	**Architectural urban engineering**
Course code	**DHID11**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lect. (L), Exercises (E), Programme and seminar work	Hours per week	**2L + 2E**
Name of lecturer	Željko Rozić, PhD, senior lecturer	ECTS	**5.0**
Course contents	Dynamics of the hydrologic cycle in urban areas. Water demands - categorisation of demands by quantities and water quality standards. Ambient water and rainwater - problems of high water and solving strategies. Structural and nonstructural protection solutions. Revitalization of watercourses in urban areas. Aquatic systems as urban recreational facilities. Groundwater in urban areas and associated construction problems. Wastewater recipient capacity assessment procedures. Water quality modelling. The sea as a part of urban space and wastewater recipient. Infrastructural utility water systems - water supply systems, drainage and sewerage systems, low-quality water supply systems. Functional analysis and organisation. Institutional organisation and economics. Reuse-oriented wastewater treatment methods. Coastal and underwater structures and facilities. Ports, marines, quays, coastal communications. Urban water facilities and spatial planning. Legislative regulations.		
Recommended reading	(1) Bonacci, O.: Karst hydrology (2) Margeta, J.: Osnove gospodarenja vodama (3) Tedeschi, S.: Zaštita voda		
Supplementary reading	(1) Bonacci, O.: Ekohidrologija vodnih resursa i otvorenih vodotoka (2) Bonacci, O.; Roje-Bonacci, T.: Posebnosti krških vodonosnika (3) Linsley, R.K.; Franzini, J.B.; Freyberg, D.L.: Water Resources Engineering (4) Margeta J.: Oborinske i otpadne vode - teret onečišćenja (5) Margeta J.: Kanalizacija naselja (6) Margeta, J.; Azzopardi, E.; Iacovides, I.: Smjernice za integralni pristup razvoju, gospodarenju i korištenju vodnih resursa.		
Teaching methods	Lectures and exercises using a projector and blackboard. Programme and seminar work: independent work with consultations.		

Distribution of ECTS credits				
Regular attendance of classes	Programme works	Seminar papers	Examinations	
	1.0	**1.0**	Written	**1.0**
1.5			Oral	**0.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme works (requirement for admission to the exam): Preparation and defence of 2 programme works, 2 x 0.5 = 1.0 ECTS credit. Seminar papers (requirement for admission to the exam): Preparation and presentation of 3 seminar papers, (2x0.3)+0.4 = 1.0 ECTS credit. Examinations: Written part, 1.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 0.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to describe the functions of an urban water system and its elements, participate in the processes of planning, design, construction and management of urban water systems and their functional elements, as well as in the selection of optimal mode of operation of an urban water system for a particular urban environment.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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<table>
<tr><td>Course title</td><td colspan="2">URBAN PLANNING AND DESIGN</td><td>Programme</td><td colspan="2">Architectural urban engineering</td></tr>
<tr><td>Course code</td><td colspan="2">DARH08</td><td>Year of study</td><td colspan="2">II. (second)</td></tr>
<tr><td>Group</td><td colspan="2">Architectural</td><td>Semester</td><td colspan="2">III. (winter)</td></tr>
<tr><td>Teaching form</td><td colspan="2">Lectures (L), Exercises (E), Programme work</td><td>Hours per week</td><td colspan="2">2L + 2E</td></tr>
<tr><td>Name of lecturer</td><td colspan="2">Dina Stober, PhD, senior lecturer</td><td>ECTS</td><td colspan="2">5.0</td></tr>
<tr><td>Course contents</td><td colspan="5">Methodology of urban planning and urban design (roles, objectives, principles, development, adoption and implementation). Ideal sites - historical overview. Industrial town, the theory of garden city, city based on art, city from the functionalism period, zoning, post-modern town, neo-racionalists, post-industrial city: Natural and anthropogenic conditions. Sustainable urban development. Visual inventory techniques. Urban planning and design for residential use, central facilities. Urban planning and design of industry, traffic, municipal infrastructure. Urban planning and design of green areas, recreation. Compact and scattered town, expansion and contraction of the urban area. Reconstruction of urban areas. Urban ecology, green systems in the city.</td></tr>
<tr><td>Recommended reading</td><td colspan="5">(1) Prinz, D.: Urbanizam I - Urbanističko planiranje, GMTK - AF, Zagreb, 2006.
(2) Prinz, D.: Urbanizam II - Urbanističko oblikovanje, GMTK - AF, Zagreb, 2008.</td></tr>
<tr><td>Supplementary reading</td><td colspan="5">(1) Pogačnik, A.: Urbanistično planiranje, Univerza v Ljubljani, FGG, Ljubljana,1999.
(2) Linč K.: Slika jednog grada, Građevinska knjiga, Beograd, 1974.</td></tr>
<tr><td>Teaching methods</td><td colspan="5">Lectures, using a projector and blackboard. Exercises: auditory + design.
Programme work: design exercises + independent work + defence of work.</td></tr>
<tr><td colspan="6">Distribution of ECTS credits</td></tr>
<tr><td rowspan="2">Regular attendance of classes</td><td colspan="2">Programme work</td><td colspan="2">Examination</td><td></td></tr>
<tr><td>preparation</td><td rowspan="2">1.5</td><td rowspan="2">written</td><td rowspan="2">2.0</td></tr>
<tr><td>1.5</td><td>defence</td></tr>
<tr><td>Course requirements and evaluation methods</td><td colspan="5">Regular attendance of classes, 1.5 ECTS credits.
Programme work: Preparation and defence of the programme work, 1.5 ECTS credits (requirement for admission to the exam).
Exam: written, 2.0 ECTS credits</td></tr>
<tr><td>Requirement(s) for admission to the make-up exam</td><td colspan="5">Regular attendance of classes. Preparation and defence of the programme work.</td></tr>
<tr><td>Learning outcomes</td><td colspan="5">The student knows and understands the objectives and principles of urban space planning and design. S/he is able to interpret development examples of urban planning. The student is able to identify and analyse the factors influencing urban space and functional needs in the area. S/he comprehends modern trends in urban transformation and the principles of sustainable urban area planning. S/he is able to participate in development of documents at a local level.</td></tr>
<tr><td>Language of instruction</td><td colspan="5">Croatian.</td></tr>
<tr><td>Quality assurance methods</td><td colspan="5">(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.</td></tr>
</table>

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Course title	**ENVIRONMENTAL PROTECTION AND ENERGY EFFICIENCY**	Programme	**Architectural urban engineering**
Course code	**DARH05**	Year of study	**I. (first)**
Group	Architectural	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Seminar work	Hours per week	**2L + 2E**
Name of lecturer	Jerko Pavličević, PhD, senior lecturer	ECTS	**5.0**
Course contents	Environmental protection: **1. Basics of ecology, environment and environmental protection**: a) Emergence and development of environmental policies - international activities, b) Impact of the public on development of environmental policies. **2. Environmental management systems**: a) Environmental management systems, b) Development of environmental management system, c) Process orientation of environmental management systems, d) Environmental conditions and raising awareness of environmental quality, e) Demographic effects on the environment, f) Economic and technological changes - the conditions of survival. **3. Environmental policy in the EU**: a) Environmental institutions and policies in the EU, b) What is particularly topical in the implementation of the environmental policy in the EU, c) Environmental policy and foreign policy of the EU. **4. Poverty and sustainable development**: a) Environmental policies of poor countries, b) Subsidies for the environment and debt forgiveness, c) Use of standards and laws. **5. Environmental permit** a) Preparation of environmental impact studies, b) Development of adjustment plans, c) Monitoring in the environment. Energy efficiency: The role and forms of energy in building construction. Legal and technical regulations. Fundamentals of energetics and physics of buildings. Structural elements of buildings and their energy characteristics. Heating and cooling systems in buildings. Renewable energy sources. Calculation of thermal energy for heating and cooling. Energy certification of buildings.		
Recommended reading	(1) Črnjar, Mladen, Ekonomika i politika zaštite okoliša, Ekonomski fakultet Sveučilišta u Rijeci, Rijeka 2002.; (2) Carter N. (2001.) Strategija zaštite okoliša, Oskar P.S. prevedeno izdanje (2004); (3) Ekološki leksikon, (2001.), Zagreb; (4) Dragoslav Šumarac: Energetska efikasnost zgrada, Građevinski institut Beograd 2005; (5) Europske direktive 2002/91; (6) Standard EN 13790;		
Supplementary reading	(1) Bešker, Marko - Politika okoliša, Zagreb, Biblioteka kvaliteta okoliša,2005.; (2) Injac, Nenad - MALA ENCIKLOPEDIJA KVALITETE - Okoliš i njegova zaštita, Oskar, Zagreb; (3) Relevantni znanstveni i stručni radovi; (4) Skripte.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**2.5**	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Exam: Oral, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to assess the energy efficiency of buildings and their impact on the environment.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**WASTEWATER AND SOLID WASTE MANAGEMENT**	Programme	**Architectural urban engineering**
Course code	**DHID10**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Seminar work	Hours per week	**2L + 2E**
Names of lecturers	Željko Rozić, PhD, senior lecturer Gordan Prskalo, PhD, senior lecturer	ECTS	**5.0**
Course contents	Wastewater and its characteristics; Levels and types of wastewater treatment and processes; Primary, secondary and tertiary treatment; Sludge treatment and disposal; Hydraulic of treatment plants; Wastewater and sludge reuse and disposal; Operation, maintenance and management of treatment plant. Solid waste and its characteristics; Integrate concept; Collection and transport; Treatment and disposal of waste; Special types of waste; Tools and techniques for wastewater and solid waste management.		
Recommended reading	(1) J. Margeta (prijevod): Uređaj za pročišćavanje komunalnih otpadnih voda, WHO, Athens, 2001.; (2) S. Tedeschi: Zaštita vodnih sustava i pročišćavanje otpadnih voda, Građevinski institut, Zagreb, 1996.; (3) J. Margeta: Kruti otpad, Građevinski fakultet Split, 1986.		
Supplementary reading	(1) J. Margeta*:* Guidelines on Sewage Treatement and Disposal for the Mediterranean Region, WHO-GEF, Athens, 2004.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to plan, design, manage and maintain wastewater treatment plants, and coordinate solid waste collection, transport and disposal systems.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**OPERATIONAL RESEARCH IN CIVIL ENGINEERING**	Programmes	**General** **Architectural urban engineering**
Course code	**DPRI01**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lect. (L), Exercises (E), Semin. and Prog. work	Hours per week	**2L + 2E**
Name of lecturer	Ivana Domljan, PhD, senior lecturer	ECTS	**5.0**
Course contents	Introduction, objective and definition of operation research (OR). Basics of system theory. System analysis. System structure and functioning. System modelling. Process modelling. Definition, basic terms and application of cybernetics. Principles of complex problem solving and principles of approach. Cybernetics models and modelling. Basics of decision theory. Decision process. Decision models. Mathematical models of OR applicable in civil engineering. Linear programming. Transport problem. Mixture model. Integer programming. Dynamic programming. Simulation models. Games theory (Monte Carlo). Queuing theory. Inventory model. Application of information theory in civil engineering. OR software and application in civil engineering.		
Recommended reading	(1) D. Kalpić, V. Mornar: Operacijska istraživanja, Zeus, Zagreb, 1996.		
Supplementary reading	(1) A.T. Handy: Operations Research - An Introduction, Prentice - Hall Ing., New York, 1997.; (2) S.K. Brown, B.J. Re Velle: Quantitative methods for managerial decisions, Addison-Wesley, Massachusetts, 1978.		
Teaching methods	Lectures, using a projector. Exercises: auditory and constructive. Seminar and programme work: individually with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Programme work	Make-up exams	
	1st assessment	**1.5**	**0.5**	**0.5**	Written	**1.5**
1.5	2nd assessment	**1.0**			Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.5 ECTS credits. 2nd assessment passed, 1.0 ECTS credit. In order to earn 2.5 credits through assessments, the student must pass both of them. Otherwise, s/he is considered not to have earned a single ECTS credit and is required to take the make-up exam. Programme and seminar work (requirements for admission to the make-up exam): Preparation and defence of the programme and seminar work, 2 x 0.5 = 1.0 ECTS credit. Make-up exams: Written part, 1.5 ECTS credits (requirement for taking the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme and seminar work.
Learning outcomes	The student is able to identify and distinguish system characteristics in the field of civil engineering, apply mathematical programming models in the field of civil engineering, apply simulation and other models (games theory, queuing theory and inventory model) to particular problems in the field of civil engineering, analyse production processes and model certain segments by using OR models, apply information theory models in decision processes in civil engineering.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**TRAFFIC ENGINEERING**	Programmes	**General** **Architectural urban engineering**
Course code	**DPRO02**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Prog. work	Hours per week	**2L + 2E**
Name of lecturer	Ivan Lovrić, PhD, associate professor	ECTS	**5.0**
Course contents	History of traffic engineering. Transportation planning fundamentals. Trip generation models. Trip distribution models. Modal split analysis. Route assignment models. Solution analysis, evaluation and choice. Traffic demands and supply. Short term forecasting methods. Traffic studies inventories. Functional street classification. Traffic flow, speed, density. Capacity and Level of services of highways segments, intersections, elements of interchanges. Intersections; optimal type and location. Traffic volume distribution. Traffic flow structure. Capacity and other measures of effectiveness. Intersection design. Safety. Traffic flow management. Fundamentals of analytical and simulation traffic models.		
Recommended reading	(1) McShane, W.R. Roess, R.P., Prassas, E.S.: *Traffic engineering*, Prentice Hall, 1998.; (2) Pađen, J.: *Osnove prometnog planiranja*, Informator Zagreb, 1986.; (3) Lozić, I., Tedeschi, S.: *Osnovni elementi za planiranje i projektiranje gradskih prometnica*, Fakultet građevinskih znanosti Split, 1979.		
Supplementary reading	(1) *Highway capacity manual 2000*, Transportation research board.; (2) *Handbuch für die Bemessung von Straßenverkehrsanlagen, Ruhr-Universität Bochum 2001.;* (3) ITE: *Transportation and traffic engineering handbook*, Prentice-Hall; (4) Cvitanić: *Materijali s predavanja*.		
Teaching methods	Lectures, using a projector and blackboard. Exercises: auditory + design. Programme work: design exercises + independent work + defence of work.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exams	
	1st assessment	**1.0**	**0.5**	Written	**0.5**
1.5	2nd assessment	**1.0**		Oral	**0.5**/2.5

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 0.5 ECTS credits (requirement for admission to the make-up exam). Assessments: 1st assessment passed, 1.0 ECTS credit; 2nd assessment passed, 1.0 ECTS credit. A student who passes both assessments is required to take a short make-up exam (oral part) in order to establish his/her final grade, and one who does not pass both assessments is required to take the makeup exam (written and oral part). Make-up exams: Written part, 0.5 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 0.5/2.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to analyse the capacity of functional elements of a road network and to design intersections.
Language of instruction	Croatian. Italian
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**BUSINESS AND INVESTMENTS IN CIVIL ENGINEERING**	Year of study	**II. (second)**
Course code	**DORG01**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Semin. and Prog. work	ECTS	**5.0**
Names of lecturers	Snježana Knezić, PhD, full professor, Ivana Domljan, PhD, senior lecturer		
Course contents	Investments in civil engineering. Business concepts. Success factors of business strategy. Business principles (rationalisation, productivity, profitability, return on investment and cash flow). Production factors. Cost functions. Choice and replacement of technology or equipment. Depreciation. Balance sheet. Profit and loss. Direct costing and controlling. Break-even analysis. Estimation. Investment types. Sources of investment funds. Intercalar interest. Working capital. Borrowing. Financial analysis of investment (time value of money, cash-flow, rate of return, present worth method, equivalent uniform annual cash flow, period of return). Other methods of financial analysis (cost-benefit analysis, sensitivity analysis). Importance and content of investment studies. Contract models, BOT (Build Operate Transfer), joint-venture. Tender documentation.		
Recommended reading	(1) Z. Ribarović: Ekonomske osnove i jednoperiodični investicijski račun, Zebra plus d.o.o. Split, 2003.; (2) Z. Ribarović: Uvod u studiju podobnosti, Zebra plus d.o.o. Split, 2005.		
Supplementary reading	(1) J. Bendeković i koautori: Planiranje investicijskih projekata, Ekonomski institut Zagreb, 1993; (2) D. Marušić: Optimalizacija Investicijskih projekata, Građevinski fakultet, Split, 1999.; (3) E.L. Grant, W.G. Ireson, R.S. Leavenworth: Principles of Engineering Economy, John Wiley & Sons 1976		
Teaching methods	Lectures, using a projector. Exercises: auditory and constructive. Seminar and programme work: individually with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Programme work	Make-up exams	
	1st assessment	**1.0**	**0.5**	**0.5**	Written	**1.5**
1.5	2nd assessment	**1.5**			Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.5 ECTS credits. In order to earn 2.5 credits through assessments, the student must pass both of them. Otherwise, s/he is considered not to have earned a single ECTS credit and is required to take the make-up exam. Programme and seminar work (requirements for admission to the make-up exam): Preparation and defence of the programme and seminar work, 2 x 0.5 = 1.0 ECTS credit. Make-up exams: Written part, 1.5 ECTS credits (requirement for taking the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme and seminar work.
Learning outcomes	The student is able to evaluate production based on standard indicators, identify, structure and analyse costs, evaluate a company based on balance sheet, control production, develop and evaluate cash flow of an investment and feasibility study, evaluate and compare investment ventures, develop and recommend a government/public investment project financing model through models of public-private partnerships.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**BUILDING CONSTRUCTION**	Year of study	**I. (first)**
Course code	**DARH01**	Semester	**II. (summer)**
Group	Architectural	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Jaroslav Vego, PhD, full professor		
Course contents	Introduction: organisation and use of space; concepts of function, construction, and form / design. Man as a module in the space organisation. Designing processes. Residence: functions and functional groups; operating space and equipment. Residential building: typology classification of single-family houses and blocks of flats; construction systems; building technology and rationalisation. Technical conditions and standards. Public buildings of different purposes: typology features, construction, and technology. Construction design as an essential element of the project solution. Principles of creative cooperation between designers of diverse specialities. Contemporary building aesthetics. Designer aspect of different forms of protection: physical, fire-fighting, occupational safety, and other forms of protection.		
Recommended reading	(1) Knežević, G., Kordiš, I.: Stambene i javne zgrade, Zagreb, 1986; (2) Knežević G.: Višestambene zgrade, Zagreb, 1984.		
Supplementary reading	(1) Neufert, E.: Elementi arhitektonskog projektiranja Zagreb, 2002.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Students perform the programme work independently, with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exam
	1st assessment	**0.5**	**1.0**	**1.0/2.5**
1.5	2nd assessment	**0.5**		
	3rd assessment	**0.5**		

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 0.5 ECTS credits (requirement for admission to the 2nd assessment). 2nd assessment passed, 1.0 ECTS credit (requirement for admission to the 3rd assessment). 3rd assessment passed, 1.0 ECTS credit. A student who does not pass all three assessments is required to take the make-up exam. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the make-up exam). The student who passes all three assessments, and submits and defends the programme work, is required to take the make-up exam. Make-up exam: 1.0/2.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to establish a good cooperation with architects and other designers on the development of construction projects of buildings for various purposes. S/he also has a knowledge of basic elements of building regulations in the field of fire protection and safety at work.
Language of instruction	Croatian. German.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**DIPLOMA WORK**	Year of study	**II. (second)**
Course code	**DZAV01**	Semester	**IV. (summer)**
Group	Professional	Hours per week	**0L + 15E**
Teaching form	Independent work	ECTS	**30.0**
Name of lecturer	Lecturer (mentor) from the selected subject		
Course contents	The student selects the subject of the diploma work according to the previously defined subjects determined by the Scientific and Teaching Council for each academic year. The Student performs individual and independent research in the subject selected in collaboration with the lecturer/mentor. The Student accomplishes her/his diploma work in written or in digital form.		
Recommended reading	According to the subject lecturer recommendation.		
Supplementary reading	According to the subject lecturer recommendation.		
Teaching methods	Consultations with selected subject lecturer (mentor) and individual research work, as well as development of the diploma work in a defined form.		
Course requirements and evaluation methods	With the beginning of the IV. (summer) semester, student submits the "Request for assignment of a diploma work mentor", proposing 5 (five) possible mentors ordered according to his/her preferences. The "Commission for final and graduation exams" makes a "Decision on assignment of the diploma work mentor" according to established criteria. After receiving the decision, in agreement with the mentor, the student chooses 2 (two) elective subjects in III. (winter) semester of the II. year of studies. During the IV. semester, the student develops the diploma work in consultation with the mentor. After the student passes all subjects of the university graduate studies in civil engineering, s/he proceeds with the defence of the diploma work. The mentor can organise an internship for the student in a company or institution for a maximum of 60 hours (7 business days) which is aimed at preparing the diploma work. In that case, the internship is worth 5.0 ECTS credits, and other activities in development of the diploma work 25.0 ECTS credits.		
Requirement(s) for admission to defence of the diploma work	Successfully passed all courses of the university graduate studies in civil engineering.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer		

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3.2.4.2 Description of the curriculum of elective courses

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**CONCRETE STRUCTURES I**	Year of study	**I. GS or III. UGS**
Course code	**PKON05**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	Reinforced concrete structures: Internal forces basics (theory of elasticity, theory of elasticity with redistribution, theory of plasticity, general non-linear analysis). Impact of construction on internal forces and reinforced concrete structures calculations. Building loads. Structural details. Reinforcement positioning and details. Construction, maintenance and inspection of structures. Basics of concrete structure's durability. Hinges. Short elements. One-way reinforced slabs. Two-way reinforced slabs. Column supported slabs. Wall girders. Floor structures. Crane girders. Linear frame and curved (arch) structures. Latticed structures. Prefabricated structures. Foundations. Retaining walls. Shells. Large halls. Bunkers. Silo. Shore structures. Dams. Basic concepts of building design and calculations in regard to earthquake. Remediation of reinforced concrete structures. Basics of masonry structures. Regulations.		
Recommended reading	(1) Tomičić I.: Betonske konstrukcije (Concrete structures), Školska knjiga, Zagreb 1988; (2) Tomičić I.: Betonske konstrukcije - odabrana poglavlja (Concrete structures - selected chapters), DHGK, Zagreb 1993; (3) Eurocode 2.; (4) Eurocode 4.; (5) Eurocode 6.; (6) Eurocode 8.		
Supplementary reading	(1) Bresler B.: Reinforced concrete engineering, John Wiley and Sons, 1974; (2) Nawy E.G.: Reinforced concrete, Prentice-Hall, 1985.		
Teaching methods	Lectures, using a projector and blackboard. Exercises, using a projector, by directly solving problems on the blackboard, through fieldwork.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.5**	Written	**2.0**
1.5	2nd assessment	**2.0**	Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.5 ECTS credits (requirement for admission to the 2nd assessment). 2nd assessment passed, 2.0 ECTS credits. A student who does not pass both assessments is required to take the make-up exam. Make-up exams: Written, 2.0 ECTS credits (requirement for admission to the oral part of the exam). Oral, 1.5 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student acquires a more detailed knowledge of conventional reinforced concrete structures. S/he is able to dimension cross sections subjected to bending, shear and torsion, slender compression elements, two-way load-carrying slabs, point supported slabs. S/he is able to prove the state of cracks in cross-sections in a state of usability.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**DYNAMICS OF STRUCTURES AND EARTHQUAKE ENGINEERING**	Year of study	**I. GS or III. UGS**
Course code	**PMEH07**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Kožul, PhD, senior lecturer		
Course contents	Introduction to structural dynamics. Types of dynamic loads. Response of single-degree-of-freedom system in time and frequency domain. Introduction to response analysis based on numerical techniques. Free vibrations of multiple-degree-of-freedom system, eigenfrequences and modes. Compulsory vibrations by spectral analysis. Response to base excitation. Introduction to dynamic and seismic modelling of civil engineering structures. Structure response to random excitation. Power spectral density of white noise. Earthquake characteristics. Seismograph and accelerograph. Seismicity. Response spectra. Deterministic and stochastic formulation of seismic loads. Base assumptions of design and building of seismic resistant structures. Introduction to European Standards for design and building in seismic regions.		
Recommended reading	(1) A. Mihanović: Dinamika konstrukcija, Građevinski fakultet Sveučilišta u Splitu, 1995.; (2) J.L. Humar: Dynamic of structures, Prentice Hall, New Jersey, 1990.; (3) D. Aničić, P. Fajfar, B. Petrović, A. Szavits-Nossan, M. Tomažević: Zemljotresno inženjerstvo, Građevinska knjiga, Beograd, 1990.; (4) Eurocode 8 - Design provisions for earthquake resistance of structures.		
Supplementary reading	(1) A. K. Chopra: Dynamic of structures - Theory and Applications to Earthquake Engineering, Prentice Hall, New Jersey, 1995.; (2) P. Fajfar: Dinamika gradbenih konstrukcij, Fakultet za arhitekturo, gradbeništvo in geodezijo, Ljubljana, 1984.; (3) M. Čaušević: Potresno inženjerstvo (odabrana poglavlja), Školska knjiga, Zagreb, 2001.		
Teaching methods	Lectures, using a projector and blackboard. Exercises by solving problems using the blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.5**	Written	**1.5**
1.5	2nd assessment	**2.0**	Oral	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.5 ECTS credits (requirement for admission to the 2nd assessment). 2nd assessment passed, 2.0 ECTS credits. A student who does not pass both assessments is required to take the make-up exam. Make-up exams: Written part, 1.5 ECTS credits (requirement for taking the oral part of the exam). Oral part, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes.
Learning outcomes	The student is able to describe dynamic properties of structures and perform dynamic analysis of simple structures according to the applicable Regulations for building construction in seismic areas. S/he is able to participate in the development of dynamic calculations of simple structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**GEOTECHNICAL ENGINEERING**	Year of study	**I. GS or III. UGS**
Course code	**PGEO03**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lect. (L), Exercises (E), Prog. and semin. work	ECTS	**5.0**
Name of lecturer	Maja Prskalo, PhD, associate professor		
Course contents	The design geotechnical profile. Ground anchors (types and design). Type of the drainage and protection from underground erosion. Complex geotechnical constructions (underpinning, complex construction pits). Shallow foundation: elastic footings. Foundation beam on the one parametric soil model. Foundations in tension. Deep foundations. Piles: types, design of horizontally loaded piles. Caissons and wells. Methods and criterions for selection of foundations type and depth. Beams on the one parametric soil model. Improvement of the foundation soil. Procedures of settlement homogenisation for rigid spread footing. Reinforcement of the soil. Causes of the landslides and methods of their improvement. Earth constructions: types, design, methods of construction. Control of the quality of embankments. Construction of embankments near rigid objects. Drainage and erosion control of earth construction.		
Recommended reading	(1) "Temeljenje", T. Roje Bonacci, P. Miščević Građevinski fakultet Split, 1997.; (2) "Zbirka riješenih zadataka s primjenom EC 7", M. Prskalo, 2012. - skripta; (3) "Mehanika tla i temeljenje građevina", E. Nonveiller, Školska knjiga Zagreb, 1979.; (4) "Zbirka riješenih zadataka iz mehanike tla", P. Miščević, Građevinski fakultet Split, 1999.		
Supplementary reading	(1) Programski paketi FLAC 3.05 i Z_SOIL 2001.; (2) "Geosintetici u graditeljstvu", B.Babić, HDGI, Zagreb, 1995.; (3) EUROCODE 7- translation in Croatian (4) “Foundation engineering handbook”, H. Fang, Chapman&Hall, 1991.		
Teaching methods	Lectures using a projector and blackboard. Exercises using the blackboard. Fieldwork, one field visit. Laboratory work, visiting a relevant institute or in the faculty laboratory.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Programme work	Make-up exams	
	1st assessment	**1.0**	**0.5**	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.0**			Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.0 ECTS credit. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Seminar paper: Preparation and defence of the seminar paper, 0.5 ECTS credits (requirement for admission to the make-up exam). Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the make-up exam). Make-up exams: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar and programme work.
Learning outcomes	The student is able to describe basic concepts of calculation of loads and dimensioning of geotechnical structures (retaining walls, sheet-pile walls, construction pits, excavations and embankments). S/he is able to design shallow and deep foundations.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**RAILWAY**	Year of study	**I. GS or III. UGS**
Course code	**PPRO03**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 1E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**4.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	The railway characteristics in general. Types of railway vehicles; types of brakes. Estimation of tracking: forces that attack on train; track resistant; track force and locomotive track characteristics; estimation of a train weight; differential equation of train motion; gradient-speed diagram; analytical and graphics method for train speed determination; construction for diagram of running train; breaking forces, braking distance. Capacity and caring capacity of a line. Components of railway line: lay-out and longitudinal section; track formation; number of tracks; structure and loading gauge; track geometry in plane and profile; lessening of gradient in the curves and tunnels. Railway line design: influence of geography, geology and morphology; slope determination; railway station allocation; railway tunnels, viaducts and bridges. Phases of railway line design. Evaluation of alternatives; exploitation costs. Estimation of a line capacity. Railway line reconstruction: possibility for increase of capacity; selection of elements for line reconstruction; basic principles of railway line reconstruction. Design of second track: basic principles of second track construction; allocation of a second track according to existing tunnels, viaduct or bridges; cross section design. Permanent way elements: rails, sleepers, rail fastening, ballast; turnouts. Substructure of the track. Special construction on the track: turnouts, travelling platform, turntable. Maintenance of tracks. Construction site visit.		
Recommended reading	(1) Marušić, D: Projektiranje i građenje željezničkih pruga, Građevinski fakultet Sveučilišta u Splitu, 1994.		
Supplementary reading	(1) Marušić, D: Željeznički kolodvori, Građevinski fakultet Sveučilišta u Splitu. Split, 2003.; (2) Marušić, D.: Ranžirni kolodvori, Građevni godišnjak '96. [urednik: Veselin Simović], Zagreb: Hrvatsko društvo građevinskih inženjera. Zagreb, 1995. str. 471-527.; (3) Marušić, D.; Čatlak, Z.: Izbor radijusa horizontalnih krivina pri rekonstrukciji pruga, Građevinar 43 (1991.);		
Teaching methods	Lectures, using a projector and blackboard. Exercises: auditory + design. Programme work: design exercises + independent work + defence of work.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exam
	1st assessment	**1.0**	**0.5**	**0.5**/2.5
1.0	2nd assessment	**1.0**		

Course requirements and evaluation methods	Regular attendance of classes, 1.0 ECTS credit. Programme work: Preparation and defence of the programme work, 0.5 ECTS credits (requirement for admission to the make-up exam). Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.0 ECTS credit. A student who passes both assessments is required to take a short make-up exam in order for his/her final grade to be determined, and a student who does not pass both assessment is required to take a make-up exam of a longer duration with the scope of questions at the teacher's discretion. Make-up exam: Oral, 0.5/2.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to describe, analyse and argument the railway line design and construction procedures. S/he distinguishes the main elements of railway lines, as well as planning, design and maintenance methods.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**HYDRAULIC STRUCTURES**	Year of study	**I. GS or III. UGS**
Course code	**PHID04**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 1E**
Teaching form	Lectures (L), Exercises (E), Progr. works	ECTS	**4.0**
Name of lecturer	Zoran Milašinović, PhD, full professor		
Course contents	Subsurface exploration works: geological, hydrogeological, seismic, and geophysical. Hydraulic structures in the subsurface: boreholes, wells, collectors. Design, construction and maintenance of wells, boreholes, collectors. Testing and monitoring methods in the wells and boreholes. Dams: division and classification, design and construction principles, historical and statistical data. Design and construction characteristics of concrete dams, earth dams and arch dams. Hydraulic structures on dams: bottom outlet, spillway, diversion tunnel and channel, penstock and turbines. Analysis of key hydrodynamic processes and how they could influence the design. Structures for waste disposal. Design and construction principles, drainage and leachate collection network. Monitoring principles required. Few basic principles of risk assessment in hydraulic structures with uncertainty analysis.		
Recommended reading	(1) R. Andričević: Hydraulic structures and surrounding processes, Class notes, FCEA Split, 1999; (2) Petar Stojić, Hydraulic Structures, book III, FCEA Split, 1999.		
Supplementary reading	(1) Fuat Senturk, Hydraulics of dams and reservoirs, Water Resources Publication, 1994; (2) U.S. Dep. of Int. Design of Small Dams, Water Resources Technical Publication, 1987.		
Teaching methods	Lectures and exercises, using a projector and blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Programme works	Examinations	
	1.0	Written	**1.0**
1.0		Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.0 ECTS credit. Programme works (minimum 3): Preparation and defence of programme works, 1.0 ECTS credit (requirement for admission to the examination). Examinations: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the exam	Regular attendance of classes. Submission and defence of programme works.
Learning outcomes	The student is able to describe and analyse the key functions of hydraulic structures, basic surrounding processes and to use basic methods in the design and construction of hydraulic structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**PORTS AND MARINE CONSTRUCTIONS**	Year of study	**I. GS or III. UGS**
Course code	**PHID05**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**4.0**
Name of lecturer	Mijo Vranješ, PhD, associate professor		
Course contents	General consideration about the sea, basic characteristics, physical and chemical properties. Basic wave theories. Wind, action on the sea and objects. Sea water levels, springtide-ebbtide, seiche, sea currents. Ship (boat), ship types. Navigational way. Navigation and manoeuvre. Port as traffic, economic and developmental element. Planning and design (layout) of ports, feasibility study. Ports classified (bulk cargo, cargo general, container cargo, travelling, car ferry, sport, fishing, special). Marinas, capacity design, berth equipment. Breakwaters, piers, quays, type constructions. Berthing and mooring. Port traffic infrastructure, road, rail. Dredging technology. Ecological criteria in the ports and waterway. Visit some ports and marinas.		
Recommended reading	(1) Vranješ, M.: Luke i pomorske građevine, autorizirana predavanja 2001.; (2) Kirinčić, J.: Luke i terminali, Školska knjiga Zagreb, 1991.; (3) Babić, L.: Primjena betona kod radova u moru, Epoha, Beograd, 1968.; (4) Donald, W. A : Marinas, The Architectural press Ltd., London, 1984.; (5) Brun, P.: Port Engineering, Gulf Publishing Company, Huston, Texas, 1976.		
Supplementary reading	(1) Prikril, B., Božičević, D.: Mehanizacija pretovara i skladištenja, skripta fakulteta prometnih znanosti Zagreb, 1987.; (2) Press, H.: Seewasserstrasen und Seehafen, Verlag von Wilhelm Ernst&Sohn, Berlin-Munchen, 1962.; (3) Kampus, J. W.: Itroduction to Coastal Engineering and Management, World Scientific; (4) Shore Protection Manual CERC Coastal Engineering Resesarch Center, US Government Printing Office, Washington DC 1984.		
Teaching methods	Lectures and exercises, using a projector and blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.5**	Written	**1.0**
1.0	2nd assessment	**1.0**	Oral	**0.5**/2.0

Course requirements and evaluation methods	Regular attendance of classes, 1.0 ECTS credit. Assessments: 1st assessment passed, 1.5 ECTS credits. 2nd assessment passed, 1.0 ECTS credit. A student who does not pass both assessments is required to take the make-up exam. A student who passes one of the assessments or both is required to take the make-up exam (oral part). Make-up exams: Written, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral, 0.5/2.0 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student is able to describe and analyse the basic information on the function, planning and dimensioning of ports and appropriate constructions. S/he is able to successfully get involved in solving problems of construction of marinas and ports.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**BRIDGES**	Year of study	**I. GS or III. UGS**
Course code	**PKON04**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Alen Harapin, PhD, full professor		
Course contents	History of bridge construction (stone, wooden, metal, reinforced concrete and prestressed concrete bridges). Bridge definition; bridge significance; general definitions; names of bridge elements. Bridge materials. Bridge types. Requirements for bridges: preliminary works in bridge construction, selection of the site and position, foundation conditions, span size; total bridge length; bridge gradient selection; longitudinal and cross falls; bridge clearance. Types of bridge load-bearing structures: girder bridges, frame bridges, vaulted and arch bridges, cable-stayed bridges, suspension bridges. Calculation concepts and basics. Load-bearing metal bridge superstructure. Pavement structure (railway and road bridges), principal girders (solid and truss girders), composite girders, bracings. Cross-sections of girder bridges, dimension and span selection; calculation basics. Cross-sections of arch bridges, dimension and span selection; calculation basics. Columns, abutments and wing walls of girder and arch bridges - types and calculations. Bridge loads. Dynamic impacts. Deformation limits. Load-bearing structure safety. Cornice and railing details. Pavements. Drainage. Vertical and horizontal insulation. Bearings. Expansion joints. Transition devices. Construction procedures for girder and arch bridges. Bridge aesthetic design. Generation of bridge design. Bridge value assessment. Bridge management - durability and maintenance. Field visits to bridges under construction and some already constructed ones.		
Recommended reading	(1) A. Harapin, G. Šunjić, M. Jurišić, "Mostovi - radni materijali za praćenje predavanja", Interna skripta, (Bridges, Course materials) Građevinski fakultet Sveučilišta u Mostaru, (2) J. Radić, Mostovi (Bridges), Dom i svijet, Zagreb, 2002, (3) K. Tonković, Mostovi (Bridges), SNL, Zagreb, 1981, (4) K. Tonković, Masivni mostovi - opća poglavlja (Massive bridges - general chapters), Školska knjiga, Zagreb, 1977, (5) K. Tonković, Masivni mostovi - građenje (Massive bridges - construction), Školska knjiga, Zagreb, 1979, (6) D. Horvatić i Z. Šavor, Metalni mostovi (Metal bridges), HDGK, Zagreb, 1988, (7) S.Šram, Građenje mostova (Bridge construction), Golden marketing, Zagreb, 2002.		
Supplementary reading	(1) K. Tonković, Oblikovanje mostova (Bridge aesthetic design), Tehnička knjiga, Zagreb, 1985; (2) K. Tonković, Mostovi u izvanrednim okolnostima (Brides in emergency conditions), Školska knjiga, Zagreb, 1979; (3) Brzović, D.; Šunjić, G.; Radnić, J.; Harapin, A., poglavlje 10: Numerical model for fluid-structure coupled problems under seismic load// materials with complex behaviour ii / A. Öchsner et al. (eds.) (ur.). Berlin: Springer-Verlag, Heidelberg 2012. pp. 175-198.		
Teaching methods	Lectures, using a projector and blackboard. Exercises, using a projector and by direct students' work on computers. Students perform the programme work independently, with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Programme work	Examination	
	1.0	**2.5**	
1.5			
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Submission and defence of the programme work, 1.0 ECTS credit (requirement for admission to the exam). Examination: Oral, 2.5 ECTS credits.		
Requirement(s) for admission to the exam	Regular attendance of classes. Submission and defence of the programme work.		
Learning outcomes	When designing bridges, the student is able to position a bridge over an obstacle in disposition, draw all its major parts, perform partial dimensioning of a section. S/he is able to identify different technological processes of bridge construction.		
Language of instruction	Croatian. English.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**APPLIED MATHEMATICS**	Year of study	**I. GS or III. UGS**
Course code	**PPRI07**	Semester	**I. GS or VI. UGS**
Group	Basic	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Bojan Crnković, PhD, senior lecturer		
Course contents	Orthogonal systems: Orthogonal sets of functions, Fourier series, Dirichlet theorem, series expansions and approximations of functions. Boundary value problems for ordinary differential equations: Eigenvalue boundary value problems, stretched string problem, Sturm-Liouville problem. Partial differential equations and boundary value problems: First order partial differential equations, first order linear and quasi-linear equation, trajectories and surfaces. High-order equations, classification and equation transforming. Wave, Laplace and diffusion equation, initial and boundary value problems for string and membrane, free and forced oscillations. D'Alambert formula, Fourier separation method, Dirichlet and Neumann problem. Numerical analysis: Approximate numbers and errors, approximate function value and argument errors. Solving nonlinear equations. Solving systems of linear equations, iteration methods. Least square method. Approximations of functions, finite differences, interpolation polynomials, empirical formulas. Numerical integration, trapezoidal and Simpson method, geometric integration. Solving initial and boundary value problems for ordinary and partial differential equations. Euler and Runge-Kutta methods, finite difference method, collocation method, least square method and Galerkin method.		
Recommended reading	(1) S.Kurepa, Matematička analiza III,Tehnička Knjiga, Zagreb, 1990.; (2) I. Aganović, Jednadžbe matematičke fizike, Školska knjiga, Zagreb, 1985.; (3) R. Scitovski, Numerička matematika, Sveučilište J.J. Strossmayera u Osijeku, Osijek, 2002.		
Supplementary reading	(1) I. Aganović, Linearne diferencijalne jednadžbe, PMF, Zagreb, 1992.; (2) B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1996.		
Teaching methods	Lectures, using a projector and blackboard. Exercises, using a projector, by directly solving problems on the blackboard.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)		Make-up exam
	1st assessment	**1.5**	**3.5**
1.5	2nd assessment	**2.0**	

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed (consisting of 3 tests), 1.5 ECTS credits. 2nd assessment passed (consisting of 3 tests), 2.0 ECTS credits. A student who does not pass both assessments is required to take the make-up exam. Make-up exam: Oral, 3.5 ECTS credits.
Requirement(s) for admission to the exam	Regular attendance of classes.
Learning outcomes	The student is able to describe and analyse the basic theoretical concepts of numerical mathematics, and use some standard commercial software packages in carrying out the tasks in the domain of numerical mathematics. S/he is able to identify adequate numerical methods for prepared simpler mathematical formulations of engineering problems, properly define the fundamental idea of a specific numerical method and advantages and disadvantages of each of them, apply ready-made and make simple computer programmes for particular numerical methods, and analyse the results of numerical methods.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**BUILDING MATERIALS II**	Year of study	**I. GS or III. UGS**
Course code	**DMAT01**	Semester	**I. GS or VI. UGS**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	Non-ferrous metals. Polymers. Glues. Paints and coatings. Carbohydrate binders, properties and products. Coatings and waterproofing. Asphalt-concrete, characteristics of aggregate, design of structure. Lightweight concrete, fibre reinforced concrete, hydrotechnical concrete, massive concrete, roller-compacted concrete and heavyweight concrete. High performance concrete and concrete for prestressing. Decorative concrete. Floors. Clay-concrete. Preplaced-aggregate concrete. Pumped concrete. Grouting. Splashed concrete. Structural design and technology of special concretes.		
Recommended reading	(1) P. Krstulović: Concrete properties and technology, Faculty of Civil Engineering University of Split, Split, 2000 (in Croatian); (2) Ukrainczyk, V.: Concrete - Structure, Properties, Technology, Alcor, Zagreb, 1994 (in Croatian)		
Supplementary reading	(1) Orchard, D.F.: Concrete Tehnology, Vol 1-3, Applied Science Publishers, Essex, England, 1979.		
Teaching methods	Lectures and exercises, using a projector and blackboard. Laboratory exercises.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.0**	**1.5**	
Course requirements and evaluation methods	Seminar paper: Preparation and defence of the seminar paper, 2.0 ECTS credits (requirement for admission to the make-up exam). Examination: Oral, 1.5 ECTS credits.		
Requirement(s) for admission to the exam	Regular attendance of classes. Preparation and defence of the seminar paper		
Learning outcomes	The student is able to design the structure and technology of special types of concrete.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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**** UGS - University Undergraduate Studies in Civil Engineering, GS - University Graduate Studies in Civil Engineering***

Course title	**COMPUTER AIDED DESIGN OF STRUCTURES**		Year of study	**I. GS or III. UGS**
Course code	**DINF01**		Semester	**I. GS or VI. UGS**
Group	Professional		Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work		ECTS	**5.0**
Name of lecturer	Alen Harapin, PhD, full professor			
Course contents	Architecture of CAD. Definitions and field of applications. Computer geometric modelling. Coordinate systems and transformations. Computer aided drafting: Basis of 2D graphics primitives and transformations. 3D geometric modelling: wire frame model, surface model, solid model. Parametric solid modelling. Feature based design. Shading, photorealistic model, animation (software applications). Automated drafting based on output results. Computer aided engineering: Basis in application of numerical methods in structural design and computations. Preparing of computations models of trusses, frames, plates, and complex structures. Basis of AUTO-LISP programming language. Creating of DXF-files.			
Recommended reading	(1) Trogrlić B., Harapin A., Multimedia lectures - Basis of CAD with application in drafting and design of structures (in Croatian); (2) Jović V., Introduction to Engineering Numerical Modelling, Aquarius Engineering, Split, 1993 (in Croatian); (3) Mihanović A., Marović P. and Dvornik J., Nonlinear Computations of Reinforced Concrete Structures, Society of Croatian Structural Engineers, 1993 (in Croatian)			
Supplementary reading	(1) Manuals of computer programmes NEMETSCHEK (in English), FEAT (in English), ASPHALATHOS (in Croatian), EMRC-NISA (in English), PRONEL (in Croatian).			
Teaching methods	Lectures and exercises, using a projector and practical work on computers.			
Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Programme work	Examination
	1st assessment	**1.0**	**1.0**	**2.5**
1.5	2nd assessment	**1.5**		
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.5 ECTS credits. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the make-up exam). Make-up exams: Oral (on computer), 2.5 ECTS credits.			
Requirement(s) for admission to the exam	Regular attendance of classes. Submission and defence of the programme work.			
Learning outcomes	The student is able to make practical use of computers in the design and calculation of structures.			
Language of instruction	Croatian. English.			
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.			

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Course title	**HIGHWAY INTERCHANGES**	Year of study	**II. (second)**
Course code	**DPRO03**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	Traffic flow conflict points. Crossing, merging, diverging and weaving. General types of interchanges. Traffic operation. Interchange ramp design. Ramps terminals. Segments. Ramps; types and examples, one quadrant ramps… General ramp design consideration: types according to topography and angle of crossing. Geometric design of ramp terminals and through traffic lanes. Horizontal and vertical alignment. Cross section elements. Signing and markings. Longitudinal distance of adjacent terminals. Capacity and Level of service. Optimal interchange type warrants: 1) functional classification of highways; 2) traffic volume and capacity; 3) safety; 4) landscape and topography; 5) environmental warrants.		
Recommended reading	(1) Klemenčić, A.: Oblikovanje cestovnih čvorišta izvan razine, monografija, Građevinski institut, 1982.; (2) Korlaet, Ž.: Čvorišta, skripta, Građevinski fakultet, Zagreb, 1995.; (3) A Policy on geometric design of Highways and streets, AASHTO 2001.		
Supplementary reading	(1) Highway capacity manual 2000, Transportation research board.; (2) Smjernice za projektiranje, građenje, održavanje i nadzor na cestama, Sarajevo/Banja Luka, 2005.		
Teaching methods	Lectures, using a projector and blackboard. Exercises: auditory + design. Programme work: design exercises + independent work + defence of work.		
Distribution of ECTS credits			
Regular attendance of classes	Programme work	Examination	
1.5	**1.0**	**2.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the exam). Examination: Oral, 2.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.		
Learning outcomes	The student is able to determine optimal location and type of interchanges; design horizontal alignment, vertical alignment and cross sections elements of main roads and ramps.		
Language of instruction	Croatian. Italian		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**ECOHYDROLOGY**	Year of study	**II. (second)**
Course code	**DHID05**	Semester	**III. (winter)**
Group	Professional	Hours per week	**3L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Gordan Prskalo, PhD, senior lecturer		
Course contents	Interaction between hydrology and ecology. Concepts of sustainable development. The definition of ecohydrology. Elements of hydrology and water resources fundamental for ecology. Hydrological systems and processes. Impact of global climate changes on hydrological cycle. Floods, flooded and wet areas. Droughts and arid areas. Open flows as the part of ecosystem. Open channel flow management. Environmental requirements for the open channel flows. Principles and problems in determination of an ecologically acceptable flow.		
Recommended reading	(1) O. Bonacci: Ekohidrologija, Građevinski fakultet Split, 2003.		
Supplementary reading	(1) O. Bonacci: Oborine-glavna ulazna veličina u hidrološki ciklus, Geing, Split, 1994.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**1.5**	**2.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe the connection between ecology and hydrology and solve a wide range of engineering tasks associated with ecohydrology.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**GEOTECHNICAL STRUCTURES**	Year of study	**II. (second)**
Course code	**DGEO03**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Maja Prskalo, PhD, associate professor		
Course contents	Soil as construction material: Engineering properties of soils and its investigation in situ and in laboratory. Excavation: large excavations, excavations in limited space, excavations with protection. Embankments: Classification and sorts, dams. Planning, realization and oscultation. Reinforced soil: fabric-reinforced soils, soil nailing, jet grouting. Soil improvement: dinamic shallow and deep soil stabilization, vertical and horizontal drainage, shallow and deep soil stabilization mix in place. Project of deep excavation (Slope stability, drainage). Project of multilayer embankment (Slope stability, settlement, waterproof , erosion protection, culvert projects). Soil reinforcement project: affecting of reinforcement on soil structures, design of reinforcements, stability control of construction.		
Recommended reading	(1) Roje-Bonacci, T. Mehanika tla (2003.), Građevinski fakultet Sveučilišta u Splitu, Split. (2) Roje-Bonacci, T. Potporne građevine i građevne jame, Građevinsko-arhitektonski fakultet Sveučilišta u Splitu, 2005. (3) Nonveiller, E. (1983.) Nasute brane, projektiranje i građenje, Školska knjiga, Zagreb. (4) Nonveiller, E. (1987.) Kliženje i stabilizacija kosina, Školska knjiga, Zagreb. (5) Babić, B. (1995.) Geosintetici u graditeljstvu, Hrvatsko društvo građevinskih inženjera, Zagreb. (6) Linarić, Z., Žabek, K. (2004.) Tehnike i tehnologije poboljšanja temeljnog podtla. U V. Simović, ur., Građevni godišnjak '03/04, Hrvatski savez građevinskih inžanjera, Zagreb.		
Supplementary reading	(1) Schroderer, W.L. (1975.) Soils in construction, John Wiley&Sons, Inc. New York. (2) Fang, H.-Y. (1991.) Foundation engineering handbook. Poglavlje 7 Dewatering and groundwater control (autor Powers, P.); poglavlje 8 Compacted fill (autor Hilf, J.W.) i poglavlje 9 Soil stabilization and grouting (autori Winkerton, H.F. i Pamukcu, S.), Chapman&Hall, New York. (3) U.S. Department of the interior, Bureau of reclamation, (1977.) Design of small dams (poglavlje V. Foundations and construction materials, VI. Eatrhfill dams, poglavlje VII. Rokfill dams, United States Government printing office, Washington D.C. (4) U.S. Department of the interior, Bureau of raclamation, (1974.) Earth Manual, A guide to the use of soils as foundations and as construction materials for hydraulic structures, United States Government printing office, Washington D.C.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Make-up exams	
	1st assessment	**1.0**	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.5**		Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.5 ECTS credits. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Seminar paper: Preparation and defence of the seminar paper, 1.0 ECTS credit. Make-up exams: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to project, organise field works, manage and control quality of all geotechnical works with soils or/and in soils.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**GIS IN MUNICIPAL INFRASTRUCTURE PLANNING**	Year of study	**II. (second)**
Course code	**DARH06**	Semester	**III. (winter)**
Group	Architectural	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	The theory of spatial data modeling. Database management systems. Municipal databases. Geographic Information Systems (GIS): history, data types, components. Spatial data. Vector (point, line, polygon) and raster data. Database modeling, types of logical models. Relational and object-oriented data models. Spatial data processing software: introduction and application. The role of digital surveying plan in creation of land information system. Application of GIS in municipal infrastructure planning and management. Specific registers of urban utility facilities: roads, water supply, sewerage, public, industrial and residential buildings, power lines. Data analysis in GIS. Linking with other databases and ways of presenting spatial data. Introduction to GIS concept and application. Training for solving basic tasks in the management of utility infrastructure databases using GIS. Training for solving planning tasks in the field of utility infrastructure using GIS.		
Recommended reading	(1) Brukner, M., Olujić, M. Tomanić, S.:GIZIS - metodološka studija. INA-INFO, 1992. (2) Bohnam-Carter, G.F.: Geographic Information Systems For Geoscientists, Pergamon, 1994.		
Supplementary reading	(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 modeling for GIS. Taylor & Francis, 1998.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to manage GIS databases.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**URBANISTIC METHODOLOGY AND MANAGEMENT**	Year of study	**II. (second)**
Course code	**DARH02**	Semester	**III. (winter)**
Group	Architectural	Hours per week	**2L + 0E**
Teaching form	Lectures (L)	ECTS	**2.0**
Name of lecturer	Jaroslav Vego, PhD, full professor		
Course contents	Definitions of basic concepts: management; space. Legislation: laws, statutes, codes, decrees. Programming, planning, and designing; function analysis, zoning, infrastructure, traffic. Space / urban plans: strategy and programme of urban planning at the national, county, municipal, city, and other levels. Balance of surfaces with development coefficients from the aspects of efficiency and density parameters. Urban planning: preparation and construction of a facility, equipment and installations of both individual and communal utility / use. Management of the developed areas. Parameters for determining utility costs. Investment programme concerning the use of developed areas. Space management organisation models.		
Recommended reading	(1) Marinović-Uzelac, A.: Teorija namjene površina u urbanizmu, Zagreb, 1989.		
Supplementary reading	(1) Marinović-Uzelac, A.: Prostorno planiranje, Zagreb, 2001.		
Teaching methods	Lectures, using a projector.		

Distribution of ECTS credits			
Regular attendance of classes	Assessments (preliminary exams)		Make-up exam
	1st assessment	**0.5**	**1.3**
0.7	2nd assessment	**0.8**	

Course requirements and evaluation methods	Regular attendance of classes, 0.7 ECTS credits. Assessments: 1st assessment passed, 0.5 ECTS credits, 2nd assessment passed, 0.8 ECTS credits, The student who passes only the 1st or only the 2nd assessment is required to take the make-up exam of the failed assessment. A student who does not pass the 1st and 2nd assessment is required to take the make-up exam. Make-up exam: 1.3 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes.
Learning outcomes	The student is able to associate the construction business with the process of space planning and management, and is able to describe, analyse and identify physical planning documents.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**URBAN TRAFFIC AREAS**	Year of study	**II. (second)**
Course code	**DPRO04**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	Course introduction. Types of vehicles. Public transportation systems. Individual passenger transport. Planning of urban traffic areas (location, capacity, design). Functional classification of urban streets. Capacity and Level of service. Design elements: Horizontal and Vertical alignment. Optimal type of intersection design and control. Typical cross sections. Speed change lanes. Grades. Horizontal and vertical sight distance. Intersection superelevation design. Pavements. Drainage. Illumination. Signing and markings. Structures. Parking. Parallel and diagonal parking. On street and off street parking. Garages. Bus stations and multimodal transportation terminals. Gas stations. Traffic control devices. Pedestrian traffic areas. Cyclist traffic areas. Types of public transport facilities and vehicles.		
Recommended reading	(1) Lozić, I.,Tedeschi, S.: Osnovni elementi za planiranje i projektiranje gradskih prometnica, Fakultet građevinskih znanosti Split, 1979.; (2) A Policy on geometric design of Highways and streets, AASHTO 2001; (3) Maletin, M.: Planiranje i projektovanje saobraćajnica u gradovima, ORION-ART, Beograd 2009.		
Supplementary reading	(1) Highway capacity manual 2000, Transportation research board.; (2) ITE: Transportation and traffic engineering handbook, Prentice-Hall.; (3) Smjernice za projektiranje, građenje, održavanje i nadzor na cestama, Sarajevo/Banja Luka, 2005.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Programme work: independent work with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exams	
	1st assessment	**1.0**	**0.5**	Written	**2.0**
1.5	2nd assessment	**1.0**		Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 0.5 ECTS credits (requirement for admission to the make-up exam) Assessments: 1st assessment passed, 1.0 ECTS credit (requirement for admission to the 2nd assessment). 2nd assessment passed, 1.0 ECTS credit. A student who passes both assessments is required to take a short make-up exam (oral part) in order to establish the final grade, and one who does not pass both assessments is required to take the make-up exam (written and oral part). Make-up exams: Written part, 2.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to choose and design main urban traffic areas (streets, intersections, parking and pedestrian areas).
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**HYDRO POWER ENERGY**	Year of study	**II. (second)**
Course code	**DHID06**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Zoran Milašinović, PhD, full professor		
Course contents	First part: Types of energy, renewable energy sources (biogas, sun and wind), estimation of fossil fuel energy lifespan, energy conservation principles. Second part: Water power utilization, water power budget, river discharge, power, energy. Volumetric discharge curve, method of subsequent maximums, energy-economic characteristics of artificial reservoirs and reservoir sizing. Multicriteria analysis for defining location, size and discharge characteristics for small hydro power plants. Third part: Sea energy, tides and energy from waves and kinetic energy from sea currents. Introduction into the design principles in utilizing sea energy and geothermal energy. Energy from biogas: gas generation from landfills, energy from animal waste, current practice and future directions.		
Recommended reading	(1) Petar Stojić: Iskorištavanje vodnih snaga, Građevinski fakultet Split, 1994.		
Supplementary reading	Selected materials: professional studies, feasibility studies and published papers in the field of hydro power, bioenergy and geothermal energy, by the teacher's choice.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to describe and analyse the hydro power and other renewable energy, use the methods of water power utilization, describe the principal methods for management of hydro power facilities and other renewable energy sources and use the basic methods of design and construction of power facilities.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**KARST HYDROGEOLOGY**	Year of study	**II. (second)**
Course code	**DGEO09**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Amira Galić, PhD, senior lecturer		
Course contents	Introduction to the basic characteristics of karst. General information on the porosity and permeability of karst terrains; The relationship between porosity and permeability; Hydrogeological phenomena in karst and their genesis; Water in the underground of karst and specifics of its movement; Aquifers in karst - their specifics; Divides in karst; Physical and chemical properties of karst groundwaters; Methods of investigating hydrogeological characteristics of karst: geological analysis, structural-tectonic analysis, geomorphological, climatic analysis, geophysical analysis, statistical and probabilistic analysis; Influence of hydrogeological karst properties on engineering activities (foundations, physical planning, roads, tunnels, bridges and viaducts, cuts, side cuts and embankments, landfills and cemeteries) with special reference to the influence of hydrogeological karst properties on the possibility of creating water reservoirs; Groundwater protection in karst (approaches to natural and specific vulnerability assessment, assessment of sources of risk to groundwater and surface water).		
Recommended reading	(1) Milanović, P.T. (1979): Hidrogeologija karsta i metode istraživanja. Hidroelektrane na Trebišnjici i Institut za korištenje i zaštitu voda na kršu, Trebinje; (2) Biondić, B. et al. Ed. (1995): Hydrogeological aspects of groundwater protection in karstic area. Final report - COST ACTION 65, Bruxelles; (3) Bakalowicz, M. : Karst groundwater: a challenge for new resources; Springer-Verlag 2005.; (4) Bonacci, O. :Karst hydrology; Springer-Verlag Berlin Heidelberg, 1987. (5) Herak, M. Stringfild, V.T. :Karst; Elsevier publishing company Amsterdam-London New York, 1972.; (6) Komatina, M.: Hidrogeološka istraživanja; Geozavod, Beograd, 1984.		
Supplementary reading	Selected papers from international journals.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.0**	**1.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe hydrogeological phenomena and problems in karst. S/he is able to analyse and identify the structure of karst terrains and hydrogeological phenomena and predict the associated problems that can occur in areas with karst structure of terrain.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**KARST HYDROLOGY**	Year of study	**II. (second)**
Course code	**DHID07**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Gordan Prskalo, PhD, senior lecturer		
Course contents	Karst terminology and definitions. Soluble rocks as the basis of karstification processes. Geomorphologic characteristics of karst. Hydrological characteristic of karst. The phenomena of water in karst. Groundwater circulation in karst. Karst aquifer. Hydrological budget. Karst springs. Discharge curves. Hydrograph analysis. Determination of the catchment area. Swallow holes (Ponors). Determination of swallow capacity of ponors. Natural streamflows in karst. Interaction between groundwater and water in the open streamflows in karst. Hydrological regime of rivers in karst. Water losses along the open streamflows in karst. Tracer tests in karst hydrogeology. Groundwater temperature in karst. Hydrologic characteristic of the Dinaric karst.		
Recommended reading	(1) O. Bonacci, Karst Hydrology, Springer Verlag, Heidelberg, 1987.; (2) O. Bonacci, T. Roje-Bonacci, Posebnosti krških vodonosnika, Građevni godišnjak 2003/2004.		
Supplementary reading	(1) P. Milanović, Hidrogeologija krša, Svjetlost, Sarajevo, 1979.; (2) W.B. White, Karst hydrology-concepts from the Mammoth Cave area. Van Nostrand Reinhold New York: 223-258.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to explain the basic concepts of hydrological processes, perform analyses related to water circulation in karst and solve engineering problems in karst hydrology.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**STRUCTURAL TESTING**	Year of study	**II. (second)**
Course code	**DKON09**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	Historical review and the role of structural testing. Classification of testing: control, scientific, special; site, model; short-time, long-time; static, dynamic; field, laboratory. Mechanical and geometrical quantities which are measured during structural testing. Instruments for measuring different quantities. Determination of structural properties, accuracy and bandwidth of measurement instruments. Project, performance, loading systems, handling and marking of results of measurement. Particularities of static and dynamic testing. Structural testing norms. Extensometry. Classification and types of extensometers. Advantages and disadvantages of electro-resistant strain gages. Procedures for determination and verification of tested structure material properties by core sampling, ultrasonic testing, sclerometry or radiography. Stress state analysis based on strain measurements and forecast of generated stresses. Outline of some other important methods for determining stress and strain state: Brittle lacquers method; Photoelastic method of stress analysis; Moire method; Holography; Photogrametry. Description of some procedures and methods of measurement on illustrative examples from practice.		
Recommended reading	(1) Mjerenje deformacija i analiza naprezanja, Autorizirana predavanja za seminar, Ur. A. Kiričenko, Društvo građevinskih inženjera i tehničara Zagreb, Zagreb, 1982.; (2) D. Aničić, Ispitivanje konstrukcija, Građevinski fakultet Sveučilišta u Osijeku, Osijek, 2002.; (3) P. Marović, Zapisi s predavanja (pisani materijali + CD)		
Supplementary reading	Test reports selected by the teacher.		
Teaching methods	Lectures and exercises using a projector and blackboard.		
Distribution of ECTS credits			
Regular attendance of classes	Examination		
1.5	**3.5**		
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Examination: Oral, 3.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes.		
Learning outcomes	The student is able to describe an appropriate number of methods for testing of engineering structures, analyse test results and make a test report.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**CONSTRUCTION OF CONCRETE STRUCTURES**	Year of study	**II. (second)**
Course code	**DKON10**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Alen Harapin, PhD, full professor		
Course contents	Construction site organization for residential, public and industrial buildings in different conditions – examples from practice. Construction site organization for bridges and other engineering structures in different conditions – examples from practice. Construction technology for residential and public buildings (foundations, columns, walls, floor structures). Construction of prefabricated concrete and steel factory halls. Bridge substructure construction technology (abutments, columns, head beams). Some common construction methods for bridge span structures. Construction and erection technology of prestressed concrete girders. Construction and erection technology of steel girders. Organization and construction methods of high cuts and embankments. Particularities of coastal and hydrotechnical structure's construction (quays, berths, breakwaters, dams, navigation locks). Construction of complex foundation structures. Formwork. Scaffolding. Elementary construction machinery. Concrete production, transport and placement. Steel bending workshops. Welding technology. Contractor's parties. Field visits to several construction sites in regard to applied construction organization and technology.		
Recommended reading	Lecture notes, movies, photographs and other education materials prepared by lecturers.		
Supplementary reading	Organization and technology projects of some constructed structures.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**3.0**	**0.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 3.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 0.5 ECTS credits (used to define the final grade).		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to identify different construction works technologies, describe them and substantiate the selection of construction technology.		
Language of instruction	Croatian. English.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**CONSTRUCTIONS OF HISTORICAL STRUCTURES**	Year of study	**II. (second)**
Course code	**DARH03**	Semester	**III. (winter)**
Group	Architectural	Hours per week	**2L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**4.0**
Name of lecturer	Jaroslav Vego, PhD, full professor		
Course contents	Review of the most significant historical structures (monuments, religious structures, fortresses, stone bridges and aqueducts and other historical stone structures). Introduction of main characteristics of materials used, original building techniques and technologies. Techniques of reconstruction and remedial works on structures of cultural heritage, particularly in view of adequate selection of materials (rock, brick, lime, sand, wood, metal etc.). Defining of original static system and application of modern materials (calx romana, carbon grain, stainless steel, compregnated wood, mixtures based on epoxide resin) and technologies of ''patching'', grouting, ''stitching'' and prestressing. Partially and fully reinforced stone structures (Old Bridge in Mostar). Constructive measures for taking over loads caused by earthquake.		
Recommended reading	(1) Crnković B., Šarić Lj.;Construction by natural stone, IGH, Zagreb, 2003; (2) Gojković M.; Stone structures, ICS, Beograd, 1976; (3) Gojković M.; Old stone bridges, Naučna knjiga, Beograd, 1989.		
Supplementary reading	(1) Pande G. N and Middleton J.; Computer Method in Structural Masonry 1-2-3, University of Wales Swansea, Wales U. K., 1995.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.0	**2.0**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.0 ECTS credit. Seminar paper: Preparation and defence of the seminar paper, 2.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to assume a competent attitude towards monuments of cultural heritage, and properly select types of materials and design schemes for revitalization of historical structures.		
Language of instruction	Croatian. German.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**HOUSING INSTALLATIONS**	Year of study	**II. (second)**
Course code	**DARH04**	Semester	**III. (winter)**
Group	Architectural	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Jaroslav Vego, PhD, full professor		
Course contents	Engineering aspects of installations. Engineering prerequisites for building-in the sewer system installations; installations for cold and hot water, fire-protection systems for raising the pressure in the sewer system installations, sanitary issues. Engineering prerequisites for heating installations and boiler-room; pipeline implementation, location of heating equipment, location solutions for the boiler-room, fuel storehouses, chimney, remote heating. Engineering conditions for the use of renewable energy sources. Engineering conditions for the installation of high-voltage and low-voltage electric current, thunder protection installations. Bringing into accordance all types of installations in engineering design and construction.		
Recommended reading	(1) B. Tušar: Sewer system in buildings, Civil Engineering Faculty, Zagreb, 2001; (2) M. Šivak: Centralheating, ventilation, air-conditioning system, Nakladnička djelatnost M. Šivak, Zagreb, 1998.		
Supplementary reading	(1) J. Grabovac, M. Dragović: Application of low-temperature solar thermal equipment in housing,, "Đ. Đaković", Sarajevo, 1988.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Programme work: independent work + defence of work.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exam
1.5	1st assessment	**0.5**	**1.0**	**1.0**/2.5
	2nd assessment	**0.5**		
	3rd assessment	**0.5**		

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 0.5 ECTS credits (requirement for admission to the 2nd assessment). 2nd assessment passed, 0.5 ECTS credits (requirement for admission to the 3rd assessment). 3rd assessment passed, 0.5 ECTS credits. A student who does not pass all three assessments is required to take the make-up exam. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit (requirement for admission to the make-up exam). The student who passes all three assessments, and submits and defends the programme work, is required to take the make-up exam. Make-up exams: 1.0/2.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to use final design/projects for specific installations during the design and construction phases.
Language of instruction	Croatian. German.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**MECHANICS OF DEFORMABLE BODY**	Year of study	**II. (second)**
Course code	**DMEH02**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivo Čolak, PhD, full professor		
Course contents	Defining the general purpose of mechanics of deformable body. Elastical and linear elastical deformable body and elaboration of elasticity theory submodels. Definition of state of equilibrium by principles of virtual work and minimum potential energy. Torsion of prismatic bars – problem equation and boundary conditions by stress and strain methods, strict solution, variational formulation, approximate solutions, numerical solutions, practical results. Plane problems. Semiplane. Stress and strain conditions under foundation. Lame's solution of circular ring. Application of Lame's solution for tunnels and underground structures. Practical solution of plane stress and plane strain, known solutions. Introduction to theory of plasticity. Principal models of nonlinear behaviour of material. Illustration on examples of axial symmetry.		
Recommended reading	(1) Kostrenčić Z.: Teorija elastičnosti, Školska knjiga, Zagreb 1982; (2) Boresi A. P. and Lynn P. P.: Elasticity in Engineering Mechanics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1974.		
Supplementary reading	(1) Gurtin M. E.: An Introduction to Continuum Mechanics, Academic Press, New York, 1981.; (2) Hill R.: The Mathematical Theory of Plasticity, Oxford Universitiy Press, New York, 1985.; (3) D. R. J. Owen and E. Hinton, Finite Elements in Plasticity: Theory and Practice, Pineridge Press, Swansea, U.K., 1980.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to analyse global fields of stress and strain for various engineering structures; use various linear and nonlinear models of materials; explain local effects at places of concentrated actions; describe conditions around openings and curved parts of model area boundary.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**MECHANICS OF MATERIALS**	Year of study	**II. (second)**
Course code	**DGEO04**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivo Čolak, PhD, full professor		
Course contents	Mechanical characteristics of materials General considerations. Mechanical characteristics in tension. Mechanical characteristics in compression. Schematization of stress-strain curve of material. Influence of different parameters on the behaviour of solids under loadings. Strength of materials under dynamic load. Impact strength of materials or toughness. Strength of materials under alternating load. Technological material tests. Hardness of a material. Determination of hardness of a material: statical and dynamical procedures. Non-destructive tests. Basis of the Rheology of Materials Introduction. Basic rheological models and basic mathematical equations. Creation of complex rheological models and appropriate mathematical equations. Basis of the Fracture Mechanics Introduction. Basic notes and tasks of fracture mechanics. Griffith's and Irwin's criterion for crack instability.Connection between fracture mechanics and strength of materials.		
Recommended reading	(1) V. Šimić: Strength of Materials I – Chapter 9, Školska knjiga, Zagreb, 1992 (in Croatian); 2nd edition, 2001 (in Croatian); (2) J. Brnić: Elastomechanics and plastomechanics, Školska knjiga, Zagreb, 1996 (in Croatian); (3) P. Marović: Lecture Notes in Mechanics of Materials, Faculty of Civil Engineering and Architecture, Split, yearly updated (written materials + CD).		
Supplementary reading			
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to describe basic concepts in mechanics of materials, rheology and fracture mechanics.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**MANAGEMENT IN CIVIL ENGINEERING**	Year of study	**II. (second)**
Course code	**DORG02**	Semester	**III. (winter)**
Group	Professional	Hours per week	**3L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Vlado Majstorović, PhD, full professor		
Course contents	Basic concept of management and its role in construction company management. Classification of construction companies according to business types. Company organization. Planning (operative, tactical, strategic). Statistical methods in management. Business risk management. Positioning of construction company in business environment. Operational management in construction production. Business forecasting. Financial management. Project management within company business. Human resources management. Market research and marketing. Marketing management in construction industry. Management information systems (MIS).		
Recommended reading	(1) B. Medanić.: Management u građevinarstvu, Sveučilište u Osijeku, 1997; (2) Z. Ribarović: Uvod u studiju podobnosti, Zebra plus d.o.o. Split, 2005. (3) S. Knezić: Autorizirani materijali s predavanja.		
Supplementary reading	(1) Lj. Vidučić: Financijski menadžment, Ekonomski fakultet Split, RRiF-plus, Zagreb 2004.; (2) F. Bahtijarević-Šiber: Management ljudskih potencijala, Golden marketing, Zagreb 1999.; (3) P. Kotler: Upravljanje marketingom, Mate, Zagreb 2001.; (4) M. Buble: Management, Ekonomski fakultet Split, Split 2000.; (5) M. Harrison: Principles of Operations Management, Pitman Publishing, London 1996.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**3.0**	**0.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. <u>Seminar paper:</u> Preparation and defence of the seminar paper, 3.0 ECTS credits (requirement for admission to the exam). <u>Examination:</u> Oral, 0.5 ECTS credits (used to define the final grade).
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to describe the basic principles and identify contemporary methods of management at all levels and of all types of resources. S/he is able to manage state companies, and run big and small construction firms.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**METAL BRIDGES**	Year of study	**II. (second)**
Course code	**DKON08**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Vlaho Akmadžić, PhD, senior lecturer		
Course contents	Historical review of the development of metal bridges. Modern solutions in the design of metal bridges – general remarks. Characteristic actions upon bridges. The concept of stability proof. Plate main girders, box girders. Torsion resistance. Optimal dimensions. Main truss girders – types, theory, structural rules for the computations, details, modern implementations. Pavements for highway and railroad bridges. Composite structures, general remarks, stability and interaction with main girders. Span composite steel-concrete structure. Limit state of the bearing capacity and exploitability. Stress redistribution by creeping and contraction, elastic and plastic analysis. Steel orthotropic plate in bridges, structural formation, main analyses. Arch bridges. Cable bridges, Suspended bridges. Bearing/supporting structures. Expansion joints. Transitory devices. Accompanying elements. Bridge equipment. Connections and joints, Production and assembly of bridges. Scientific research in bridge construction.		
Recommended reading	(1) Androić B., Peroš B. i drugi: Čelični i spregnuti mostovi, IA projektiranje, Zagreb, 2005.; (2) Horvatić D., Šavor Z.: Metalni mostovi, HDGK, Zagreb, 1998.		
Supplementary reading	(1) Tonković K.: Mostovi, Liber, Zagreb, 1981.; (2) Horvatić D.: Spregnute konstrukcije čelik-beton, Mas media, Zagreb, 2003.		
Teaching methods	Lectures and exercises using a projector and blackboard. Programme work: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Programme work	Examination	
1.5	**2.0**	**1.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. <u>Programme work:</u> Preparation and defence of the programme work, 2.0 ECTS credits (requirement for admission to the exam). <u>Examination:</u> Oral, 1.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.		
Learning outcomes	The student is able to participate in the design of metal and composite bridges.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**FINITE ELEMENT METHOD**	Year of study	**II. (second)**
Course code	**DPRI04**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Mladen Kožul, PhD, senior lecturer		
Course contents	Basic equations in the analysis of structures. Variational formulation of fundamental problems. Generating a finite element mesh. Numerical integration. 1D finite elements. Beam finite elements. Calculation of element stiffness matrix of a beam element. Assembling element matrices into a global stiffness matrix. Application of finite element method (FEM) to frame plane girders. Finite elements (FE) for wall girders. FE for plates. Calculation of element stiffness matrix for plates. FE for shells. Finite elements for stationary conduction equation. Error estimation for FEM.		
Recommended reading	(1) Jović, V.: Uvod u inženjersko numeričko modeliranje, Aquarius engineering d.o.o., Split, 1993.; (2) Harapin, A., Trogrlić, B.: Uvod u metodu konačnih elemenata - štapni sustavi u ravnini, Interna skripta, Građevinski fakultet Split, 2009.: (3) Sorić: Metoda konačnih elemenata, Golden Marketing - Tehnička knjiga Zagreb, 2004.; (4) Hughes: The Finite Element Method - Linear Static and Dynamic Analysis, Dover, 2000.		
Supplementary reading	(1) Kraetzig, Basar: Tragwerke 3, Theorie und Anwendung der Methode der Finiten Elemente, Springer, 1997.; (2) Werkle: Finite Elemente in der Baustatik, Vieweg, 1995.; (3) Hartmann, Katz: Statik mit finiten Elementen, Springer, 2002.; (4) Cook, Malkus, Plesha, Witt: Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 2001.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**2.0**	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to describe the finite element method, analyse, define and create a finite element mesh of various engineering structures, develop algorithm solutions of engineering problems.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**RESEARCH METHODS**	Year of study	**II. (second)**
Course code	**DPRI05**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivo Čolak, PhD, full professor		
Course contents	Collecting, studying and systematisation of reference materials and information. Concept, types and testing of hypoteses. The concept and purpose of seminar papers and critical reviews. Data collection. Data analysis. Research methodologies. Research methods: Modelling, Statistical methods, Mathematical methods, Experimental methods, System theory as a method, Case study methods, Observation methods, Questionnaire and interview methods, The Delphi method. Presenting research results. Citing references. Bibliography. Presentation skills.		
Recommended reading	(1) Zelenika, R. Metodologija i tehnologija izrade znanstvenog i stručnog djela, Ekonomski fakultet Sveučilišta u Rijeci, 1999. (2) Fellows, R., Liu, A. Research Methods for Construction. Oxford: The Blackwell Science, 1997.		
Supplementary reading	(1) Holt, D.G. A guide to successuful dissertation study for students of the built environment. Wolverhampton: University of Wolverhampton, 1997; (2) R., K.Yin. Case study reserach, design and methods: SAGE Publications, 1994.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**3.0**	**0.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 3.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 0.5 ECTS credits (used to define the final grade).
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to conduct research independently or in a team. Higher levels of eloquence and presentation skills.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**GROUNDWATER FLOW AND TRANSPORT MODELLING**	Year of study	**II. (second)**
Course code	**DHID08**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Zoran Milašinović, PhD, full professor		
Course contents	First part: Hydrogeology and aquifer definition, confined and unconfined conditions, vadose zone, generalization of Darcy's law and equation of groundwater flow, hydraulic conductivity heterogeneity, conductivity and porosity measurements. Second part: Governing flow equation, stationary and nonstationary conditions, mathematical modelling and numerical methods, use of filed data and defining initial and boundary conditions. Introduction to software package MODFLOW and SUTRA. Third part: Introduction to transport processes in the aquifers, advective transport, mass-balance consideration and the Eulerian approach to advective transport, dispersive transport and mass transfer. Introduction in mathematical modelling and numerical/analytical methods of solution. Introduction to software package PTRACK, MODPATH and MT3DMS. Fourth part: Application of the introduced software package in the field case study, uncertainty and sensitivity analysis, risk assessment caused by contaminated groundwater resources.		
Recommended reading	(1) Andričević, R., Groundwater flow and transport modeling, lecture notes (in English), University of Nevada, USA, 1999.; (2) Zheng, C. and G. D., Bennet, Applied Contaminant transport modeling, John, Wiley and Sons, Inc., 2002.; (3) Stochastic subsurface hydrology, Academic press, 1993.		
Supplementary reading	(1) Bear, J. and A. Verrujit, Modeling groundwater flow and pollution, D. Reidel, Dordrecht, Netherlands, 414 p. 1987.; (2) Andričević, R., J. Daniels, and R. Jacobson, Radionuclide migration using travel time transport approach and its application in risk analysis, Journal of Hydrology, 163, 125-145, 1994.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe the basic principles of physical processes defining the flow and transport in groundwater, design monitoring programmes and describe heterogeneity of geologic formations-aquifers.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**NON-LINEAR ENGINEERING STATICS**	Year of study	**II. (second)**
Course code	**DMEH03**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Mladen Kožul, PhD, senior lecturer		
Course contents	Material non-linearity. Types of simple numerical models, uniaxial and multiaxial. Non linear material line structures with small displacements theory. Incremental – iterative procedures. Concentrated plasticity. Continuous plastic. Space frames with material and geometrical non-linearity. Error estimate of incremental – iterative procedure. Line structures with large displacements theory and small displacements theory. Usage of tangential and quasi-tangential method. Introduction of material and geometrical non-linearity. Model of torsion. Large displacements and small displacements in numerical assignment of form finding for cable structures. A basic numerical material non-linear model for boulders, plates and shells. Usage of small and large displacements models for small deformations. Incremental – iterative procedures. Engineering static for complex space structures of rods, plates, shells and boulders. Numerical model of material and geometric non-linearity with small and large displacements theory. Plates and bearers on non-linear supports. Non linear release of point and line supports. Simulation of time dependent deformation with static models. Static adaptation of moments. Static interaction of non-linear complex construction – non-linear soil. .		
Recommended reading	(1) Mihanović A., Stabilnost konstrukcija, Društvo hrvatskih građevinskih konstruktora, Zagreb, 1993. (2) Owen D. R. J. and Hinton E., Finite elements in plasticity, Pineridge Press, Swansea, 1980.		
Supplementary reading	(1) Bažant Z. P. and Cedolin L., STABILITY OF STRUCTURES: Elastic, Inelastic, Fracture and Damage Theories, Dover Publications, Inc., New York, 2003.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to define and describe the problems of nonlinear analysis of structures (material and geometrical nonlinearity). S/he is able to solve problems of nonlinear static analysis (incremental - iterative procedures) and describe the types of material nonlinearity of structures. The student is able to conduct nonlinear static analysis of structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**NUMERICAL MODELLING OF CONCRETE STRUCTURES**	Year of study	**II. (second)**
Course code	**DMEH04**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Alen Harapin, PhD, full professor		
Course contents	Types and properties of concrete and reinforcement. Concrete creep and shrinkage. Concrete strength and deformation under different loads (short-term, long-term, static, dynamic, uniaxial, multi-axial, cyclic). Steel behaviour. Concrete -reinforcement relationship. Tensile and shear rigidity of cracked concrete. Models of concrete behaviour under different loads (linear and non-linear elastic, elastoplastic, plastic with strengthening, cracked, rheologic). Concrete crack modelling. Cracked concrete tensile and shear rigidity modelling. Reinforcement sliding modelling. Some problems and dilemmas in practical analyses of reinforced concrete structures: spatial discretisation, time discretisation, material and geometry models, numerical integration, structural and radiation damping, load increment, time increment, finite element mesh size, convergence criteria, non-linear problem solution method, soil-structure interaction. Reliability of analyses results and congruence with the regulations in force. Some structural analyses details: member structures, plane (2D) structures, slabs and shells, membranes, spatial (3D) structures, complex structures. Modelling of structures in practice: buildings, bridges, dams, silos, masonry structures. Interaction structure-soil-liquid.		
Recommended reading	(1) Radnić J., Harapin A.: Numeričko modeliranje betonskih konstrukcija, napisi za predavanja; Računalni programi: ASPALATHOS, DKP, SALJ, DALJ, DAK, DAFIK, SOFISTIK i drugi raspoloživi računalni programi.		
Supplementary reading	(1) Hofstetter G. and. Mang H.A: Computational Mechanics of Reinforced Structures, Braunschweig/Wiesbaden, 1995.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**2.5**	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to numerically model concrete structures in practice and analyse calculation results.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**COASTAL ENGINEERING**	Programme	**GENERAL**
Course code	**DHID02**	Year of study	**I. (first)**
Group	Professional	Semester	**II. (summer)**
Teaching form	Lectures (L), Exercises (E), Sem. and Prog. work	Hours per week	**2L + 2E**
Name of lecturer	Mijo Vranješ, PhD, associate professor	ECTS	**5.0**

Course contents	Definition and classification of marine structures. Sea bottom and hydrogeology. Oceanographic, physical and chemical properties of the sea. Movement of seawater, waves, currents. Seawaves, linear wave theory, finite amplitude wave theory, wind generated waves. Wave transformation, refraction, diffraction, reflection, breaking. Wave energy and force on structures. Design wave environment, wave energy spectral analysis, wave statistics, wind wave prediction. Long period waves, springtide-ebbtide, seiche, tsunami. Sea currents on shore. Seawater levels. Wave measurement. Breakwaters, type of constructions, define force and design. Jetties, wharves, piers and quays, type of constructions, define force and design. Navigation locks. Docks: on the land and floating, floating airports. Underwater pipelines, cables, wastewater outfalls, underwater constructions, seawater forces on it. Sinking of submarine pipes. Wave force on small structures. Wave force on large structures. Floating structure dynamics. Coastal processes. Estuaries and river deltas, formation and development of deltas. Seawater intrusion in the rivers. Sea effect on the shoreline, design and protection. On shore sediment transport, design and beach stability. Field measurements in the on shore area, topographic, hydrographic, and geotechnical measurement. Modelling, physical and numerical models. Construction and maintenance of marine objects, technology, equipment. Diving and protection.
Recommended reading	(1) Babić, L.: Primjena betona kod radova u moru, Epoha, Beograd, 1968.; (2) Prskalo, M.: Zbirka riješenih zadataka, Mostar, 2009. - skripta; (3) Silvestar, R.: Coastal Engineering 1, 2, Scientific Publishing 1974; (4) Horikawa, K.: Coastal engineering, University of Tokyo Press, 1978.; (5) Chakrabarti, S.K.: Hydrodinamics of Offshore Structures, Springer-Verlag, 1987.; (6) Sorensen, M..R.: Basic Coastal Engineering, Academic Publishers, Boston 2002.; (7) Kamphuis, J.W.: Introduction to Costal Engineering and Mangement, World Scientific, 2002.
Supplementary reading	(1) Reeve, D., Chadwick, A. and Fleming, C.: Coastal Engineering, Processes, Theory and Design Practice, Spon Press 2004.; (2) Shore Protection Manual CERC Coastal Engineering Resesarch Center, US Government Printing Office, Washington DC 1984.; (3) McDowell, D.M. and O'Connor B.A.: Hydraulic Behaviour of Estuaries, MacMilan Press Ltd, 1977.
Teaching methods	Lectures using a projector and blackboard. Exercises using the blackboard. Seminar and programme work - independent student work on a given topic.

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Programme work	Make-up exams	
	1st assessment	**1.0**	**0.5**	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.0**			Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st and 2nd assessment passed, 2 x 1.0 = 2.0 ECTS credits. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Seminar paper: Preparation and defence of the seminar paper, 0.5 ECTS credits. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit. Make-up exams: Written part, 1.0 ECTS credit (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar and programme work.
Learning outcomes	The student is able to dimension shallow and deep foundations in the sea and on the coast, perform load calculations and dimensioning of retaining walls, sheet-pile walls and construction pits in the sea and on the coast.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**SPECIFIC TIMBER STRUCTURES**	Year of study	**II. (second)**
Course code	**DKON11**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	HRN, DIN, Eurocode 5. Organization of the production of timber structures. Materials, technologies and quality control. Implementation. Adaptability Adaptability. Composite structures: timber to other materials. Prestressing, Industrialized prefabricated girders. Plates. Structural glued laminated timber. Details and computations, specific problems. Spatial concept and spatial systems. Special structures. Design and construction of timber bridges: types, details, computation of the structure and details. Wall, floor and roof panels. Details. Industrial construction of buildings. Reconstruction of damaged structures as part of cultural heritage.		
Recommended reading	(1) Eurocode 5 (prijedlog hrvatske verzije EC5 standarda za drvene konstrukcije); (2) S. Takač: Novi concept sigurnosti drvenih konstrukcija, Građevinski fakultet, Osijek, 1997.; (3) Z. Žagar: Drvene konstrukcije I-IV, skripta, Građevinski fakultet, Zagreb, 1994.; (4) Z. Žagar: Proračun građevinskih konstrukcija računalom, Školska knjiga, Zagreb, 1993.; (5) M. Gojković , D. Stojić: Drvene konstrukcije, Grosknjiga Beograd, 1996.; (6) M. Gojković i ostali: Drvene konstrukcije, Čigoja Beograd, 2001.; (7) M. Gojković, B. Stevanović: Drveni mostovi, Naučna knjiga Beograd, 1985.		
Supplementary reading	(1) Gotz-Hoor-Mohler-Natterer. Holzbauatlas, CMA, Munchen, 1980.; (2) Z. Žagar: COSMOS/M FEA program, upute, skripta, Građevinski fakultet, Zagreb, 1994. (3) Halasz R., SCHeer C.: Holzbau-Tachenbuch, IES Verlag, Berlin, 1986.		
Teaching methods	Lectures and exercises using a projector and blackboard. Programme work: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Programme work	Examination
1.5	**2.0**	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work: Preparation and defence of the programme work, 2.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student acquires advanced theoretical and practical knowledge in the field of timber structures and dimensioning of complex timber structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**STRUCTURE RELIABILITY**	Year of study	**II. (second)**
Course code	**DKON12**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	The concept "structure reliability". Deterministic and probabilistic approaches. Determination of reliability/safety by probability concepts, regularities in the distribution of random quantities, resistance and action. The probabilitic procedure in determination of structure reliability. Methods used in the probability procedure of the I, II, III and IV level. The presentation of the Hasofer – Lind procedure/method, Determination of the reliability index - new procedures. Semi-probabilistic approach - new technical standards, the association of partial safety factors with reliability index. Calibration of existing structures. Reliability models for supporting structures- FORM and SORM methods. Application of reliability models. Reliability of supporting structures from the standpoints of exploitation and damage. Examples illustrating the computation of the reliability index for some supporting structures.		
Recommended reading	(1) Milčić V., Peroš B.: Uvod u teoriju sigurnosti nosivih konstrukcija, Građevinski fakultet Split, 2003.		
Supplementary reading	(1) Schueler, Shinozuka: Structural Safety and Reliability, Proc. Cossar, Vol 1,2,3, Innsbruck, 1993.; (2) Kiureghain L.:Structural component Reliability and Finite element, Reliability Methods, Lecture Note for "Structural Reliability - Methods and Applications", University of California at Berkeley, 1989.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Examination		
1.5	**3.5**		
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Examination: Oral, 3.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes.		
Learning outcomes	The student is able to describe fundamentals of the theory of structure reliability and apply suitable methods to structural computations in accordance with recommendations presented in specific norms and regulations.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**APPLIED STOCHASTIC METHODS**	Year of study	**II. (second)**
Course code	**DPRI03**	Semester	**III. (winter)**
Group	Theoretical	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Roko Andričević, PhD, full professor		
Course contents	First part: Introduction to stochastic processes, applications in the engineering problems, expectation, moments, Bayes theorem, conditional probability and conditional moments Second part: Principles of stochastic and deterministic modelling, stochastic simulation, parametric uncertainty and intrinsic uncertainty. Uncertainty propagation in modelling, small perturbation method, Monte Carlo method and spectral method. Third part: Temporal stochastic processes, time series of one and many variables, uncertainty in estimation, statistical stationarity and non-stationarity. Examples in hydrology, hydro-power management, economy and meteorology. Fourth part: Stochastic processes in the space, random fields. Introduction to geostatistics, random field generation. Examples in modelling of groundwater, hydrogeology and atmospheric processes.		
Recommended reading	(1) Andričević, R., Stochastic processes, Class notes, University of Nevada, USA, 1997.; (2) Gelhar, L., Stochastic subsurface hydrology, Academic press, 1993.; (3) Andričević, R., H., Gotovac, Ljubenkov, I., Geostatistika umjeće prostorne analize, Barbat (in review), 2005.		
Supplementary reading	(1) Kitanidis, P.K. and R. Andričević, Accuracy of the first-order approximation to the stochastic optimal control of reservoirs, in Dynamic Programming for Optimal Water Resources Systems Analysis, edited by A. O. Esogbue, pp. 545, Prentice-Hall, 1989.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**2.5**	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to describe the basic stochastic approach from monitoring to modelling physical processes, quantify uncertainty in engineering sciences and distinguish the basic uncertainty sources in modelling natural phenomena.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**APPLIED GEOLOGY**	Year of study	**II. (second)**
Course code	**DGEO05**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Amira Galić, PhD, senior lecturer		
Course contents	Earth processes such as plate tectonics through a practical approach to study of minerals, rocks, fossils and geological structures. Engineering geology: tunnel geology, dam geology, geology related to road construction, landslides. Rock mechanics: rock mass classification. Hydrogeology: groundwater in Karst. Disaster geology: earthquake disaster and subsurface geology, disaster prevention city planning. Environmental geology: waste disposal. Geophysical prospecting. Geohazards and georesources. Terrain: Lecture and practical work. Training in geological fieldwork is undertaken in Dalmatia.		
Recommended reading	(1) S. Šestanović: Osnove inženjerske geologije - primjena u graditeljstvu, Geing, 159 pp, Split, 1993; (2) D. Mayer: Kvaliteta i zaštita podzemnih voda, Hrvatsko društvo za zaštitu voda i mora, 146 pp, Zagreb, 1993.; (3) B. Crnković i Lj. Šarić: Građenje prirodnim kamenom, RNG Fakultet Sveučilišta u Zagrebu, 184 pp, Zagreb, 1992.		
Supplementary reading	(1) A.C. McLean and C.D. Gribble (1979): Geology for Civil Engineers, George Allen and Unwin, 310 pp, Boston-Sydney; (2) W.R. Dachrot (1992): Baugeologie, 2, Auflage, Springer-Lehrbuch, 531 pp, Berlin; (3) Goodman, R. (1993): Engineering Geology. J. Wiley & Sons Inc, 412 pp, New York.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.0**	**1.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to analyse problems in the terrain, describe the basic characteristics of all three genetic types of rock important for construction practice, identify hydrogeological concepts of problems in civil engineering, describe rock as a construction material. S/he is able to define the structure of terrain, independently identify and describe defects in the structure of terrain and predict the associated problems that will accompany construction works, caused by the structure of terrain.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**ROAD DESIGN**	Year of study	**II. (second)**
Course code	**DPRO08**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	Theory of road design: methodology of road design, horizontal and vertical alignment and cross sections, space visualization, stopping and passing sight distance, methods for determining surfaces and mass haul diagrams, alternative solutions and selection of optimal solution. Computer aided road design: digital terrain models, horizontal and vertical alignment design, development of cross sections, earthworks volume calculation, stakeout elements. Alignment analysis.		
Recommended reading	(1) *Manual for the computer programme used in instruction;* (2) *Regulations on the basic conditions that public roads, their elements and structures on them must meet in terms of traffic safety* ("Official Gazette BiH", number 6/06);		
Supplementary reading	(1) H. Lorenz; *Trassierung und Gestaltung von Strassen und Autobahnen, Bauverlag GMBH*, Wiesbaden und Berlin, 1970.; (2) *Guidelines for design, construction, maintenance, and monitoring on roads,* Sarajevo/Banja Luka, 2005.		
Teaching methods	Lectures and exercises using a projector and blackboard. Programme work: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Programme work	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Programme work (requirement for admission to the exam): Development and presentation of the programme work, 2.5 ECTS credits. Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.		
Learning outcomes	The student acquires theoretical and practical knowledge necessary for road design. S/he is qualified to independently design a road with all its elements using computer software.		
Language of instruction	Croatian. Italian		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**TRANSPORTATION FACILITIES AND ENVIRONMENT**	Year of study	**II. (second)**
Course code	**DPRO05**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L**
Teaching form	Lectures (L), Seminar paper	ECTS	**3.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	The basic parts of environment. Impact of transportation facilities on the environment. Emission of the substances and sound from the transportation facilities during their operation. Determination of the harmful environmental impacts of the transportation facilities during the construction and during the operation as well as of possible environmental accidents and the risks of their occurrence. Principles of harmful impact mitigation. Sustainable transportation.		
Recommended reading	(1) Golubić, J.: Promet i okoliš. Fakultet prometnih znanosti, Zagreb, 1999.;		
Supplementary reading			
Teaching methods	Lectures using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
0.7	**1.3**	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 0.7 ECTS credits. Seminar paper (requirement for admission to the exam): Development and presentation of the seminar paper, 1.3 ECTS credits. Examination: Oral, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to describe the basic environment elements and the relationship between the transportation facilities and the environment as well as to plan, design, build and maintain transportation facilities with regard to the environment.
Language of instruction	Croatian. Italian
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**TRANSPORTATION FACILITIES - SELECTED CHAPTERS**	Year of study	**II. (second)**
Course code	**DPRO09**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	The role of transportation in planning. Fundamentals of the vehicle movement theory. Classification of urban and suburban roads. Development and implementation of the urban and suburban road design concept. Criteria. Road management and maintenance. Environmental protection. Analysis. Assessment of potential pollution. Protection measures. General considerations in planning and design. Traffic control. Capacity. Characteristics of traffic flow. Flow, density, speed, distance in space and time. Measurements of characteristic values at a point, measurements in sections. Two-dimensional and three-dimensional speed-flow-density relationship models. Driver characteristics (reaction time, limit values of acceleration, deceleration, impact). Car following models. Lane change models. Models of continuous flow - shock wave analysis. Macroscopic traffic flow models. Intersection operation analysis models. Analytical models and application of queuing theory. Gap acceptance theory. Critical headways. Saturated flow. General information on traffic flow simulation models.		
Recommended reading	(1) Manuals for the computer programmes used in instruction; (2) D. Cvitanić, I. Lovrić, D. Breški: The theory of traffic flow, Split postgraduate studies lecture notes (in Croatian); (3) Highway capacity manual 2000, Transportation research board.; (4) W. R. McShane, R. P. Roess, E. S. Prassas: Traffic engineering, Prentice Hall, New Jersey 1998.		
Supplementary reading			
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**1.5**	**2.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper (requirement for admission to the exam): Development and presentation of the programme work, 1.5 ECTS credits. <u>Examination:</u> Oral, 2.0 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to design roads at a higher complexity level and develop simulation models.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**NUMERICAL PROGRAMMING**	Year of study	**II. (second)**
Course code	**DINF03**	Semester	**III. (winter)**
Group	Basic	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Alen Harapin, PhD, full professor		
Course contents	Types of data, floating point arithmetic, control statements, dimensions, procedures, pointers and dynamical structures, Input/Output, compile, link, module, libraries, implementations of numerical algorithms, coding and testing of numerical algorithms.		
Recommended reading	(1) Fortran 90/95 Explained by Michael Metcalf, John Ker Reid; (2) Numerical Recipes in Fortran by William H. Press, et al		
Supplementary reading	(1) Jović, V.: Uvod u inženjersko numeričko modeliranje, Aquarius engineering d.o.o., Split, 1993.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to code simple numerical algorithms and edit programmes/libraries written in some of the programming languages.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**COMPLEX FOUNDATIONS**	Year of study	**II. (second)**
Course code	**DGEO06**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Programme work	ECTS	**5.0**
Name of lecturer	Maja Prskalo, PhD, associate professor		
Course contents	Soil as the basis of constructions. Physical and mechanical properties, deformation characteristics of soil. Soil models, application of soil model in numerical models. Shallow foundations. Types and design of flexible shallow foundations (analytical and numerical solutions). Deep foundations. Transfer of horizontal forces in soil. Design of horizontally loaded pile (analytical solutions, solutions with numerical models). Foundations loaded with tensile forces. Shallow foundations loaded with tensile force, transfer of tensile loads in deep layer of soil, piles loaded with tensile force, bolts and cabelbolts. Retaining structures built in place or driven into soil. Correlation between strain and stress, solutions with numerical models. Steel sheet piles, diaphragm walls, jet grouting walls, walls mixed in place.		
Recommended reading	(1) Roje-Bonacci, T, Miščević, P. (1997.) Temeljenje. Građevinski fakultet Sveučilišta u Splitu, građevinski fakultete Sveučilišta J.J. Strossmaqyer u Osijeku, Split. (2) Roje-Bonacci, T. Mehanika tla (2003.), Građevinski fakultet Sveučilišta u Splitu, Split. (3) Roje-Bonacci, T. Potporne građevine i građevne jame, Građevinsko-arhitektonski fakultet Sveučilišta u Splitu, 2005.		
Supplementary reading	(1) Ng, C., Simons, N., Menzies, B., (2004.) Soil-structure Engineering of Deep Foundatins, Excavations and Tunnels, a short course in. Thomas Telford, Cernica, John N. (1995.), Geotechnical engineering: foundation design. (2) John Wiley & Sons, Inc. New York. (3) Nonveiller, E. (1979.) Mehanika tla i temeljenje građevina, Školska knjiga, Zagreb. (4) Verić, F. (ur.) (1981.) Temeljenje, autorizirana predavanja za seminar. Društvo građevinskih inženjera i tehničara, Zagreb. (5) Poulos, H.G., Davis, E.H., (1980.) Pile foundation analysis and design, John Wiley & sons, New York.		
Teaching methods	Lectures and exercises using a projector and blackboard. Fieldwork. Programme work: independent work with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Programme work	Make-up exams	
	1st assessment	**1.0**	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.5**		Oral	**1.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.5 ECTS credits. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Programme work: Preparation and defence of the programme work, 1.0 ECTS credit. Make-up exams: Written part, 1.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the programme work.
Learning outcomes	The student is able to design, construct, organize, manage and test the quality of construction of all types of shallow and deep foundations and retaining structures..
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**COMPOSITE STRUCTURES**	Year of study	**II. (second)**
Course code	**DKON13**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Radoslav Markić, PhD, senior lecturer		
Course contents	Fundamentals: Construction principles. Types of composite structures. Properties of materials and equipment for shear connectors. Main problems in composite structures (transfer of shear along the shear surface, ultimate limit state, serviceability limit state, computational methods, duration and maintenance. Dimensioning the cross-section of an arbitrary shape to bending for exploitability and limit loads (including the formation process in phases and the rheological effects of concrete). Prestressed steel-concrete structures: The solutions of the element cross-section. Prestressing methods. Levels of prestressing. Influence of the construction upon the internal forces and the prestressing level. Computations of the elements for shear and displacement. Computation of prestressed elements. Problems of prestressed concrete in tension. Prestressed beams. Classification of cross-sections-classes 1,2,3,4. Prestressed slabs. Prestressed columns. Shear connectors. Prestressing the slab in tension. Examples of prestessed structures in high-rise and low-rise buildings. Regulations. Composite concrete-concrete structures: Examples of composite structures in high-rise structures and bridges (slabs, piles, columns). Construction and its influence upon the internal forces. Influence of rheological properties of concrete. Solutions for prestressing concrete of different age. Computation of the composite cross-section to bending and shear. Computation of prestressing elements. Limit bearing capacity of the prestressed cross-section. Determination of regulations. Composite wood-concrete structures: Preliminary solutions of the cross-section and elements. Composite equipment. Composite levels/degrees. Influence of the construction upon the internal forces and the prestressing level. Computation of the elements for bending and shear. Computation of the composite equipment. Problems related to prestressed concrete in tension. Examples of composite structures in high-rise structures and bridges. Composite wood-wood structures. Identification of regulations. Fundamental principles of numerical modelling of linear prestressed structure for long-term and short-term loading. Visit to the composite structures under construction and structures in use.		
Recommended reading	(1) Horvatić D.: Spregnute konstrukcije čelik-beton, Masmedia. Zagreb 2003.; (2) Pržulj M.: Spregnute konstrukcije, Građevinska knjiga Beograd, 1989.; (3) Gojković i drugi: Drvene konstrukcije, Beograd 2001.; (4) Radnić J., Peroš B., Harapin A.: Spregnute konstrukcije, napisi za predavanja; (5) EUROCODE 1, 2, 3, 4.		
Supplementary reading	(1) Knowles, P.R.: Composite Steel and Concrete Construction, Butterworks, London, 1973.; (2) Johnson, R. P. and Buckly, R. P.: Composite structures of Steel and Concrete, Volume 2, Bridges, Second Edition, 1986.		
Teaching methods	Lectures and exercises, using a projector and blackboard.		
Distribution of ECTS credits			
Regular attendance of classes	Examinations		
	Written	**1.5**	
1.5	Oral	**2.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Examinations: Written, 1.5 ECTS credits (requirement for admission to the oral part of the exam). Oral, 2.0 ECTS credits.		
Requirement(s) for admission to the exam	Regular attendance of classes.		
Learning outcomes	The student is able to design and compute composite structures of steel-concrete, concrete-concrete and wood-concrete systems.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**DECISION SYSTEMS IN CIVIL ENGINEERING**	Year of study	**II. (second)**
Course code	**DORG03**	Semester	**III. (winter)**
Group	Professional	Hours per week	**3L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Snježana Knezić, PhD, full professor, Ivana Domljan, PhD, senior lecturer		
Course contents	Basics of system theory. System approach. Decision theory. Decision support systems paradigm. Types of problems. Decision support models. Multicriteria decision making. Examples of decision support systems and application in civil engineering. Information systems (IS). Executive information systems. Geographical information systems (GIS) (spatial data, comparison of GIS and IS). Decision software and IS development in civil engineering. Expert systems (ES). Conceptual basics of expert systems. Knowledge base models. Expert systems as a part of decision support systems. Software in civil engineering.		
Recommended reading	(1) N. Mladineo, S. Knezić: Autorizirani materijali s predavanja.; (2) P. Sikavica, B. Bebek, H. Skoko, D. Tipurić: Poslovno odlučivanje, Informator, Zagreb, 1999.		
Supplementary reading	(1) E. Turban: Decision Support and Expert Systems (Management Support Systems), Macmillan Publishing Company New York, 1993.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits		
Regular attendance of classes	Seminar paper	Examination
1.5	**3.0**	**0.5**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 3.0 ECTS credits (requirement for admission to the exam). Examination: Oral, 0.5 ECTS credits (used to define the final grade).
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is competent in systematic analysis, decision theory and information technology in the decision-making and management processes in civil engineering.
Language of instruction	Croatian. English.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**DURABILITY OF STRUCTURES**	Year of study	**II. (second)**
Course code	**DKON14**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	General: Analyses of main factors impacting durability of structures (environment conditions; exploitation conditions; design quality; construction quality; quality of materials; properties of load-bearing systems; construction details; maintenance). External impacts on basic construction material (stone, wood; fired clay; mortar; concrete; conventional reinforced concrete and prestressed concrete; steel). Steel corrosion processes. Concrete corrosion processes. Wood deterioration processes. Impact of structure's durability on their exploitation value, safety and maintenance costs. State-of-the-art requirements for durability of structures. Structures in aggressive environment. Inspection, maintenance and monitoring of structures. Experience regarding structure's durability on constructed structures. Particularities of reinforced concrete and masonry structure's durability: Quality of materials. Concreting. Concrete protective layers. Concrete joints. Protection of conventional and prestressed reinforcement. Concrete protection. Concrete surfaces in contact with soil and water. Impact of construction. Examples of well and inadequately solved construction details for buildings and bridges. Experience and regulations. Particularities of steel and composite (steel-concrete) structure's durability: Steel corrosion protection. Steel surfaces in contact with concrete. Examples of well and inadequately solved construction details for buildings and bridges. Analyses of steel structure damages in regard to fatigue of materials. Experience and regulations. Particularities of wooden and composite (wood-concrete) structure's durability: Detrimental impacts of live organisms and moisture. Wood protection. Wooden surfaces in contact with concrete and stone. Examples of well and inadequately solved construction details. Experience and regulations. Field visits to some damaged structures in aggressive environment.		
Recommended reading	(1) Radnić J., Peroš B., Harapin A.: Trajnost konstrukcija, napisi za predavanja; (2) Tomičić I.: Betonske konstrukcije, Školska knjiga Zagreb, 1988.; (3) EUROCODE 2, 3, 4, 7, 8.		
Supplementary reading	(1) Leonhardt F.: Vorlesungen uber Massivbau, Teile 1-6, Springer Verlag; (2) Mathivar J.: The Cantilever Construction of Prestressed Concrete Bridges, J. Wiley & Sons, 1983.; (3) Menn, Ch.: Stahlbeton-brucken, Springer-Verlag, Vien, 1990.		
Teaching methods	Lectures and exercises using a projector and blackboard.		
Distribution of ECTS credits			
Regular attendance of classes	Examination		
1.5	**3.5**		
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Examination: Oral, 3.5 ECTS credits.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes.		
Learning outcomes	The student is able to analyse and identify the parameters that are crucial in providing sufficient durability of structures and decreasing maintenance costs.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**TUNNELS AND UNDERGROUND STRUCTURES**	Year of study	**II. (second)**
Course code	**DGEO07**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**4.0**
Name of lecturer	Maja Prskalo, PhD, associate professor		
Course contents	Brief presentation of development of tunnel and underground structures construction. Tunnel classification. Selection of tunnel alignment. Geological, engineering geological and hydrogeological basis. Technical elements and specific characteristics of railway tunnels, road tunnels, underground railways, hydrotechnical tunnels and special purpose tunnels. Drainage, discharge and hydro insulation of tunnel. Ventilation in tunnels. Tunnel lighting. Tunnel portal cuts. Classical methods of tunnel construction. Modern methods of tunnel design and construction. Upland pressure on underground structures. Geostatical calculation and selection of support system. Tunnel lining for roadway and hydrotechnical tunnels. Control measurement during construction and exploitation of tunnel. Inspection, repair works, reconstruction and maintenance of tunnel. Technical documentation for tunnel construction.		
Recommended reading	(1) P. Stojić: Hydrotechnical structures, knjiga II, 237-369, Građevinski fakultet Sveučilišta u Splitu, 1998.; (2) I. Banjad: Tunnels, FGZ, Zagreb 1982.; (3) P. Kožar: Tunnels, Rijeka 1981.; P. Kožar: Underground structures, Rijeka, 1986.; (4) B. Gotovac, V. Kozulić: Manual for use of programme package "SIGMA", Split 1995. godine.		
Supplementary reading	(1) T.M. Megaw and J.V. Barlett: Tunnels, Volume 1 & Volume 2, Ellis Horwood Ltd. West Sussex, England, 1981.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits						
Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Make-up exams		
	1st assessment	**1.0**	**1.0**	Written	**1.0**	
1.0	2nd assessment	**1.0**		Oral	**1.0**	

Course requirements and evaluation methods	Regular attendance of classes, 1.0 ECTS credit. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.0 ECTS credit. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Seminar paper: Preparation and defence of the seminar paper, 1.0 ECTS credit. Make-up exams: Written part, 1.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to make geostatical calculation and selection of support system, and describe conventional and modern tunnel construction methods. S/he is able to participate in the project documentation development stage, as well as all stages of construction of tunnels and underground structures.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**PROJECT MANAGEMENT**	Year of study	**II. (second)**
Course code	**DORG04**	Semester	**III. (winter)**
Group	Professional	Hours per week	**3L + 1E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Vlado Majstorović, PhD, full professor		
Course contents	Project life cycle. Basic concepts of project management (PM). System engineering. Planning (continue from Construction Management). Cost, time and quality control. Material management. Resources management, planning and project management in terms of constrained resources. Optimisation methods in PM. Project risk management. Activity duration modelling. Simulation (Monte Carlo, Cyclone). Most economical project duration. Project cash-flow. Quality management. TQM (Total Quality Management) of project. Constructability. Information systems in PM. Software for PM.		
Recommended reading	(1) V. Majstorović: Projektni menadžment, Sveučilište u Mostaru, 2010.; (2) R. Lončarić: Organizacija izvedbe graditeljskih projekata, HDGI, 1995.; (3) S. Knezić: Autorizirani materijali s predavanja; (4) H.N. Ahuja, S. P. Dozzi, S. M. Abourizk: Project management - Techniques in Planning and Controlling Construction Projects, John Wiley & Sons, 1994.		
Supplementary reading	(1) D. W. Halpin, L.S. Riggs: Planning and Analysis of Construction Operations, John Wiley & Sons, 1992.; (2) H. Kerzner: Project Management, a System Approach to Planning, Scheduling and Controlling, VNR New York.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**3.0**	**0.5**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. <u>Seminar paper:</u> Preparation and defence of the seminar paper, 3.0 ECTS credits (requirement for admission to the exam). <u>Examination:</u> Oral, 0.5 ECTS credits (used to define the final grade).		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe and explain the basic principles and modern methods of project management (optimisation methods, management simulation and resources control), and implement the acquired principles and methods in practice.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**WATER POLLUTION CONTROL AND ENVIRONMENTAL ENGINEERING**	Year of study	**II. (second)**
Course code	**DHID09**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Zoran Milašinović, PhD, full professor		
Course contents	Water and environment pollution: basic ecology and water chemistry, pollution and its characteristics, sources and types of pollution, transport of pollution in the environment and waters, biochemical processes in environment, impact of pollution, standards. Pollution control: integrated approach, management framework, strategy and principles, recipient and their protection, monitoring. Control measures: minimization of pollution, best available technology, best environmental practice, clean technology, treatment processes and operations, disposal and reuse of effluent. Pollution control planning. EIA.		
Recommended reading	(1) S. Tedeschi: Zaštita vodnih sustava i pročišćavanje otpadnih voda, Građevinski institut, Zagreb, 1996.; (2) J. Margeta: Osnove gospodarenja vodama, Građevinski fakultet Split, 1992.		
Supplementary reading	(1) J. Margeta*:* Guidelines on Sewage Treatement and Disposal for the Mediterranean Region, WHO-GEF, Athens, 2004.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. <u>Seminar paper:</u> Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). <u>Examination:</u> Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe and analyze basic environmental processes, environmental and water protection issues, measures and activities, sources and types of pollution, pressures on the environment and participate in planning and solving problems in environmental protection and pollution control.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		

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Course title	**SOIL IN CONSTRUCTION**	Year of study	**II. (second)**
Course code	**DGEO08**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Maja Prskalo, PhD, associate professor		
Course contents	Soil as construction material: Excavation fields, field and laboratory investigations of excavated soil, artificial samples. Excavation: large excavations, excavations in limited space, blasting, slopes stability, water protection and drainage. Embankments: embankments, soil disposals, slopes stability, planning, seepage protection, rain water protection. Soil improvement: reinforced soil, shallow and deep dynamic and chemical stabilisation of soil, vertical drain, accelerated consolidation. theoretical solutions, calculations, case study. Quality control of embankments and monitoring of high dams. Data collecting, engineer limit, classical methods, statistical methods. Project of deep excavation (Slope stability, drainage). Project of embankment for road or waterway (Slope stability, settlement, waterproof, erosion protection, culvert projects). Soil reinforcement project (Affecting of reinforcement on soil structures, design of reinforcements, stability control of construction).		
Recommended Literatura	(1) Bosnić, P. (1978.) Zemljani radovi, građevinski fakultet u Sarajevu, Sarajevo. (2) Babić, B. (1995.) Geosintetici u graditeljstvu, Hrvatsko društvo građevinskih inženjera, Zagreb. (3) Babić, B., Prager, A. (1997.) Projektiranje kolničkih konstrukcija. U V. Simović, ur., Građevni godišnjak '97, Hrvatsko društvo građevinskih inženjera, Zagreb. (4) Linarić, Z., Žabek, K. (2004.) Tehnike i tehnologije poboljšanja temeljnog podtla. U V. Simović, ur., Građevni godišnjak '03/04, Hrvatsko društvo građevinskih inženjera, Zagreb.		
Supplementary reading	(1) Schroderer, W.L. (1975.) Soils in construction, John Wiley&Sons, Inc. New York. (2) Fang, H.-Y. (1991.) Foundation engineering handbook. Poglavlje 7 Dewatering and groundwater control (autor Powers, P.); poglavlje 8 Compacted fill (autor Hilf, J.W.) i poglavlje 9 Soil stabilization and grouting (autori Winkerton, H.F. i Pamukcu, S.), Chapman&Hall, New York. (3) U.S. Department of the interior, Bureau of reclamation, (1977.) Design of small dams (poglavlje V. Foundations and construction materials, VI. Eatrhfill dams, poglavlje VII. Rokfill dams, United States Government printing office, Washington D.C. (4) U.S. Department of the interior, Bureau of raclamation, (1974.) Earth Manual, A guide to the use of soils as foundations and as construction materials for hydraulic structures, United States Government printing office, Washington D.C.		
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		

Distribution of ECTS credits

Regular attendance of classes	Assessments (preliminary exams)		Seminar paper	Make-up exams	
	1st assessment	**1.0**	**1.5**	Written	**1.0**
1.5	2nd assessment	**1.0**		Oral	**1.0**

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit. 2nd assessment passed, 1.0 ECTS credit. If a student does not pass both assessments during classes, s/he is required to take the make-up exam. Seminar paper: Preparation and defence of the seminar paper, 1.5 ECTS credits. Make-up exams: Written part, 1.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 1.0 ECTS credit.
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.
Learning outcomes	The student is able to calculate slope stability, design seepage and rainwater protection, develop a project of deep excavation, develop a project of embankment for roads or hydraulic structures, develop a soil reinforcement project.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**MASONRY STRUCTURES**	Year of study	**II. (second)**
Course code	**DKON16**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E)	ECTS	**5.0**
Name of lecturer	Mladen Glibić, PhD, associate professor		
Course contents	Masonry elements (concrete, stone, fired clay, other). Mortars. Wall types. Wall deformation properties. Non-reinforced and reinforced walls. Bricklaying. Wall openings and niches. Wall bracing (reinforcement, tie beams and tie columns, diaphragms). Concepts of structural designs of masonry structures. Earthquake impact on masonry structures. Impact of foundation soil deformability (foundation shrinkage). Masonry structures calculations to vertical and horizontal loads (in particular earthquake). Simple and complex calculation models. Role of horizontal floor structures. Role and solutions of lintels. Requirements regarding foundation structure. Strengthening (remediation) of stone masonry structures (in particular historic heritage buildings). Strengthening of flexible floor structures. Rising and extension of masonry structures. Basic rules of masonry structure design and construction. Structural solutions and details of masonry structures. Regulations. Construction. Examples of masonry structure construction and remediation. Field visits to masonry structures under construction.		
Recommended reading	(1) Sorić Z.: Zidane konstrukcije I, Sveučilište u Zagrebu, Zagreb 2004.; (2) Radnić J., Trogrlić B.: Zidane konstrukcije, napisi za predavanja; EUROCODE-2, 6		
Supplementary reading			
Teaching methods	Lectures and exercises using a projector and blackboard.		

Distribution of ECTS credits				
Regular attendance of classes	Assessments (preliminary exams)		Make-up exams	
	1st assessment	**1.0**	Written	**1.0**
1.5	2nd assessment	**1.0**	Oral	**1.5**
	3rd assessment	**1.5**		

Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Assessments: 1st assessment passed, 1.0 ECTS credit (requirement for admission to the 2nd assessment). A student who does not pass the 1st assessment is required to take the make-up exam. 2nd assessment passed, 1.0 ECTS credit (requirement for admission to the 3rd assessment). A student who does not pass the 2nd assessment is required to take the make-up exam. 3rd assessment passed, 1.5 ECTS credits. A student who does not pass the 3rd assessment is required to take the make-up exam (oral part). Make-up exams: Written part, 1.0 ECTS credits (requirement for admission to the oral part of the exam). Oral part, 1.5 ECTS credits.
Requirement(s) for admission to the make-up exam	Regular attendance of classes.
Learning outcomes	The student is able to analyse and define structural solutions of masonry structures and perform their calculations.
Language of instruction	Croatian.
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.

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Course title	**AIRPORTS**	Year of study	**II. (second)**
Course code	**DPRO06**	Semester	**III. (winter)**
Group	Professional	Hours per week	**2L + 2E**
Teaching form	Lectures (L), Exercises (E), Seminar paper	ECTS	**5.0**
Name of lecturer	Ivan Lovrić, PhD, associate professor		
Course contents	Air transportation system. Classification, types and definitions of airports. The basic elements and characteristics of airports. Airport and airspace marks (codes). Restriction for the airport surrounding area. Airports accesses. Traffic loading analysis for airport pavements. Types of airplanes, types of airport pavement. Design and estimation of airport pavements. Building, maintenance and reconstruction of airport pavement. Airport visit.		
Recommended reading	(1) S. Pavlin: Aerodromi I, Fakultet prometnih znanosti Sveučilišta u Zagrebu. Zagreb 2002.; (2) Z. Horvat: Aerodromi I, Fakultet građevinskih znanosti Zagreb, 1990.; (3) A. Prager: Aerodromi I - izmjene i dopune, Građevinski fakultet Zagreb, 1991.; (4) R. Horanyeff: Planning and Design of Airports, Berkeley, 1975.		
Supplementary reading			
Teaching methods	Lectures and exercises using a projector and blackboard. Seminar paper: independent work with consultations.		
Distribution of ECTS credits			
Regular attendance of classes	Seminar paper	Examination	
1.5	**2.5**	**1.0**	
Course requirements and evaluation methods	Regular attendance of classes, 1.5 ECTS credits. Seminar paper: Preparation and defence of the seminar paper, 2.5 ECTS credits (requirement for admission to the exam). Examination: Oral, 1.0 ECTS credit.		
Requirement(s) for admission to the make-up exam	Regular attendance of classes. Preparation and defence of the seminar paper.		
Learning outcomes	The student is able to describe the basic elements of an airport as well as to plan, design, build and maintain an airport.		
Language of instruction	Croatian.		
Quality assurance methods	(1) University; (2) Faculty by Quality Control Committee; (3) Lecturer.		