University of Split

Faculty of Civil Engineering, Architecture and Geodesy

COURSE PROGRAMME FOR EXCHANGE STUDENTS

Civil Engineering

Split, January 2024

Course list for exchange students – Graduate University Study of Civil Engineering

Teacher	Course	Code	Hours	ECTS
Semester I (Autumn)				
A. Harapin, N. Grgić	Concrete Structures I	GAE701	30+30	5.0
Ž. Nikolić	Dynamics of Structures and Earthquake Engineering	GAO701	30+15	4.0
S. Juradin	Building materials II	GAN701	30+30	5.0
P. Miščević, G. Vlastelica	Geotechnical Engineering	GAG703	30+30	5.0
Semester II (Spring)				
V. Srzić	Coastal Engineering	GAK701	30+30	5.0
P. Miščević, G. Vlastelica	Rock Mechanics	GAG701	30+30	5.0
B. Trogrlić, M. Smilović Zulim	Masonry Structures	GAE702	30+30	5.0
A. Harapin, N.Grgić	Concrete Structures II	GAE704	30+30	5.0
I. Andrić	Water protection and municipal wastewater and rain water treatment	GAJ702	30+30	5.0
M. Galić	Mechanics of Materials	GAR701	30+30	5.0
I. Boko	Metal Structures II	GAP702	30+30	5.0
G. Baloević, G. Vlastelica	Laboratory and in-situ testing of geomaterials	GAN702	30+30	5.0
G. Baloević, N. Grgić	Ultra-High Performance Concrete Structures	GAN703	30+30	5.0
N. Štambuk Cvitanović, P. Miščević	Ground improvement	GAG802	30+30	5.0
I. Boko, N. Torić	Advanced timber structures	GAP704	30+30	5.0
G. Vlastelica	Earthworks	GAG702	30+30	5.0
G. Vlastelica	Retaining Structures and Construction Pits	GAG801	30+30	5.0
D. Breški, I. Škarica	English	GAA003	30+30	5.0
K. Rogulj	Operational Research in Civil Engineering	GAL701	30+30	5.0
Semester III (Autumn)				
I. Boko, N. Torić	Advanced timber structures	GAP704	30+30	5.0
I. Andrić	Wastewater and solid waste management	GAJ703	30+30	5.0
G. Vlastelica	Earthworks	GAG702	30+30	5.0
G. Vlastelica	Retaining Structures and Construction Pits	GAG801	30+30	5.0
A. Harapin, M. Galić	Housing installations	GAM701	30+30	5.0
B. Trogrlić	Building physics	GAO706	30+30	5.0
G. Baloević, G. Vlastelica	Laboratory and in-situ testing of geomaterials	GAN702	30+30	5.0
G. Baloević, N. Grgić	Ultra-High Performance Concrete Structures	GAN703	30+30	5.0
N. Štambuk Cvitanović, P. Miščević	Ground improvement	GAG802	30+30	5.0
D. Breški, I. Škarica	English	GAA003	30+30	5.0
K. Rogulj	Project Management	GLA705	45+15	5.0
Semester IV (Spring)				
	Master thesis	GAX801	-	30.0

Course title		DYNAMICS OF STRUCTURES AND EARTHQUAKE ENGINEERING	
Course code		GAO701	
Type of course		Lecture, exercise course, guided personal study.	
Level of course		Basic level course	
Year of study	I	**Semester**	Autumn
ECTS (Number of credits allocated)		4,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 15 hrs exercise) = 1.1 ECTS; Individual work and learning = 2.9 ECTS	
Name of lecturer		Željana Nikolić, PhD, Full Professor **Contact: zeljana.nikolic@gradst.hr**	
Learning outcomes and competences		At the end of the course the student will be able to perform dynamic analysis of simple structures (buildings, etc.).	
Prerequisites		Basic knowledge from engineering statics and strength of materials	
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, Split, 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	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Test, oral presentation, paper.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		MECHANICS OF MATERIALS	
Course code		GAR701	
Type of course		Lecture, exercise course, laboratory work.	
Level of course		Basic level course	
Year of study	I	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Mirela Galić, PhD, Full Professor **Contact: mirela.galic@gradst.hr**	
Learning outcomes and competences		Student will obtain basic theoretical knowledge in the field of mechanics of materials, rheology and fracture mechanics.	
Prerequisites		Completed undergraduate study of civil engineering.	
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	Demonstrative laboratory exercises. Consultative class. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Oral examination, written examination.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		CONCRETE STRUCTURES I	
Course code		GAE701	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Alen Harapin, PhD, Full Professor Nikola Grgić, PhD, Associate Professor **Contact: alen.harapin@gradst.hr; nikola.grgic@gradst.hr**	
Learning outcomes and competences		Student will be able to understand basics of conventional reinforced concrete structures and prestressed concrete.	
Prerequisites		Basics of concrete structures.	
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. Prestressed concrete basics: Purpose of concrete prestressing. Prestressing types and levels. Prestressing steel. Concrete. Tensioning and anchoring systems. Prestressing force losses. Sizing to bending and shear. Prestressing force edge. Cable plan. Cable grouting. Regulations. 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	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Written exam, oral exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality and success rate monitoring at three levels: (1) University; (2) Lecture quality control committee at the Faculty; (3) Lecturer.

Course title		CONCRETE STRUCTURES II	
Course code		GAE704	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Alen Harapin, PhD, Full Professor Nikola Grgić, PhD, Associate Professor **Contact: alen.harapin@gradst.hr; nikola.grgic@gradst.hr**	
Learning outcomes and competences		Student will be able to understand complex problems of reinforced concrete structures design and calculations.	
Prerequisites		Basics of concrete structures.	
Course contents		Details of reinforced concrete structure calculations according to limit states -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	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Written exam, oral exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality and success rate monitoring at three levels: (1) University; (2) Lecture quality control committee at the Faculty; (3) Lecturer.

Course title		ADVANCED TIMBER STRUCTURES	
Course code		GAP704	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Ivica Boko, PhD, Full Professor Neno Torić, PhD, Associate professor **Contact: neno.toric@gradst.hr**	
Learning outcomes and competences		After completion of the course the student will acquire advanced theoretical and practical knowledge in the field of timber structures and design of complex timber structures.	
Prerequisites		Basic knowledge on design of timber structures.	
Course contents		HRN, DIN, Eurocode 5. Organization of the production of timber structures. Materials, technologies and quality control. Implementation. 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 structure types. 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) A Bjelanović, V. Rajčić: Drvene konstrukcije prema europskim normama, Hrvatska sveučilišna naklada, 2007.; (2) HRN EN 1995, travanj 2013., (3) N. Torić: Predavanja, Fakultet građevinarstva, arhitekture i geodezije u Splitu, 2018.	
Supplementary reading		(1) Design of timber structures, Structural aspects of timber construction, volume 1:edition 2, Swedish Forest Industries Federation, Stockholm, 2016. (2) Designers' guide to Eurocode 5: Design of timber buildings EN 1995-1-1, J. Porteous, P. Ross, ICE Publishing, London, 2013. (3) Gotz-Hoor-Mohler-Natterer. Holzbauatlas, CMA, Munchen, 1980. (4) Z. Žagar: COSMOS/M FEA program, upute, skripta, Građevinski fakultet, Zagreb, 1994.	

	(5) Halasz R., SCHeer C.: Holzbau-Tachenbuch, IES Verlag, Berlin, 1986.
Teaching methods	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Written exam, oral exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by the Quality Assurance Committee (3) Lecturer's level.

Course title		METAL STRUCTURES II	
Course code		GAP702	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Ivica Boko, PhD, Full Professor **Contact: ivica.boko@gradst.hr**	
Learning outcomes and competences		After the completion of the course the student is able to solve problems related to the design and computation of composite steel structures.	
Prerequisites		Introduction to metal structures.	
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: Radna skripta, 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		Fieldwork. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	
Assessment methods		Written exam, oral exam.	
Language of instruction		Croatian, consultations in English	

Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Assurance Committee (3) Lecturer's level.

Course title		MASONRY STRUCTURES	
Course code		GAE702	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Boris Trogrlić, PhD, Full Professor Marija Smilović Zulim, Associate Professor **Contact: boris.trogrlic@gradst.hr; marija.smilovic@gradst.hr**	
Learning outcomes and competences		Student shall comprehend basic structural solutions of masonry structures and get acquainted with complex problems of their calculations.	
Prerequisites		Engineering statics II, Strength of materials II.	
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 (Masonry structures I), Sveučilište u Zagrebu, Zagreb 2004.; (2) Radnić J., Trogrlić B.: Zidane konstrukcije, napisi za predavanja (Masonry structures - lectures); EUROCODE-2, 6.	
Supplementary reading			

Teaching methods	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Oral exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality and success rate monitoring at three levels: (1) University; (2) Lecture quality control committee at the Faculty; (3) Lecturer.

Course title		BUILDING MATERIALS II	
Course code		GAN701	
Type of course		Lectures, practical assignment, laboratory work.	
Level of course		Advanced level course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Sandra Juradin, PhD, Full Professor **Contact: sandra.juradin@gradst.hr**	
Learning outcomes and competences		After the completed course one should expect from the student the knowledge of material properties and design of structure and technology of special types of concrete.	
Prerequisites		Basics of building materials	
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		V. Ukrainczyk: Concrete - Structure, Properties, Technology, Alcor, Zagreb, 1994. (In Croatian).	
Supplementary reading		D.F. Orchard: Concrete Technology, Vols. 1-3, Applied Science Publishers, Essex, 1979.	
Teaching methods		Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	
Assessment methods		Oral examination, written examination, project.	
Language of instruction		Croatian, consultations in English	
Quality assurance methods		Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.	

Course title		COASTAL ENGINEERING	
Course code		GAK701	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Veljko Srzić, PhD, Associate Professor **Contact: veljko.srzic@gradst.hr**	
Learning outcomes and competences		In this course gives basic knowledge of large spectar civil engineering tasks on shore necessary for design and constract marine constructions.	
Prerequisites		Hydromechanics, Fundamentals of geology and petrography, Ports and marine constructions, Soil mechanics, Geotechnical engineering, Basics of concrete structures.	
Course contents		Definition and classification marine structures. Sea bottom and hydrogeology. Oceanographic, physical and chemical properties of the sea. Movement 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 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) Silvestar, R.: Coastal Engineering 1, 2, Scientific Publishing 1974; (3) Horikawa, K.: Coastal engineering, University of Tokyo Press, 1978.; (4) Chakrabarti, S.K.: Hydrodinamics of Offshore Structures, Springer-Verlag, 1987.; (5) Sorensen, M.R.: Basic Coastal Engineering, Academic Publishers, Boston 2002.; (6) 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, MacMillan Press Ltd, 1977.
Teaching methods	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Practical exercises, written and oral examination.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		WATER PROTECTION AND MUNICIPAL WASTEWATER AND RAIN WATER TREATMENT	
Course code		GAJ702	
Type of course		Lecture, research seminar, practical assignment, laboratory work, guided personal study, fieldwork.	
Level of course		Basic level course.	
Year of study	II	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.0 ECTS.	
Name of lecturer		Ivo Andrić, PhD, Associate Professor **Contact: ivo.andric@gradst.hr**	
Learning outcomes and competences		Student is expected to be able to describe and explain water protection issues; basic ecological characteristics of water and environment, sources and types of pollution, impact of pollution on water and environment, measures and activities for water and environment protection, the basics of municipal wastewater treatment plant design, as well as planning, control and operation of the plant.	
Prerequisites		None.	
Course contents		***An introduction to problems of water pollution and protection:*** Water pollution. Pollution sources. Wastewater characteristics. Pollution load. Wastewater treatment. Control of dispersed sorces of pollution. Water protection plan. ***Municipal wastewater treatment***: General water treatment flowchart. Preliminary treatment. Primary wastewater treatment. Secondary wastewater treatment. Nutrient elimination. Disinfection of treated wastewater. Sludge treatment. Natural treatment systems. ***Hydraulic aspects of wastewater treatment plants:*** Main hydraulic parts. Main types of flow. Flow through treatment plant units. Hydraulic dimensioning of treatment plants. Use of pumps in treatment plants. ***Disposal and reuse of treated wastewater and sludge:*** Discharge of treated wastewater. Sludge disposal. Treated wastewater and rain water reuse. ***Environmental impact of treatment plants and impact reduction measures:*** Main impacts. Treatment plant operation impact. Odour and odour control. Aerosol and VOCs and control. Insects. Noise and other matters. Measure presentation. ***Treatnent plant operation control***	

	and problem elimination: Sampling and measurement. Control systems. Basic problem types and causes. Problem elimination methods. Health problems and protection measures. ***Wastewater treatment plant operation:*** The essentials. Work organization. Data and reporting. Public relations. Construction and plant costs. Financing. ***Rain water treatment:*** Calculation of volume and pollution load of rain water. Rain water treatment processes.
Recommended reading	(1) J. Margeta: Zaštita voda i pročišćavanje komunalnih otpadnih voda. Authorized lectures. Split 2009. (2) J. Margeta: Oborinske i otpadne vode: teret onečišćenja i mjere zaštite, Građevinskoarhitektonski fakultet, Split 2007. (3) S. Tedeschi: Zaštita vodnih sustava i pročišćavanje otpadnih voda, Građevinski institut, Zagreb, 1996.
Supplementary reading	J. Margeta: Guidelines on Sewage Treatement and Disposal for the Mediterranean Region, WHO-GEF, Athens, 2004.
Teaching methods	Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Homework (30%), seminar paper (30%), final oral and written examination (40%).
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		WASTEWATER AND SOLID WASTE MANAGEMENT	
Course code		GAL703	
Type of course		Lecture, research seminar, practical assignment, laboratory work, guided personal study, fieldwork.	
Level of course		Advance level course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.0 ECTS	
Name of lecturer		Ivo Andrić, PhD, Assistant Professor **Contact: ivo.andric@gradst.hr**	
Learning outcomes and competences		Students will be educated to acquire basic theoretical and practical knowledge related to wastewater and solid waste management in urban areas.	
Prerequisites		Water supply and wastewater management in urban areas.	
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; (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		J. Margeta: Guidelines on Sewage Treatment and Disposal for the Mediterranean Region, WHO-GEF, Athens, 2004.	
Teaching methods		Laboratory work and field work. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	
Assessment methods		Oral examination, written examination, oral presentation, test, report on fieldwork, continuous assessment, etc.	

Language of instruction	Croatian, consultations in English
Quality assurance methods	Assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		ROCK MECHANICS	
Course code		GAG701	
Type of course		Lectures, practical assignment, laboratory work.	
Level of course		Basic level course	
Year of study	I	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Predrag Miščević, PhD, Full Professor **Contact: predrag.miscevic@gradst.hr** Goran Vlastelica, PhD, Associate Professor **Contact: goran.vlastelica@gradst.hr**	
Learning outcomes and competences		Student is expected to acquire basic knowledge about determination of the characteristics of rock, discontinuities and rock mass, and use that knowledge in design of foundations on rock, the rock slope stability and stability of the underground excavations.	
Prerequisites		-	
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		"Inženjerska mehanika stijena", P. Miščević, FGAG Split, 2015 Dr. Hoek's Practical Rock Engineering (2023 ed.) - https://www.rocscience.com/learning/hoeks-corner	
Supplementary reading		(1) Rocscience geotechnical software; (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*, Institute of Mining and Metallurgy, London; (5) Hudson J. A. & Harrison J. P. (1997.), *Engineering rock mechanics, an introduction to the principles*, Pergamon.	

Teaching methods	Laboratory presentations. Fieldwork. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the
	semester will be given in the form of semester project or seminar paper.
Assessment methods	Oral examination.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		GROUND IMPROVEMENT	
Course code		GAG802	
Type of course		Lectures, practical assignment, fieldwork (if possible).	
Level of course		Advanced level course	
Year of study	II	**Semester**	Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Nataša Štambuk-Cvitanović, PhD, Full Professor Predrag Miščević, PhD, Full Professor **Contact: nstambuk@gradst.hr**	
Learning outcomes and competences		The student is expected to acquire knowledge on design and construction of ground improvement, complex foundations and retaining structures.	
Prerequisites		Soil mechanics and foundations, Geotechnical engineering.	
Course contents		Introduction. Soil as the basis of constructions. Physical and mechanical properties, deformation characteristics of soil important for the foundation. Principles of ground improvement: increasing bearing capacity, settlement control, influence on consolidation, liquefaction potential, permeability and strength. Reinforcement methods: replacement (excavation, placement and compaction); Deep replacement (vibro-compaction, vibro-replacement, granular and other columns); Use of vertical, horizontal and deep drainage (drainage and dewatering); Compaction grouting and jet grouting. Dynamic shallow and deep soil compaction. Surface and deep soil stabilization by mixing. Ground reinforcement. Quality control: laboratory and field.	
Recommended reading		(1) Roje-Bonacci, T. (2010) Duboko temeljenje i poboljšanje temeljnog tla, Građevinsko-arhitektonski fakultet Sveučilišta u Splitu (in Croatian), (2) Kirsch, K., Bell, A. (2013) Ground improvement. CRC Press, New York. (3) Nicholson, P.G. (2015) Soil improvement and ground modification methods. Elsevier Inc.	

Supplementary reading	(1) Han, J. (2015) Principles and Practices of Ground Improvement. Wiley. (2) Moseley, M.P. (2004) Ground Improvement. Spoon Press, New York. (3) Croce, P., Flora, A., Modoni, G. (2014) Jet Grouting. Spoon Press, New York. (4) Shukla, S.K. (2002) Geosynthetics and their applications. Thomas Telford Limited. (5) Indraratna, B., Chu, J. (2005) Ground Improvement — Case Histories. Elsevier. (6) Kirsch, K, Kirsch, F. (2010) Ground Improvement by Deep Vibratory Methods. Spoon Press, New York.
Teaching methods	Fieldwork (if possible). Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Oral presentations of individual examples, contious continuous assessment.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.

Course title		EARTHWORKS	
Course code		GAG702	
Type of course		Lecture, practical assignment, guided personal study.	
Level of course		Advanced level course	
Year of study	II	**Semester**	Autumn, Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Goran Vlastelica, PhD, Associate Professor **Contact: goran.vlastelica@gradst.hr**	
Learning outcomes and competences		After the lecture ending, student will be capable to design, organise field works, manage and control quality of all soil-works.	
Prerequisites		-	
Course contents		Soil as construction material: Excavation fields, field and laboratory investigations of excavated soil, artificial samples. (4h) Excavation: large excavations, excavations in limited space, blasting, slopes stability, water protection and drainage (8h) Embankments: embankments, soil disposals, slopes stability, planning, seepage protection, rain water protection (8h) Soil improvement: reinforced soil, shallow and deep dynamic and chemical stabilisation of soil, vertical drain, accelerated consolidation. theoretical solutions, calculations, case study (8h) Quality control of embankments (2h) and monitoring of high dams. Data collecting, engineer limit, classical methods, statistical methods (2h) Exercise course (30h) :Lecture (6h), in lab (4h), project work (20h) Project of deep excavation (Slope stability, drenage, 10h) Project of embankment for road or waterway (Slope stability, settlement, waterproff , erosion protection, culvert projects 8h) Soil reinforcement project: affecting of reinforcement on soil structures, design of reinforcements, stability control of construction 8 h)	
Recommended reading		Earthworks: a guide, Second edition, Paul Nowak and Peter Gilbert, Published by ICE Publishing (2015)	

Supplementary reading	(1) Fang, H.-Y. (1991.) Foundation engineering handbook. Poglavlje 7 Dewatering and groundwater control (autor Powers, P.); chapter 8 Compacted fill (author Hilf, J.W.) i chapter 9 Soil stabilization and grouting (autori Winkerton, H.F. i Pamukcu, S.), Chapman&Hall, New York. (2) Vaniček, I.; Jirásko, D.; Vaniček, M. (2020.) Modern Earth Structures for Transport Engineering. CRC Press, London. (3) Caicedo, B.(2019.) Geotechnics of Roads: Fundamentals. CRC Press, London.
Teaching methods	Lectures with the use of a projector with a computer, auditory exercises, constructive exercises (creating two seminar papers during the hours of exercises from the course), demonstrative and constructive laboratory exercises, field work.
Assessment methods	Presentation of the seminar papers, and oral verification of learning outcomes that are not included in the seminar work/project.
Language of instruction	English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		Housing installations	
Course code		GAM701	
Type of course		Lecture, practical assignment, guided personal study.	
Level of course		Basic course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Alen Harapin, PhD, Full Professor Mirela Galić, PhD, Full Professor **Contact: mirela.galic@gradst.hr**	
Learning outcomes and competences		- design and calculate the sewage and water-supply installations for residential buildings and simple public buildings; - construct and supervise the sewage and water-supply installations; - understand complex sewage and water-supply installations; - understand the electrical and HVAC installations.	
Prerequisites		-	
Course contents		- General part, Sanitary ware and appliances -Pipes and fitting, Sewerage system - Special structures, Connection schemes, Design of residential sewerage system - Stormwater drainage, Sewage design and protection - Plumbing fittings, Water supply systems and schemes - Water supply system design and construction - Fire-water supply, Preparation of hot water - Water supply and sewage design, Market overview - Introduction, classification, elements - Elements, protection and design - Introduction, Direct and indirect heating, heating systems, chimneys, heating appliances - Ventilation – natural and mechanical, Exchange of air	
Recommended reading		(1) M. Radonić: Vodovod i kanalizacija u zgradama, Croatiaknjiga Zagreb, 2003.; (2) B. Tušar: Kućna kanalizacija, Građevinski Fakultet, Zagreb, 2001.; (3) J. Margeta: Kanalizacija naselja, Split 2009. (4) M. Šivak: Centralno grijanje, ventilacija, klimatizacija, Nakladnička djelatnost M. Šivak,	

	Zagreb, 1998. (5) V. Rodeš: Električne instalacije (1. i 2. dio), Elektrostrojarska škola Varaždin, 2007.
Supplementary reading	(1) B. Blagojević: Vodovod i kanalizacija, Tehnička knjiga Beograd, 2002.
Teaching methods	Guided personal study. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.
Assessment methods	Oral presentation on project work, continuous assessment, etc.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		Building physics	
Course code		GAO706	
Type of course		Lecture, practical assignment, guided personal study.	
Level of course		Basic course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Boris Trogrlić, PhD, Full Professor **Contact: boris.trogrlic@gradst.hr**	
Learning outcomes and competences		Student will be able to design thermal and noise protection in buildings, define the buildings' protection layers, calculate heat losses in structural parts, calculate sound insulation value of a sound-proof bulkhead and the value of impact noise, define the noise protection measures.	
Prerequisites		-	
Course contents		Introduction to thermal and noise insulation. Energy efficiency. Heat transfer analysis, thermal protection, thermal stability. Difusion of water vapor. Building regulations. Energy survey and certification of buildings. Noise protection, impact and air-carried noise. Acoustics. Numerical methods in heat transfer analyis. Field class.	
Recommended reading		(1) Lecture notes.	
Supplementary reading		(1) BUILDING ACOUSTICS AND VIBRATION, Theory and Practice, O.A.B. Hassan, World Scientific Publishing, 2009.	
Teaching methods		Guided personal study. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	
Assessment methods		Oral and written exam.	
Language of instruction		Croatian, consultations in English	
Quality assurance methods		Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.	

Course title		ENGLISH	
Course code		GAA003	
Type of course		Practical assignment	
Level of course		Elective level course.	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Deana Breški, Assoc. Professor Irena Škarica, Lecturer **Contact: deana.breski@gradst.hr**	
Learning outcomes and competences		On completion of the course the student will be able to understand written and spoken English used in the field of civil engineering as well as to communicate at professional and general level.	
Prerequisites		The basics of English acquired in primary and secondary school.	
Course contents		The course helps students to increase their knowledge of English for civil engineering purposes, to develop themselves profesionally and to keep up with the latest scientific and technological achievements, thus enriching their knowledge in the broadest sense of the word.	
Recommended reading		Evans, V., Dooley, J., Revels, J., 2012. Career Paths: Construction I: Buildings. 1st ed. UK: Express Publishing UK Ltd. Evans, V., Dooley, J., Chavez, M., 2013. Career Paths: Construction II: Roads and Highways. 1st ed. UK: Express Publishing UK Ltd.	
Supplementary reading		Texts covering various fields of civil engineering selected by lecturers.	
Teaching methods		Lectures are taught in English. Selected texts are read, translated and summarised.	
Assessment methods		Written and oral examination.	
Language of instruction		English.	
Quality assurance methods		Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.	

Course title		LABORATORY AND FIELD TESTS OF GEOMATERIALS	
Course code		GAN702	
Type of course		Lecture, exercise course, guided personal study.	
Level of course		Basic level course	
Year of study	I and II	**Semester**	winter/summer
ECTS (Number of credits allocated)		5.0 Number of allocated credits is based on lecturer's estimation.	
Name of lecturer		Goran Baloević, PhD, asst.prof. **Contact: goran.baloevic@gradst.hr** Goran Vlastelica, PhD, asst.prof. **Contact: goran.vlastelica@gradst.hr**	
Learning outcomes and competences		Students will be able to: • investigate the engineering properties and behavior of geomaterials • explain the terminology and standard test methods related to the engineering properties of geomaterials • select and apply appropriate laboratory and field tests • analyze and evaluate the results of laboratory tests • draw up a final report on the conducted laboratory and field tests	
Prerequisites		Basic knowledge from building materials and soil/rock mechanics	
Course contents		Introduction. Introductory remarks. The role of the laboratory in construction. (2 + 0) Quality control. Accreditation, standards/norms. (2 + 0) Metrology. Measuring devices and concepts. (2 + 4) Overview of relevant tests within the Laboratory for Construction Materials (8 + 8) Overview of relevant tests within the Laboratory for Geotechnics (8 + 8) In-situ test methods (6 + 8) Analysis and processing of test results. Interpretation of results and preparation of test reports. (2 + 2)	
Recommended reading		1) K.H. Head: Manual of Soil Laboratory Testing, 3 volumes. Whittles Publishing, CRC Press Taylor & Francis Group. 2) M L Gambhir, N Jamwal: Building and Construction Materials: Testing and Quality Control, 1e (Lab Manual). McGraw Hill Education 2014.	

Supplementary reading	1) Fabbri, J-C Morel, J-E Aubert, Q-B Bui, D Gallipoli, B. V. Venkatarama Reddy: Testing and Characterisation of Earth-based Building Materials and Elements: State-of-the-art Report of the RILEM TC 274-TCE, Springer Nature, 2022 2) M Mulabdić: Ispitivanje tla u geotehničkom laboratoriju, Građevinski i arhitektonski fakultet Osijek, 2018. 3) National Academies of Sciences, Engineering, and Medicine: Manual on Subsurface Investigations. Washington, DC: The National Academies Press, 2019. 4) Rashad Islam, M. (2020). Civil Engineering Materials: Introduction and Laboratory Testing (1st ed.). CRC Press.
Teaching methods	Lectures; seminars/workshops; practice; field practice; individual tasks; laboratory work.
Assessment methods	Test, oral presentation, paper. Presentation of the seminar work and oral verification of learning outcomes that are not included in the seminar work/project.
Language of instruction	Croatian, English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		ULTRA HIGH PERFORMANCE CONCRETE STRUCTURES	
Course code		GAN703	
Type of course		Lecture, exercise course, guided personal study.	
Level of course		Basic level course	
Year of study	I and II	**Semester**	winter/summer
ECTS (Number of credits allocated)		5.0 Number of allocated credits is based on lecturer's estimation.	
Name of lecturer		Goran Baloević, PhD, assoc.prof. **Contact: goran.baloevic@gradst.hr** Nikola Grgić, PhD, assoc.prof. **Contact: nikola.grgic@gradst.hr**	
Learning outcomes and competences		Students will be able to: • describe the microstructure of high-performance concrete (HPC) • design the composition of high-performance concrete • make concrete quality control program at the concrete plant and construction site • perform relevant tests of high-performance concrete in fresh and hardened state • evaluate the test results of mechanical and durability properties of high-performance concrete • design and calculate structures made of high-performance concrete • elaborate the construction technology of high-performance concrete structures.	
Prerequisites		Basic knowledge from building materials and concrete structures	
Course contents		Introduction. Introductory remarks. 2 + 0 Development of high performance concrete - historical overview. 2 + 0 Constituent materials and selection of components. 2 + 0 Methods of designing the composition of high-performance concrete. 2 + 2 Microstructure of concrete. Connection of reinforcement and high-performance concrete. 2 + 0 Properties of concrete in fresh state. 2 + 2 Mechanical properties of hardened high-performance concrete. 2 + 6 Durability properties. 2 + 6 Testing of high-performance concrete. 2 + 2 Production technology. Transport, casting and care of high-performance concrete. 2 + 0	

	Quality control and assurance program. 2 + 2 Actual and potential constructive application of high-performance concrete. 2 + 2 Special types of high performance concrete. 2 + 4 Principle of structural design. Budgetary aspects, regulations and recommendations for the application. 2 + 4 Examples: structures made of high-performance concrete. 2 + 0
Recommended reading	1) Nawy, E. (2001). Fundamentals of high-performance concrete, Second edition, John Wiley&Sons, Inc., New York. 2) Aïtcin, P.-C. (1998). High Performance Concrete (1st ed.). CRC Press.
Supplementary reading	1) Malier, Y. (Ed.). (1992). High Performance Concrete: From material to structure (1st ed.). CRC Press. 2) Fehling et al (2014). Ultra-High Performance Concrete UHPC: Fundamentals, Design, Examples, Beton-Kalender Series, Wiley Ernst & Sohn
Teaching methods	Lectures; seminars/workshops; practice; field practice; individual tasks; laboratory work.
Assessment methods	Test, oral presentation, paper. Presentation of the seminar work and oral verification of learning outcomes that are not included in the seminar work/project.
Language of instruction	Croatian, English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		GEOTECHNICAL ENGINEERING	
Course code		GAG703	
Type of course		Lectures, practical assignment.	
Level of course		Basic level course	
Year of study	I	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Predrag Miščević, PhD, Full Professor **Contact: predrag.miscevic@gradst.hr** Goran Vlastelica, PhD, Associate Professor **Contact: goran.vlastelica@gradst.hr**	
Learning outcomes and competences		Student is expected to acquire basic knowledge about how to: interpret the results of geotechnical investigations and determine the necessary soil parameters; Use soil models for the analysis of geotechnical structures; Order field and laboratory tests of soil for the needs of construction of piled buildings; Design geotechnical anchors; Design flexible shallow foundations; Design tension-loaded foundations; Analyze supporting structures; Analyze laterally loaded deep foundations (piles); Design landslide rehabilitation; Analyze the seismic impact of the soil on the foundations; Design soil improvement with the purpose of preventing the phenomenon of liquefaction..	
Prerequisites		Soil mechanics.	
Course contents		Introduction. Geotechnical profiles. Analysis and definition of parameters. Embankment buildings: divisions, construction methods, elements of the budget and design of embankments building. Control of the quality of the embedded soil in the infill construction.Construction of an embankment next to the buildings. Drainage and erosion protection of embanked buildings. Geotechnical anchors: types and capacity.Support structures built in the ground.Flexible shallow foundations. Calculation of laterally loaded deep foundations (pile). Massive foundations. Causes of landslides and methods of landslide rehabilitation. Introduction to Seismic Geotechnical Engineering. Liquefaction. Soil reinforcement methods.	
Recommended reading		"Geotechnical engineering", Briaud J.L., 2013., John Wiley and sons	

Supplementary reading	(1) Tutorials for software package Rocscience; (2) EUROCODE 7 (3) “Foundation engineering handbook”, H. Fang, Chapman&Hall, 1991.
Teaching methods	Lectures with the use of a projector with a computer, auditory exercises, constructive exercises (creating two seminar papers during the hours of exercises from the course), demonstrative and constructive laboratory exercises, field work.
Assessment methods	Oral examination.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer’s level.

Course title		RETAINING STRUCTURES AND CONSTRUCTION PITS	
Course code		GAG801	
Type of course		Lecture, practical assignment, guided personal study.	
Level of course		Advanced level course	
Year of study	I	**Semester**	Autumn, Spring
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Goran Vlastelica, PhD, Associate Professor **Contact: goran.vlastelica@gradst.hr**	
Learning outcomes and competences		The student will be able to: - Interpret the results of geotechnical investigation works, determine the parameters of soil, actions and resistances necessary for calculations of various supporting structures and construction pits; - Use simple soil and rock mass models for the analysis of geotechnical structures; - Design retaining structures; - Design geotechnical anchors as part of complex supporting structures; - To design simple construction pits in soil and rock mass	
Prerequisites		Soil mechanics or Geotechnical engineering	
Course contents		Introduction. Presentation of some retaining structures and their purpose. Types of retaining walls. Analysis of actions on retaining structures (permanent, variable, incident). Possible design situations with reference to examples from practice. Basics of calculating earth pressures on retaining structures (horizontal pressure concept, strength parameters). Principles of Eurocode 7 in the design of retaining structures. Other standards. Gravity retaining walls (dimensioning and construction). Reinforced concrete retaining walls and gabions. Support structures made of reinforced soil. Drywalls. Construction pits, investigation works, problems of excavation and substructure, stability analyses, underground water and pumping. Support structures embedded in the ground. Piling walls. Anchoring of supporting structures. Elements of calculation of geotechnical anchors. Anchoring of gravity and reinforced concrete support structures. Stabilization of construction pits in soil and rock using geotechnical anchors.	

Recommended reading	(1) "Earth pressure and earth-retaining structures" Clayton C.R.I., Woods R.I., Bond A.J., Milititsky J., CRC Press, 2013. (2) "Geotechnical design to Eurocode 7", Orr T.L.L. & Farrell E.R., 2013., Springer.
Supplementary reading	(1) Software tutorials Rocscience and GEO5; (2) EUROCODE 7; (3) “Decoding Eurocode 7”, Bond A. & Harris A., Taylor&Francis, 2008.; (4) „Drystone retaining walls - Design, Construction and Assessment“ McCombie P.F., Morel J.-C., Garnier D., CRC Press, 2016.
Teaching methods	Lectures with the use of a projector with a computer, auditory exercises, constructive exercises (creating two seminar papers during the hours of exercises from the course), demonstrative and constructive laboratory exercises, field work.
Assessment methods	Presentation of the seminar papers, and oral verification of learning outcomes that are not included in the seminar work/project.
Language of instruction	English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer’s level.

Course title		Operational Research in Civil Engineering	
Course code		GAL701	
Type of course		Lecture, exercise course, guided personal study.	
Level of course		Basic level course	
Year of study	I	**Semester**	Summer
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (30 hrs lecture + 30 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Katarina Rogulj, PhD, Assistant Professor **Contact: katarina.rogulj@gradst.hr**	
Learning outcomes and competences		At the end of the course the student will be able to: - recognise and differentiate characteristics of civil engineering systems; - apply mathematical programming to civil engineering problems; - apply simulation and other models to the concrete civil engineering problems; - analyse production processes and model certain production segments using OR; - apply information theory models to decision processes in civil engineering.	
Prerequisites		Basic knowledge from mathematics and production processes in civil engineering	
Course contents		Introduction and definition of OR. Basics of system theory. System analysis. Structure and functioning of the system. System modeling. Process modeling. Expert systems. Principles of solving complex problems. Basics of decision theory. The decision-making process. Decision models. Mathematical models of OR applicable in civil engineering. Linear programming. Transport problem. Mixture model. Integer programming. Simulation models. Game theory (Monte Carlo). Queuing theory. Stock theory. Information theory application in civil engineering.	
Recommended reading		(1) K. Rogulj: Authorized presentations. (2) D. Kalpić, V. Mornar: Operational research, Zeus, Zagreb, 1996. (3) N. Limić: Monte Carlo simulacije slučajnih veličina, nizova i procesa. Zagreb 2005.	
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		Guided personal study. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	

Assessment methods	Oral and written exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.

Course title		Project Management	
Course code		GAL705	
Type of course		Lecture, exercise course, guided personal study.	
Level of course		Elective level course	
Year of study	II	**Semester**	Autumn
ECTS (Number of credits allocated)		5,0 Number of allocated credits is based on lecturer's estimation. Teaching (45 hrs lecture + 15 hrs exercise) = 1.5 ECTS; Individual work and learning = 3.5 ECTS	
Name of lecturer		Katarina Rogulj, PhD, Assistant Professor **Contact: katarina.rogulj@gradst.hr**	
Learning outcomes and competences		At the end of the course the student will be able to: - plan a life-cycle of civil engineering project and resources usage in constrained situations; - optimise project processes and evaluate simulation models; - validate and assess a success of project management; - control a usage of project resources; - manage project risks and multi-project systems.	
Prerequisites		None	
Course contents		Life-cycle of the civil engineering project. Basic concepts of project management. Planning. Cost, time and quality control. Material management. Resource management, planning and project management in conditions of limited resources. Risk management in the civil engineering project. Activity duration modeling. Determining the most economical duration of the project. Cash-flow of the project. Quality control. TQM (Total Quality Management) of the project. Constructability.	
Recommended reading		(1) K. Rogulj: Authorized presentations. (2) R. Lončarić: Organizacija izvedbe graditeljskih projekata, HDGI, 1995.; (3) 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. (3) R. H. Hodžić: Upravljanje projektom, Građevinski fakultet, Sveučilište u Sarajevu, 2010.	
Teaching methods		Guided personal study. Consultative class. Individual consultations with the course lecturer. The student assignments throughout the semester will be given in the form of semester project or seminar paper.	

Assessment methods	Oral and written exam.
Language of instruction	Croatian, consultations in English
Quality assurance methods	Quality assurance will be performed at three levels: (1) University level; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.