Subject title: Design of Reinforced Concrete Structures

Basic information on the subject	
Academic unit:	**Faculty of Civil Engineering**
Subject title:	**Design of Reinforced Concrete Structures**
Level:	**Master**
Subject status:	**Elected**
Year of studies:	**Second year**
Number of classes per week:	**2+3**
Credits - ECTS:	**6**
Time / location:	**According to time table**
Teacher:	**Prof.ass. Dr. Florim Grajcevci**
Contact details:	***e*-mail: florim.grajcevci@uni-pr.edu**
Course description:	The concept Design of buildings and their structures that belong to the construction materials concrete and reinforcement. The design of reinforced concrete structures for buildings with different functions, different locations-terrain, the possibility of external actions for general and special conditions. Analysis of foundations in locations with different earth resistance, actions for remediation and improvement of foundation conditions. Selection of the foundation for special buildings, treatment, analysis and construction. Design of reinforced concrete structural elements for different and special types of structures. Analysis, design of frame system structures, dual systems and coupled wall systems according to European standards for structures (EN 1990, EN 1991, EN 1992, EN 1997 and EN 1998). The performance of frame system structures, ductility, coefficient of behavior, regularity of structures in plan and verticality, behavior of structures under horizontal (seismic) actions. Special systems of structures for buildings; silos, reservoirs, garages, pools, domes, hydrotechnical facilities, high walls, provision of construction pits, etc.
Course objectives:	Increasing knowledge about the design and evaluation of different types of structures, respectively buildings. The design of structures from reinforced concrete, taking into account the qualities of structural materials and their use in structural elements and the whole structure. Analysis of structural elements and structures in seismic areas, structure performance, class of ductility, design criteria for RC facilities. Analysis of the behavior of the structure under the seismic

	actions, determination of horizontal displacements of structures, analysis of vertical displacements for the structure and horizontal elements.
Expected learning outcomes:	After completing the course, the student: - Analyzes structural elements from BA in which cases of objects they should be used - Calculates individual elements of the structure taking into account the effects of the whole structure. - Designs buildings with ram system, system with walls and with paired walls from reinforced concrete. - Analyzes and determines the behavior of structures to horizontal actions - seismicity - Evaluates the behavior of existing structures to external actions by designing external actions according to European standards of structures. - Structure calculations according to design criteria, degree of ductility, behavior coefficient, etc. - Designs external actions in objects and structures according to the conditions, locations where they are.

Workload that falls on the student (shall correspond with Student Learning Outcomes)			
Activity	**Teaching hours**	**Day/Week**	**total**
Lectures	2	15	30
Theory / Laboratory work / Exercises	3	15	45
Practical work	2	4	8
Preparation for intermediate test			
Consultation with the teacher	1	5	5
Field work	2	4	8
Test, seminar paper	2	3	6
Home work	2	5	10
Individual learning (in the library or at home)	2	5	10
Preparing for the final exam	2	4	8
Evaluation time (test, quiz, final exam)	1	6	6
Projects, presentations, etc.	2	5	10
Add any other activity that is not on the chart ...			
Total			**150**

Teaching methods:	Lectures, - site visits - various building types, reservoir, swimming pool, stadium, residential facility, etc. Presentation of case studies of objects of different types. Exercises, visits to various facilities and structures. Individual and group work with students for drafting the semester paper.

Evaluation methods:	Assessment parallel to teaching: - Attendance at lectures and exercises (10 - 15)% - Field visits 10% - Semester work 30% - Presentation of works 15% - Momentum tests 10% From the assessment during the semester, the student collects a maximum of 70% of the assessment. The remaining 30% assessment is part of the theory exam.
Basic literature:	- Lectures - EN1990, EN1991, EN1992, EN1997 and EN1998. - Designers' Guide to EN 1992-1-1 and EN 1992-1-2, Eurocode 2: Design of Concrete Structures. General rules and rules for buildings and structural fire design. - Eurocode: Seismic Design of Buildings Worked examples, Lisbon 2011 - B.Mosley, J. Bungey dhe R.Hulse, Projektimi i Strukturave prej Betoni të Armuar. Përkthyer nga POLIS
Additional literature:	- R.Chudley & R. Greeno, Building Construction Handbook, eighth edition, Elsevier. - Anil K. Chopra, Connections, EERI. - Conrad Boley Hrsg. Geotechnische Nachweise und Bemessung nach EC7 und DIN 1054, Springer. - M.Setareh, R.Darvas, Concrete Structure, Second Edition, Springer - A cement and concrete industry publication, How to Design Concrete Structures using Eurocode 2. - Manual for the design of the concrete building structures to Eurocode 2. - M.Fardis, E.Carvalho, P.Fajfar and A.Pecker, Seismic Design of Concrete Buildings to Eurocode, CRC Press. - G.Tsionis, R.Apostolska, F.Taucer. JRC Science and Policy Reports, Seismic strengthening of RC Buildings. EU 2014 - Tony Threlfall, Worked Examples for the Design of Concrete Structures to Eurocode 2. CRC Press - P.Bhatt, Th.MacGinley, B.Seng Choo, Reinforced Concrete Design to Eurocodes, Design Theory and examples. CRC Press.

Curriculum development	
Week	**Lecture title**
Week 1:	Introduction The concept of designing buildings - structures from reinforced concrete.
Week 2:	Reinforced concrete foundations, typologies, conditions of their use. Treatment of foundations under different scenarios of soil bearing capacity and load distribution from the facility.
***Week 3*:**	Types of reinforced concrete structures also classified according to EN1998.
Week 4:	Horizontal structural elements from reinforced concrete of frame system, with reinforced concrete walls and coupled walls. Their computation, construction and conditions – design requirements.
Week 5:	Vertical structural elements from reinforced concrete to frame system, with reinforced concrete walls and coupled walls. Their computation, construction and conditions – design requirements.
***Week 6*:**	EN1998, Requirements for the design of reinforced concrete structures. Regularities in plan and verticality.

Week 7:	EN1998, Requirements for the design of reinforced concrete structures. Ductility of structural members.
Week 8:	EN1998, Requirements for the design of reinforced concrete structures. Behavior coefficient according to EN1998.
Week 9:	Study case presentation of special facilities. Stadiums, reservoirs, silos.
Week 10:	Presentation of case studies of special facilities. Frame systems in both directions, system with walls - dual system, system with coupled walls.
***Week 11*:**	Evaluation of the performance of the RC building - structure according to the requirement of EN1998.
***Week 12*:**	Building performance containing with the structure and non-structural elements.
***Week 13*:**	Foundation Structural Design grave for the building's basements in terrains with high underground floors.
***Week 14*:**	Special structures from reinforced concrete, chimneys, channels, tunnels, etc.
***Week 15*:**	Subject recapitulation

Academic Policies and Code of Conduct
The student is obliged to follow the lectures and exercises, if the student does not follow the lesson regularly (missing more than 30%, then the student repeats the subject. (the student receives a negative grade). The code of conduct applies to both the students and the teacher.