COURSE DESCRIPTION

Name of the Course:	**Reinforced concrete structures for hydraulic facilities**							
Specialization Code:	**U02.07.ICV.IZ.M24.**			**Course Code:**	**2.DS.OP05**			
Year of study:	**1**	**Semester:**	**2**	**Examination form:** (**E-**Exam; **Co-** Colloquy; **P-**Project**; P/F-**Passed/Failed)	**E**	**ECTS credits granted (CR):**	**E (Co)**	**6**
					P		**P (P/F)**	
Course Category: (**DF**- Fundamental; **DD**- General engineering; **DS**-Specialty engineering; **DC**-Complementary; **PR**-Practical stage)								**DS**
Course Type: (**OB**-Compulsory**; OP**-Elective**; FC**-Facultative)								**OP**
Number of hours per semester: Total of hours per week (TH) x Number of weeks per semester								
TOTAL :	112	**Individual study** (IS)**:**		56	**Contact hours (C + S;L;P):**			56
Academic staff member in charge: (Full name, Academic position and Department)		*Prof. Tudor BUGNARIU* Department of Hydrotechnical Engineering						

Faculty	**Engineering in foreign languages Master study programme**		**Number of contact hours per semester**				
			Total	Course	Seminar	Laboratory	Project
Field	**Civil Engineering**						
Specialization	**Structural Engineering**		56	28			28

Course objectives - Description of the main competences:

Theoretical and practical problems concerning:

- the basic principles for conceiving and making up the concrete structures for hydraulic facilities;
- behavior and computing of axy-symmetric structures subjected to static and dynamic loads;
- behavior and computing of structures subjected to thermal field effects;
- prestressing of concrete hydraulic structures.

Content description:

1. COURSE

1. Introduction. Basic concepts

Characteristics of hydraulic reinforced structures. State of the art and future developments. Basic requirements in conceiving and design of hydraulic structures: functionality, strength, stability, durability, water tightness. Performance criteria.

2. Axy-symmetric structures made of reinforced concrete and prestressed reinforced concrete for water and water waste treatment

Conceiving and making up the concrete structures for water rinsing. Circular clarifiers. Suspension decanters with sludge recirculation.

Conceiving and making up the concrete structures for water tanks. Ground water tanks. Water towers.

Conceiving and making up the concrete structures for water waste treatment. Sludge fermentation reservoirs. Sludge concentrators.

3. Rectangular shape concrete structures for water and water waste treatment

Conceiving and making up the concrete structures for water filtration. Conceiving and making up the aeration basins.

4. Prestressing of hydraulic structures

Prestressig procedures.

Assessment of required prestressing load.

Assessment of the tension loss for post-tensioned tendons.

Tendons anchorage and dimensioning the traction ribs.

Prestressing force control.

5. Behavior and computing of axy-symmetric structures subjected to static and dynamc loads

Behavior of structures subjected to static loads. The influence of the soil-structure interaction on the stress distribution and deformation.

Behavior of structures and assessment of structural response due to seismic load. Types of damages.

Computing the hydrodynamic pressure. Assessment of stress and deformation state due to hydrodynamic pressure.

Global stability assessment of the structure subjected to seismic load.

	6. Behavior and computing of structures subjected to thermal field effects Thermal field effects on massive concrete structures. Design thermal field asignement. Computing the stress and deformation state for cilindrical structures subjected to a stady-state thermal field.
2. Seminar / Laboratory / Project / Practical stage	**Structural design of a prestressed concrete reservoir for sludge fermentation located in a seismic region.** 1. Basic concept for a given capacity. 2. Computation model. Assessment of stresses and deformation due to static load: own weight, hydrostatic pressure, presterssing and thermal field. 3. Reinforcement dimensioning and tendons position. 4. Assessment of the hydrodynamic pressure and the inertial seismic load. 5. Global stability verification of the structure and assessment of remanent compression during the earthquake. **6.** Drawing the reinforcement plans.
3. Bibliography	1. Reinforced concrete water towers, bunkers, silos, and gantries - William Samuel Gray 2. Reinforced & Prestressed Concrete – F.K. Kong, R.H. Evans 3. Reinforced Concrete Structures - R. Park, T. Paulay 4. Theory of plates ans shells – Stephen Timoshenko, S. Woinowski – Krieger 5. Designer's guide to EN 1998 - 1 and EN 1998 - 5. Eurocode 8: Design of structures for earthquake resistance. General rules, seismic actions, design rules for buildings, foundations and retaining structures - M. Fardis, E. Carvalho, A. Elnashai, E. Faccioli, P. Pinto, A. Plumier 6. Al Atik, L., Sitar, N. (2008). Experimental and analytical study of the seismic performance of retaining structures. PEER report 2008/104. :http://peer.berkeley.edu/publications/peer_reports/reports_2008/web1_PEER8104_ATIKsitar.pdf

Criteria to be considered for the final mark	**Weight of each criterion in the final mark (%)**
1. Exam defence (final examination)	60%
2. Appreciation during the entirely semester	
2.1 Seminar activity	
2.1 Laboratory activity	
2.2 Project activity (the project has not a distinct final mark)	30%
3. Periodical examinations	
3.1 Written / oral examination	10%
3.2 Home works, reports, essays etc.	
4. Other criteria (to be specified)	
Short description of the final evaluation procedure:	

Estimation of the total number of hours per semester requested for the individual study (IS)				
Type of individual activity	No. of hours		Type of individual activity	No. of hours
1. Study of the course notes	10		8. Preparation of the final examination	26
2. Study of the compulsory bibliography	6		9. Advisory class participation	
3. Study of the supplementary bibliography			10. Practical documentation on site	
4. Preparation of specific activities			11. Additional documentation on library	
5. Preparation of home works	14		12. Internet network documentation	
6. Preparation of periodical written examinations			13. Others (to be specified)	
7. Preparation of periodical oral examinations			**TOTAL number of hours**	56

Date:
March 2013

Signature of the Academic Staff member in charge:
Tudor BUGNARIU