COURSE DESCRIPTION

Name of the Course:	**Hydraulic Structures for Water Storage**							
Specialization Code:	**U02.07.ICV.IZ.M24.**			**Course Code:**	**3.DS.OP11**			
Year of study:	**2**	**Semester:**	**3**	**Examination form:** (**E-**Exam; **Co-** Colloquy; **P-**Project**; P/F-**Passed/Failed)	**E**	**ECTS credits granted (CR):**	**E (Co)**	**6**
							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)		*Radu SARGHIUTA, PhD Professor, Catalin POPESCU, PhD Assist. Professor, Dept. of Hydrotechnic 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: Provide students with concepts related to: a) the structural design of concrete structures for water storage b) the methods and mathematical models for static and dynamic stress-strain analysis of concrete dams.

Content description:

1. COURSE	**1. Numerical methods and tools used in the static and dynamic analysis of concrete dams**.....2 Hours **2. ANALYSIS OF GRAVITY DAMS, BUTTRESS DAMS AND WEIRS** Analysis objectives. Geometrical idealization. 2D simplification. Extending the foundation mesh. Material models.....4 Hours **3. Construction stresses analysis** Generals. Construction simulation. Determination of thermal field. Creep modelling. Foundation deformability. Stress analysis algorithm.....2 Hours **4. Stress analysis for empty reservoir condition.** Seepage analysis and uplift pressure. Determination of seepage flow nets. Uplift pressure calculus. Uplift pressure evaluation by transient seepage analysis. Influence of structural discontinuities on the seepage nets and uplift pressure. .....2 Hours **5. Stress analysis for full reservoir condition.** Stress due to the reservoir water. Foundation stress state. Stresses caused by temperature changes.....2 Hours **6. ANALYSIS OF ARCH DAMS** Analysis objectives. Dam mesh. Median surface mesh with shell elements. Dam body mesh with solid elements. Selecting alternative mesh and mesh composition.....2 Hours. **7. Dam-foundation interaction.** Foundation model. Foundation mesh. Contact elements.....2 Hours **8. Dead-load stress analysis.** Generals. Individual cantilevers approach. Staged construction and sequence of grouting simulation..... 2 Hours **9. Evaluation of joint-grouting induced stress.** Water load stress analysis. Thermo elastic stress analysis.....2 Hours **Modelling for structural discontinuities.** Influence of structural holes**.** Contraction joints model. .....2 Hours **11. Arch dam analysis by trial load method.**.....2 Hours **12. Dynamic analysis of concrete dams.** Structure modelling. Spectral analysis-general assumptions. Presentation and interpretation of results. Transient analysis. Setting design earthquake and motion direction. Presentation and interpretation of results. Alternative Analysis Techniques. Influence of reservoir and foundation. Dam-Water Interaction. Dam-Foundation Interaction.....4 Hours

2. Seminar / Laboratory / Project / Practical stage	1. Determining the stress – strain state for a gravity dam under the action of dead load and uplift pressure loads. Uplift pressure determination through a seepage calculation..... 10 Hours 2. Stress- strain analysis for an arch dam including the modelling of the joints between the plots, thermal and hydrostatic loads……. 8 Hours 3. Seismic analysis of an arch dam. Spectral analysis. Transient seismic analysis.....10 Hours
3. Bibliography	- FEMA 65 (2005). Federal Guidelines for Dam Safety. http://www.ferc.gov/industries/hydropower/safety/guidelines/fema-65.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	10%
2.2 Project activity (the project has not a distinct final mark)	
3. Periodical examinations	
3.1 Written / oral examination	
3.2 Home works, reports, essays etc.	30%
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	20
2. Study of the compulsory bibliography	6		9. Advisory class participation	
3. Study of the supplementary bibliography	6		10. Practical documentation on site	
4. Preparation of specific activities	14		11. Additional documentation on library	
5. Preparation of home works			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

Signature of the Academic Staff member in charge:

Date: April 2013

Radu SARGHIUTA