COURSE DESCRIPTION

Name of the Course:	**Stability and Dynamics of structures**							
Specialization Code:	**U02.07.ICV.IZ.M24.**			**Course Code:**	**1.DD.OB03**			
Year of study:	**1**	**Semester:**	**1**	**Examination form:** (**E-**Exam; **Co-** Colloquy; **P-**Project**; P/F-**Passed/Failed)	**E**	**ECTS credits granted (CR):**	**E (Co)**	**5**
							P (P/F)	
Course Category: (**DF**- Fundamental; **DD**- General engineering; **DS**-Specialty engineering; **DC**-Complementary; **PR**-Practical stage)								**DD**
Course Type: (**OB**-Compulsory**; OP**-Elective**; FC**-Facultative)								**OB**
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)		*Professor Sorin DEMETRIU* *Conf.dr.ing. Teodorescu Mircea Eugen*						

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: The main objective of this course is to acquire the basic knowledge level on the modeling process in the Structural Engineering field as well as to perform the response analysis of structures subjected to dynamic loads By enrolling in this course, the students will gain the following skills:

- Characterization of dynamic loads from various sources;
- Theoretical background and practical exercise about structural dynamic models and their dimension reduction;
- Theoretical and experimental modal parameters identification;
- Enhance the ability to solve practical and specific engineering applications. After attending the curse and fulfilling some assignments with practical character, students will be able to:
- Define the causes leading to a geometrical nonlinear analysis or a stability analysis
- Present the specific of the nonlinear analysis or stability analysis
- Properly model the loss of stability phenomena by bifurcation or by continuum deformation
- Handle correctly the techniques of incremental or iterative solving of nonlinear analysis problems.

Content description:

1. COURSE

1. The specific of the nonlinear analysis and stability analysis of the elastic structures
2. The equilibrium condition in accordance with the deformed shape of structure. Customization for second order and stability analysis.
3. General displacements method in geometrical nonlinear and stability analysis.
4. Geometrical stiffness matrices for straight beam elements.
5. Incremental and iterative procedures for resolving the equations of condition.
6. Second order and stability analysis of arch structures
7. Plane plates stability.
8. Vibration modes. Methods for the eigenvalue and eigenvectors analysis. Modal coupling. Model dimension reduction. 2 hours
9. Damping modeling. Damping models. Proportional damping. Rayleigh damping. Non-proportional damping. Complex eigenmodes 2 hours
10. Continuous systems with distributed parameters. Axial and transverse vibrations. Vibration eigenmodes. Approximate methods for modal analysis. Dynamic response analysis. 2 hours
11. Frequency-domain analysis of structures. Fourier analysis. FFT numerical algorithms implementation. Frequency response functions and matrices. Modal parameters using experimental modal analysis. 2 hours
12. Dynamic response of structures to impact and blast loads. Modeling of shock and impulse loads. Response spectra to shock loads. Approximate response analysis methods. 3 hours
13. Transmissibility of vibration. Vibration isolation. The effects of vibrations. Allowable limits. Transmissibility characteristics. 3 hours

2. Seminar / Laboratory / Project / Practical stage	1. Second order analytic calculus of some simple structures 2-3. Second order and stability analysis of plane frames. Use of specialized computer programs. 4. Geometrical nonlinear analysis and stability analysis of an arch structure. 5-6. Study of lateral buckling of the compress chord of a truss 7 Stability study of a structure made by plane shells. 8-9 Vibration eigenmodes. Damping modeling. Methods for dimension reduction. Introduction to specific software tools. 10 The vibration of continuous systems. Models with distributed dynamic parameters Modal analysis 11 Frequency-domain response analysis of structures. Spectral functions analysis. Experimental modal analysis. Introduction to specific software tools. 12 Dynamic response of structures to impact and blast loads. The use of shock spectra. 13-14 The transmissibility and the vibration isolation. The analysis of structure-isolators systems using reduced dynamic models.
3. Bibliography	1. G.J. Simitses, D.H. Hodges - Fundamentals Of Structural Stability - 2006 Elsevier Inc. 2. W.F. Chen, E.M. Lui – Stability design of steel frames, CRC Press, 1991 3. Chopra, A.K.-Dynamics of Structures, Theory and Applications to Earthquake Engineering, Third Edition, Prentice Hall, 2007 4. Clough , R W.- Penzien , J., Dynamics of Structures, McGraw-Hill, 1993 5. Humar, J. -Dynamics of Structures, Third Edition , CRC Press , 2012 6. Macavei Fl. - Dynamics and Matrix Analysis Analysis of Strucures, ICB, 1993 7. Thorby, D.- Structural Dynamics and Vibration in Practice: An Engineering Handbook , Butterworth-Heinemann, 2008 8. Structural stability an design. Purdue University course. https://engineering.purdue.edu/~ahvarma/CE%20579/CE579_Half_course_summary.ppt. 9. Structural stability - supplementary materials. John Hopkins University http://www.ce.jhu.edu/stability/supplementary/supplementary.htm

Criteria to be considered for the final mark	**Weight of each criterion in the final mark (%)**
1. Exam defence (final examination)	50
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)	
3. Periodical examinations	
3.1 Written / oral examination	35
3.2 Home works, reports, essays etc.	15
4. Other criteria (to be specified)	

Short description of the final evaluation procedure:

For stability: The final mark takes in account for continuous grading of the students by resolving and presenting of some practical individual assignments and for a final examination of the achievement level of the theoretical knowledge. The final examination is a unique test for all the students in which they are asked to answer 10 simple theoretical questions. To pass the evaluation, the student has to obtain minimum grade 5 both to the assignments presentation and to the final exam

For dynamics: Final grading consists of intermediate evaluations by submitting and presenting individual reports (50% from the final mark) and of a final examination, to evaluate the theoretical and practical knowledge level.

The final mark is the average between the two marks.

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	8		8. Preparation of the final examination	18
2. Study of the compulsory bibliography	8		9. Advisory class participation	
3. Study of the supplementary bibliography			10. Practical documentation on site	
4. Preparation of specific activities	9		11. Additional documentation on library	
5. Preparation of home works	4		12. Internet network documentation	4

6. Preparation of periodical written examinations	5	13. Others (to be specified)	
7. Preparation of periodical oral examinations		**TOTAL number of hours**	56

Signature of the Academic Staff member in charge:
Sorin DEMETRIU
Mircea Eugen TEODORESCU

Date: 15.03.2013