SYLLABUS [1]

1. Information about the program

1.1 Higher education institution	Politehnica University of Timisoara
1.2 Faculty[2] / Department[3]	Faculty of Civil Engineering /Department of Steel Structures and Structural Mechanics
1.3 Chair	—
1.4 Field of study (name/code[4])	Inginerie civilă și instalații (Civil engineering and building services) / 10
1.5 Study cycle	Master
1.6 Study program (name/code/qualification)	Inginerie civilă (Civil engineering) / 80 /Diplomă de master (Master degree)

2. Information about discipline

2.1 Name of discipline/The educational classe[5]			Theory of Elasticity and Plastic Analysis of Structures				
2.2 Coordinator (holder) of course activities			Prof.dr.ing. Viorel Ungureanu				
2.3 Coordinator (holder) of applied activities[6]			Assoc.Prof.dr.ing. Mirela Achim				
2.4 Year of study[7]	1	**2.5** Semester	1	**2.6** Type of evaluation	E	**2.7** Type of discipline[8]	DA

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities[9])

3.1 Number of hours fully assisted/week	3 ,of which:	**3.2** course	2	**3.3** seminar/laboratory/project			1
3.1* Total number of hours fully assisted/sem.	42 ,of which:	**3.2*** course	28	**3.3*** seminar/laboratory/project			14
3.4 Number of hours partially assisted/week	,of which:	**3.5** project, research		**3.6** training		**3.7** hours designing M.A. dizertation	
3.4* Number of hours pasrtially assisted/ semester	,of which:	**3.5*** project of research		**3.6*** training		**3.7*** hours designing M.A. dizertation	
3.8 Number of hours of unassisted activities/ week	2.86 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					0.68
		Study using a manual, course materials, bibliography and lecture notes					0.68
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					1.5
3.8* Total number of hours of unasssited asctivities/ semester	40 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					9.5
		Study using a manual, course materials, bibliography and lecture notes					9.5
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					21
3.9 Total hrs./week[10]	5.86						
3.9* Total hrs./semester	82						
3.10 No. of credits	8						

4. Prerequisites (where applicable)

4.1 Curriculum	• Strength of materials, Mechanics of materials, Differential and integral calculus,

[1] The form corresponds to the Syllabus promoted by OMECTS 5703/18.12.2011 (Annex 3), updated based on the Specific Standards ARACIS of December 2016.
[2] The name of the faculty which manages the educational curriculum to which the discipline belongs
[3] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[4] Fill in the code provided in HG no. 376/18.05.2016 or in HG similars annually updated.
[5] The educational classes of subjects (ARACIS – specific standards, art./paragraph 4.1.2.a) are: fundamental subjects, field subjects, majoring/specialization subjects.
[6] The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[7] The year of study to which the discipline is provided in the curriculum .
[8] The types of subjects (ARACIS – specific standards, art./paragraph 4.1.2.a) are: extended knowledge subject / advanced knowledge subject and synthetic subject (DA / DCAV and DS).
[9] Within UPT, the number of hours from 3.1*, 3.2*,…,3.9* are obtained by multipling by 14 (weeks) the number of hours from 3.1, 3.2,…, 3.9.
[10] The total number of hours/week is obtained by summing up the number of hours from 3.1, 3.4 şi 3.8.

	Linear algebra and Finite Element Method.
4.2 Competencies	• Operation with scientific and engineering fundamentals

5. Conditions (where applicable)

5.1 of the course	• Classroom, video projector, writing board, projecting screen, computer
5.2 to conduct practical activities	• Classroom, writing board

6. Specific competencies acquired through this discipline

Specific competencies	• Building design with the possibility of assuming responsibility as a Manager; • Construction and maintenance activities in the construction industry; • Research activity, development in structural domain for constructions; • Consulting, technical assistance and project verifications.
Professional competencies ascribed to the specific competencies	• **Cognitive skills**: knowledge, understanding and use of specialist terminology relating to cold-formed steel products; • **Applied-practical skills**: knowledge and understanding of concepts related to the use of elements for drafting; the theoretical base necessary for training future professional development
Transversal competencies ascribed to the specific competencies	• **Communication skills and networking**: capacity development of oral and written communication, respectively, the proper use of specific terms; • **Skills for personal and professional development**: to develop the capacity for learning, improving management skills working with building components in order to obtain a maximum construction energetic efficiency.

7. Objectives of the discipline (based on the grid of specific competemcies acquired)

7.1 The general objective of the discipline	• This course intends to provide students a comprehensive knowledge on the theory of elasticity and plasticity. The course focuses on the following topics: continuous medium, Cartesian tensors, deformation, displacement and strain tensors, compatibility conditions, external and internal forces, equilibrium, stress tensors, principal stresses, invariants and stress deviators, constitutive law, plasticity theory, yield and failure criteria, laws of mechanics, plane stress and plane strain problems. Students will obtain theoretical knowledge on stress in spatial and planar structural elements, walls, plates and shells on elastic and plastic properties of materials.
7.2 Specific objectives	• By the end of the course, the students should have the knowledge related to the type of problems, the analytical solutions exist, and for which one we must depend on numerical solutions. They have to be able to solve analytically a number of classical problems of elasticity.

8. Content

8.1 Course	Number of hours	Teaching methods
Torsion with restraint warping in thin-walled bars with non-circular open cross section	4	Oral presentation, interactive lecture, explanation, demonstration, problems, case studies.
Basic equations of elasticity theory. Three dimensional problem of stress and strain state in the surrounding of a point in elastic body. Introduction, The State of Stress at a Point, The State of Strain at a Point, Basic Equations of Elasticity, Methods of Solution of Elasticity Problems, Spherical Co-ordinates, Principal Stresses and Principal Planes.	4	
Two dimensional problems in the theory of elasticity in Cartesian co-ordinates	2	

Introduction, Formulation of all governing equations; Navier's equations; 2D stress states in Cartesian coordinates: plane stress, plane strain, Airy stress function: Bending of a cantilever loaded at the end.		
Two-dimensional problems in polar co-ordinates. Basic equations, 2D stress states in cylindrical coordinates: axisymmetry, strain-displacement relations, Airy stress function: Stress-concentration due to a Circular Hole in a Stressed Plate (Kirsch Problem), finite-difference methods (FDM).	2	
Analysis of rectangular plates – theory and methods, application of numerical methods. Introduction, Cylindrical Bending of Rectangular Plates, Type of stresses on rectangular flat plates, Determination of bending and twisting moments on any plane, finite-difference methods (FDM), Navier's solution for simply supported rectangular plates	4	
Analysis of rotationally symmetric circular plates – methods of solution. Introduction, symmetrical bending of a circular plate, governing Equations for symmetric bending of circular plates, some typical solutions	4	
Theory of rotationally symmetric thin shells – membrane and bending theory. Introduction, statics of shells - the stress resultants and stress couples in shells, the equilibrium equations, membrane theory of shells, geometry of shells of revolution.	2	
Basic theory of plasticity. Theory of rupture. - Plasticity in one dimensional stress states: material models for uniaxial tension/compression; Bauschinger effect; strain hardening; - Yield criteria in two and three dimensional stress states: general expression of yield criterion; yield criteria for ductile material: Tresca, von Mises; fracture criteria for brittle materials: Rankine, Mohr-Coulomb, Drucker-Prager; Deformations in plastic regime: yield surface; incremental deformations; convexity of the yield surface; normality of plastic deformation increment to yield surface; plastic potential en flow rule.	6	

Bibliography[11]

1. Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill, 2006.
2. Chen W.F. and Han D.J. "Plasticity for structural Engineers", 1st Edition, Springer-Verlag, 2000.
3. S. Kaliszky: Plasticity theory and engineering applications. Ed. Akademiai Kiado, Budapest, 1989.
4. J. Lubliner: Plasticity theory. University of California at Berkeley. 2006.

8.2 Applied activities[12]	Number of hours	Teaching methods
Torsion with restraint warping in thin-walled bars	4	explication, example
Two dimensional problems in the theory of elasticity in Cartesian co-ordinates	2	
Two-dimensional problems in polar co-ordinates.	2	

[11] At least one title must belong to the department staff teaching the discipline, and at least one title must refer to a relevant work for the discipline, a national and international work that can be found in the UPT Library.

[12] The types of applied activities are those mentioned in 5. If the discipline containes more types of applied activities then they are marked, consecutively, in the table below. The type of activity will be marked distinctively under the form: „Seminar:", „Laboratory:", „Project:" and/or „Practice/Training:".

Analysis of rectangular plates	2	
Analysis of rotationally symmetric circular plates	2	
Basic application in plasticity	2	

Bibliography[13]

1. C. Bia, V. Ille, M. Soare: Rezistenţa materialelor şi teoria elasticităţii, Ed. Didactică şi Pedagogică, 1983.
2. Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill, 2006.
3. Chen W.F. and Han D.J. "Plasticity for structural Engineers", 1st Edition, Springer-Verlag, 2000.
4. S. Kaliszky: Plasticity theory and engineering applications. Ed. Akademiai Kiado, Budapest, 1989.

9. Coroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- Imperial College London, UK
- Czech Technical University in Prague, Czech Republic
- Brno University of Technology, Czech Republic
- Slovak University of Technology in Bratislava, Slovakia
- KU Leuven, Belgium

10. Evaluation

Type of activity	**10.1** Evaluation criteria[14]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	A set of 10-15 short theoretical subjects and two applications.	Written exam: 2hours. Two internal examiners	60%
10.5 Applied activities	**S:**		
	L: Students are expected to attend and participate in every class session. The attendance will be monitored. 4 homeworks to be delivered.	Verification of the homeworks	50%
	P:		
	Pr:		
	Tc-R[15]:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified[16]			
• Mark 5 is given if all subjects are 50% covered. All homeworks have to be delivered to the coordinator of applied activities.			

Date of completion

Course coordinator (signature)

……

Coordinator of applied activities (signature)

……

Head of Department (signature)

……

Date of approval in the Faculty Council [17]

Dean (signature)

……

[13] At least one title must belong to the staff teaching the discipline.
[14] The Syllabus must contain the evaluation method of the discipline, specifying the criteria, the metods and the forms of evaluation, as well as mentioning the share attached to these within the final mark. The evaluation criteria must correspond to all activities stipulated in the curriculum (course, seminar, laboratory, project), as well as to the methods of continuous assessment (homework, essays etc.)
[15] Tc-R= Homework-Reports
[16] For this point turn to "Ghid de completare a Fişei disciplinei" found at: http://univagora.ro/m/filer_public/2012/10/21/ghid_de_completare_fisa_disciplinei.pdf
[17] The approval is preceeded by discussing the study program's board's point of view with redgards to the syllabus.