SYLLABUS [1]

1. Information about the program

1.1 Higher education institution	Timisoara Politehnica University
1.2 Faculty[2] / Department[3]	Civil Engineering/Steel Structures and Structural Mechanics
1.3 Chair	–
1.4 Field of study (name/code[4])	Civil Engineering /60
1.5 Study cycle	Master
1.6 Study program (name/code/qualification)	Advanced Design of Steel and Composite Structures/10/M

2. Information about discipline

2.1 Name of discipline/The educational classe[5]			Robustness of structures under extreme actions\ Field subjects				
2.2 Coordinator (holder) of course activities			Prof. Florea Dinu, PhD				
2.3 Coordinator (holder) of applied activities[6]			Ass.prof. Ioan Marginean, PhD.				
2.4 Year of study[7]	2	**2.5** Semester	3	**2.6** Type of evaluation	E	**2.7** Type of discipline[8]	DCA

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	5 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					1
		Study using a manual, course materials, bibliography and lecture notes					2
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					2
3.8* Total number of hours of unasssited asctivities/ semester	70 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field					14
		Study using a manual, course materials, bibliography and lecture notes					28
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays					28
3.9 Total hrs./week[10]	8						
3.9* Total hrs./semester	112						
3.10 No. of credits	8						

4. Prerequisites (where applicable)

4.1 Curriculum	• Bachelor Program: Mechanics of Materials, Statics, Dynamic and Seismic Engineering, Metal Structures I and 2, Composite steel-concrete structures: MSc

[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.

	(ADS): Performance Based Seismic Design, Robustness of structures under extreme actions
4.2 Competencies	• Operating with engineering fundaments and specific knowledge to design and construct steel and composite steel - concrete structures, Computer operation and Computing

5. Conditions (where applicable)

5.1 of the course	• Facilities: Adequate auditorium, audio-video facilities, black board
5.2 to conduct practical activities	• Facilities: Adequate auditorium, audio-video facilities, black board

6. Specific competencies acquired through this discipline

Specific competencies	• To gain abilities for construction, investigation, design and evaluation of structural integrity and robustness of for civil and building structures
Professional competencies ascribed to the specific competencies	• Competence in structural engineering for civil and building structures under extreme loading conditions: • - perceiving risks and threats against structural/nonstructural components of structures (civil/buildings) • - selection of technical solutions and intervention strategies to provide/enhance the robustness • - selection and application of analysis tools (in design, evaluation and/or structural assessment • -
Transversal competencies ascribed to the specific competencies	• Application of efficient and responsible work strategies (implying punctuality, seriousness and personal responsibility) based on the principles, rules and values of professional ethics • Commitment in professional and personal development, via continuous learning and efficient adaptation to the new technical specifications • To be updated with new/innovative materials, rules, techniques and practices in the field

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

7.1 The general objective of the discipline	• To introduce general concepts and specific topics in robustness of structures under extreme actions
7.2 Specific objectives	• to introduce general concepts such as extreme actions, natural and human made hazards, robustness, structural integrity, progressive collapse, resilience • to give the understanding of the role of structural robustness in limitation of damage/avoidance of collapse in case of extreme actions (impact, blast, explosion, earthquake). • to make the students familiar with the design rules and practical guidance on robustness and collapse resistance against extreme actions • to make the students familiar with the approaches for the modelling and assessment of robustness of structures under extreme actions (simplified modeling and analysis, advanced methods •

8. Content

8.1 Course	Number of hours	Teaching methods
1. Introduction to robustness a. Concepts of robustness, structural integrity, redundancy. b. Failure modes, disproportionate and progressive collapse. c. Nature of the hazards, accidental actions, extreme events, probability of occurrence d. Structural failure consequences:	4	Lecturing, conversation, explication, demonstration
Design regulations, guidelines, specialized literature:	12	

a. Introduction. b. Classification of structures (consequence/importance classes). c. Design requirements. d. Indirect design approaches (tie-force methods). e. Direct design approaches: key element design, alternative load path methods. (notional removal of members). f. Risk-based methods. g. Good detailing, best practice .		
3. Advances on structural robustness and mitigation of progressive collapse: a. Advances in modelling of extreme events (blast, explosion, impact). b. Dynamic factors (load factors, material factors). c. Modelling parameters and acceptance criteria. a. Probability-based approaches (uncertainty-based).	12	

Bibliography[11]

- SCI P391 Structural Robustness of Steel Framed Buildings, 2011.
- Practical Guide to Structural Robustness and Disproportionate Collapse in Buildings. The Institution of Structural Engineers, 2010
- EN1998: Design of structures for earthquake resistance, European Committee for Standardization, 2004;
- EN1990, Basis of structural design. CEN, European Committee for Standardisation, prEN 1990, 2001.
- EN 1991-1-7:2006. Eurocode 1: Actions on structures. General actions. Accidental actions
- FEMA 427, Risk Management Series Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings, 2003.
- Approved Document A (Structure), 2004 Edition incorporating 2004, 2010, and 2013 amendments. Department for Communities and Local Government, UK
- NISTIR 7396 (2007) “Best Practices for Reducing the Potential for Progressive Collapse in Buildings”, National Institute of Standards and Technology, Oakland, CA.
- GSA Alternate Path Analysis and Design Guidelines for Progressive Collapse Resistance, October 24, 2013. Revision 1, January 28, 2016
- Department of Defense DoD (2013). “United Facilities Criteria (UFC): Design of buildings to resist progressive collapse”. Washington (DC).
- Calculation of Blast Loads for Application to Structural Components, European Commission Joint Research Centre
- Institute for the Protection and Security of the Citizen, Luxembourg: Publications Office of the European Union, 2013, European Union, 2013

8.2 Applied activities[12]	Number of hours	Teaching methods
1. Application of Indirect Method to a frame building (tying resistance)	2	Presentations, discussions,
2. Application of Specific Local Resistance Method to a frame building due to:	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:”.

- impact - explosion		explanations, practical exercises
3. Application of Alternate Load Path Method AMP to verify the progressive collapse resistance of a frame building: - linear static procedure - nonlinear static procedure - nonlinear dynamic procedure	10	

Bibliography[13]

- Software packages SAP2000; Extreme loading for Structures ELS; CoP Steel connection software, SteelCon connection software
- SR EN 1990, SR EN 1991-1, SR EN 1993-1-1 ;SR EN 1993-1-8; SR EN 1993-1.12; SR EN 1998-1; P 100-1/2013; P100-3/2019
- other codes and documents listed in 8.1

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

- The technical content of the course, the applications and the background information were corroborated with the expectations of the representatives of the epistemic community, professional associations in the field of civil and structural engineering, industry and other stakeholders in the field. The unification of standards and codes – e.g. Eurocodes, the globalization of the construction industry and emerging of man-made hazards at the global scale have been also considered in the elaboration of the discipline content

10. Evaluation

Type of activity	**10.1** Evaluation criteria[14]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Answering to specific subjects in the field of the course and applications	Written form	50%
10.5 Applied activities	**S:** Application of Alternate Load Path Method AMP	Presentation of technical report for APM, answering to questions	50%
	L:		
	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]

- Approach of the exam questions at a satisfactory level – minimum 50%
- Delivery and defense of the technical report for APM (evaluation of loads, design, simplified analysis, advanced analysis) - minimum 50%

[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 Fișei disciplinei" found at: http://univagora.ro/m/filer_public/2012/10/21/ghid_de_completare_fisa_disciplinei.pdf

Date of completion	Course coordinator (signature)	Coordinator of applied activities (signature)
01.04.2019	……	……
Head of Department (signature)	**Date of approval in the Faculty Council [17]**	**Dean (signature)**
……		……

[17] The approval is preceeded by discussing the study program's board's point of view with redgards to the syllabus.