**SYLLABUS**

1. **Information about the program**

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| **1.1** Higher education institution |  UNIVERSITATEA POLITEHNICA TIMISOARA  |
| **1.2** Faculty[[1]](#footnote-1) / Department[[2]](#footnote-2) |  CONSTRUCTII/ CMMC  |
| **1.3** Field of study (name/code[[3]](#footnote-3)) |  INGINERIE CIVILA/ 10  |
| **1.4** Study cycle | Master  |
| **1.5** Study program (name/code/qualification) |  ADVANCED DESIGN OF BUILDINGS – PROIECTAREA AVANSATA A CLADIRILOR/ 10/ Master  |

1. **Information about discipline**

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| **2.1** Name of discipline/The educational classe[[4]](#footnote-4) | Structural safety under extreme actions – Siguranta structurala sub actiuni extreme / DCAV  |
| **2.2** Coordinator (holder) of course activities |  Prof. dr. ing. Florea Dinu  |
| **2.3** Coordinator (holder) of applied activities[[5]](#footnote-5) |  S.l. dr. ing. Calin Neagu |
| **2.4** Year of study[[6]](#footnote-6) |  2  | **2.5** Semester |  3  | **2.6** Type of evaluation |  E  | **2.7** Regime of discipline[[7]](#footnote-7) |  DI  |

1. **Total estimated time** (direct activities (fully assisted), partially assisted activities and unassisted activities[[8]](#footnote-8))

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| **3.1** Number of hours fully assisted/week |  4 ,of which:  | course |  2  | seminar/laboratory/project |  2  |
| **3.1\*** Total number of hours fully assisted/sem. |  56 ,of which:  | course | 28  | seminar/laboratory/project |  28  |
| **3.2** Number of on-line hours fully assisted/sem |  22 ,of which:  | course | 14  | seminar/laboratory/project |  8  |
| **3.3** Number of hours partially assisted/week |  ,of which:  | project, research |   | training |   | hours designing M.A. dissertation |   |
| **3.3\*** Number of hours partially assisted/ semester |  ,of which:  | project of research |   | training |   | hours designing M.A. dissertation |   |
| **3.4** Number of hours of unassisted activities/ week |  6.71 ,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 |  3 |
| Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays | 2.71  |
| **3.4\*** Total number of hours of unasssited asctivities/ semester |  94 ,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 |  42  |
| Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays | 38  |
| **3.5 Total hrs./week**[[9]](#footnote-9) |  10.71  |
| **3.5\* Total hrs./semester** | 150 |
| **3.6 No. of credits** |  6  |

**4. Prerequisites** (where applicable)

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| **4.1** Curriculum | *
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| **4.2** Competencies | *
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**5. Conditions** (where applicable)

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| **5.1** of the course | * Medium capacity room, video projector
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| **5.2** to conduct practical activities | * Medium capacity room, video projector, computers
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**6. Specific competencies** acquired through this discipline

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| Specific competencies |  To gain abilities for the design and evaluation of structural robustness / safety / integrity for common building structures:- acknowledging accidental single/multi threats against structural/nonstructural components of structures (civil/buildings)- selection of technical solutions and intervention strategies to reduce exposure, provide/enhance the robustness, reduce risk- selection and application of analytical / numerical tools in design, evaluation and/or structural assessment |
| Professional competencies ascribed to the specific competencies | * ensure compliance with security legislation; provide instructions to staff; adhere to legal regulations; provide construction counseling; apply health and safety standards; draw sketches; utilize CAD software; manage engineering projects; draft technical reports; apply numerical computing skills; supervise personnel; evaluates the integrated design of buildings; prepares scientific reports;
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| Transversal competencies ascribed to the specific competencies | * oversee quality control; apply scientific, technological, and engineering knowledge; work in teams; train others;
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**7. Objectives of the discipline** (based on the grid of specific competemcies acquired)

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| **7.1** The general objective of the discipline | * To introduce general concepts and specific topics in structural design/evaluation of building structures under extreme actions, in accordance with specific Eurocodes, but also by applying advanced numerical simulations
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| **7.2** Specific objectives | * to introduce general concepts such as natural/human made hazards, single and multi-hazards, structural robustness and integrity, local / global/progressive collapse, resilience
* to give the understanding of the role of structural robustness in prevention of injuries/fatalities, limitation of damage/avoidance of collapse in case of extreme actions (impact, blast, explosion, earthquake, cascading scenarios).
* to make the students familiar with the design rules and practical guidance on protection of buildings against extreme actions
* to make the students familiar with the approaches for the assessment of structural robustness of structures under extreme actions (simplified load modeling and analysis, advanced numerical methods
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**8. Content**

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| **8.1** Course | Number of hours | Of which online | Teaching methods |
| Abnormal loads and extreme loading scenarios:* Likelihood of hazards (blast and explosion, impact, extreme weather, others)
* Mean occurrence rate for single/cascading hazard scenarios
* Simple / advanced models
* Actions/combination of actions
 |  4  |  Max 50%  |  Lecturing, conversation, explication, demonstration, examples  |
|  Fundamentals of risk assessment for natural and human-made hazards* Mathematical and Decision Analysis Tools
* Vulnerability and exposure
* Risk assessment
 |  4  |   |
| Introduction to robustness* Concept of robustness, structural integrity, redundancy
* Failure modes, definition, acceptance criteria
* Local/global, disproportionate/ progressive collapse
* Structural failure consequences
 | 4  |   |
| Design codes and guidelines, specialized literature:* Introduction.
* Classification of structures (consequence/importance classes).
* Design requirements.
* Indirect design approaches (tie-force methods).
* Direct design approaches: key element design, alternative load path methods. (notional removal of members), enhanced protection.
* Risk assessment.
* Best practice

  |  12  |   |
| Advances on structural robustness and mitigation of progressive collapse:* Advances in modelling of extreme events (blast, explosion, impact).
* Load factors, material factors
* Modelling parameters and acceptance criteria
* Probability-based approaches (uncertainty-based)

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|  | * Bibliography[[10]](#footnote-10)
* Failnomore Mitigation of the risk of progressive collapse in steel and composite building frames under exceptional events, https://www.steelconstruct.com/eu-projects/failnomore/
* 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 (2016). “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
* CODEC Structural conception and collapse control performance based design of multistory structures under accidental actions <https://www.ct.upt.ro/centre/cemsig/codec.htm>
* Experimental validation of the response of a full scale frame building subjected to blast load – FRAMEBLAST <https://www.ct.upt.ro/centre/cemsig/frameblast.htm>
* Safety of buildings walls and claddings against accidental explosions (SAFE-WALL) https://www.ct.upt.ro/centre/cemsig/safe-wall.htm
 |
| **8.2** Applied activities[[11]](#footnote-11) | Number of hours | Of which online | Teaching methods |
| FEM: generalities, modeling criteria, parameters, results, calibration  |  6  |  Max 30% |  Presentations, discussions, explanations, practical exercises, on computer |
| Application of Indirect Method to a frame building (tying resistance  |  2  |   |
| Application of Specific Local Resistance Method to a frame building due to: - impact- explosion |  10  |   |
| Application of Alternate Load Path Method AMP to verify the progressive collapse resistance of a frame building: - linear static procedure LSP- nonlinear static procedure NSP- nonlinear dynamic procedure NDP  |  10  |   |
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|  | Bibliography[[12]](#footnote-12) - Software packages SAP2000/ETABS; 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**

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| * 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
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**10. Evaluation**

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| Type of activity | **10.1** Evaluation criteria[[13]](#footnote-13) | **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 examination | 50%  |
| **10.5** Applied activities  | **S:** Application of Specific Local Resistance Method, Alternate Load Path Method AMP  |  Presentation of technical reports, answering to questions, computer application | 50%  |
|  | **L:**   |   |   |
|  | **P:**   |   |   |
|  | **Pr:**   |   |   |
|  | **Tc-R[[14]](#footnote-14):**  |   |   |
| **10.6** Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified[[15]](#footnote-15) |
| * Approach of the exam questions at a satisfactory level – minimum 50%
* Delivery and defense of the technical reports (evaluation of loads, design, simplified analysis, advanced analysis) - minimum 50%
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| **Date of completion** | **Course coordinator****(signature)** | **Coordinator of applied activities****(signature)** |
|  15.11.2024  |   |   |

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| **Head of Department** **(signature)**  | **Date of approval in the Faculty Council [[16]](#footnote-16)** | **Dean****(signature)** |
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1. The name of the faculty which manages the educational curriculum to which the discipline belongs [↑](#footnote-ref-1)
2. The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs. [↑](#footnote-ref-2)
3. The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated. [↑](#footnote-ref-3)
4. The educational classes of disciplines are: thoroughgoing study discipline (DA), advanced knowledge discipline (DCAV), synthesis discipline (DS) or complementary discipline (DC). [↑](#footnote-ref-4)
5. The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr). [↑](#footnote-ref-5)
6. The year of study to which the discipline is provided in the curriculum . [↑](#footnote-ref-6)
7. Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT or optional discipline (DO). [↑](#footnote-ref-7)
8. 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. [↑](#footnote-ref-8)
9. The total number of hours/week is obtained by summing up the number of hours from 3.1, 3.4 şi 3.8. [↑](#footnote-ref-9)
10. 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. [↑](#footnote-ref-10)
11. 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:”. [↑](#footnote-ref-11)
12. At least one title must belong to the staff teaching the discipline. [↑](#footnote-ref-12)
13. 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.) [↑](#footnote-ref-13)
14. Tc-R= Homework-Reports [↑](#footnote-ref-14)
15. For this point turn to “Ghid de completare a Fișei disciplinei” found at: <http://www.upt.ro/img/files/2018-2019/calitate/Ghid_de_completare_fisa_disciplinei.pdf> [↑](#footnote-ref-15)
16. The approval is preceeded by discussing the study program’s board’s point of view with redgards to the syllabus. [↑](#footnote-ref-16)