**SYLLABUS**

1. **Information about the program**

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| **1.1** Higher education institution |  UNIVERSITATEA POLITEHNICA TIMISOARA  |
| **1.2** Faculty[[1]](#footnote-2) / Department[[2]](#footnote-3) |  CONSTRUCTII/ CMMC  |
| **1.3** Field of study (name/code[[3]](#footnote-4)) |  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-5) | Performance Based Design of Structures / DCAV  |
| **2.2** Coordinator (holder) of course activities |  Prof. dr. ing. Aurel STRATAN  |
| **2.3** Coordinator (holder) of applied activities[[5]](#footnote-6) |  S.l. dr. ing. Adriana CHESOAN |
| **2.4** Year of study[[6]](#footnote-7) |  1  | **2.5** Semester |  2  | **2.6** Type of evaluation |  E  | **2.7** Regime of discipline[[7]](#footnote-8) |  DO  |

1. **Total estimated time** (direct activities (fully assisted), partially assisted activities and unassisted activities[[8]](#footnote-9))

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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 | 24 ,of which:  | course | 16  | 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 | 2 |
| Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays | 3.71 |
| **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 | 28 |
| Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays | 52 |
| **3.5 Total hrs./week**[[9]](#footnote-10) | 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 | * Understanding the underlying principles of nonlinear structural analysis and development of practical skills of advanced design of buildings under static and seismic actions according to Eurocodes.
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| Professional competencies ascribed to the specific competencies | * ensure compliance with security legislation; provide instructions to staff; adhere to legal regulations; develop feasibility studies; provide construction counselling; draw sketches; utilize CAD software; draft technical reports; apply numerical computing skills; evaluates the integrated design of buildings; manage data in the field of research; conducts scientific research; prepares scientific reports; applies the principles of ethics and scientific integrity in research activities
 |
| 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 | * This course aims to equip students with advanced knowledge and practical skills in structural design using non-linear analysis methods. It focuses on understanding the behaviour of structures under static and seismic loads considering geometrical and material non-linearities.
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| **7.2** Specific objectives | * To develop students’ ability to understand and model non-linear structural behaviour, applying non-linear static and dynamic analysis methods using industry-standard software. Students will learn to interpret analysis results, design according to Eurocodes, and incorporate performance-based design principles.
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**8. Content**

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| **8.1** Course | Number of hours | Of which online | Teaching methods |
| Introduction to nonlinear structural analysis |  2  |  Max 60%  |  Lecturing, conversation, explication, demonstration, web page, resources in digital format  |
|  Geometric nonlinearity and stability |  2  |   |
|  Material nonlinearity in structural components  |  2  |   |
| Nonlinear modeling techniques |  2  |   |
|  Structural design using nonlinear analysis according to Eurocodes |  2  |   |
|  Elastic structural analysis methods for seismic action |  2  |   |
|  Nonlinear static (pushover) analysis  |  2  |   |
|  Application of pushover analysis in design  |  2  |   |
|  Nonlinear dynamic analysis methods  |  2  |   |
|  Engineering characterisation of ground motion  |  2  |   |
|  Performance-based seismic design  |  2  |   |
|  Seismic design of structures with base isolation  |  2  |   |
|  Structural control: passive, active, and semi-active  |  2  |   |
|  Resilient structural systems  |  2  |   |
|  | Bibliography[[10]](#footnote-11) 1. Stratan, A. Dinamica structurilor şi inginerie seismică, Ed. Orizonturi Universitare, Timişoara, 2007. 2. Bozorgnia, Z., Bertero V. (2004). "Earthquake engineering: from engineering seismology to performance-based engineering". CRC Press, ISBN 0-8493-1439-9.3. "The seismic design handbook, 2nd ed.", Farzad Naeim (ed.), Kluwer Academic Publishers, 2001, ISBN: 0-7923-7301-4.4. EN 1993-1-1 (2005) Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings. European Committee for Standardization (CEN)5. EN 1998-1:2004. Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings.6. EN 1998-3:2005. Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings.7. FEMA 356, 2000, "Prestandard and commentary for the seismic rehabilitation of buildings", prepared by the American Society of Civil Engineers for the Federal Emergency Management Agency, Washington, D.C. (FEMA Publication No. 356).8. Applied Technology Council (2017) Guidelines for nonlinear structural analysis and design of buildings. part I - general. National Institute of Standards and Technology, Gaithersburg, MD9. Deierlein G, Reinhorn A, Willford M (2010) NEHRP Seismic Design Technical Brief No. 4 - Nonlinear Structural Analysis for Seismic Design: A Guide for Practicing Engineers | NIST  |
| **8.2** Applied activities[[11]](#footnote-12) | Number of hours | Of which online | Teaching methods |
|  Design of a steel structure using conventional code approach: loads evaluation and combinations, linear structural analysis and member design  |  4  |  Max 35% |  Presentation on the blackboard, with video projector, on the computer, conversations, explanations, examples  |
|  Design of a steel structure using non-linear analysis methods in the fundamental design situation |  8  |   |
| Modelling inelastic structural behaviour for non-linear seismic analysis |  4  |   |
|  Non-linear static (pushover) analysis. Calculation of target displacement using the N2 method and seismic performance assessment using the nonlinear static analysis. |  4  |   |
| Nonlinear dynamic analysis and performance assessment.  |  4  |   |   |
|  Nonlinear dynamic analysis of structures with base isolation or energy dissipation systems  |  4  |   |   |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
|  | Bibliography[[12]](#footnote-13) 1. Stratan, A. Dinamica structurilor şi inginerie seismică, Ed. Orizonturi Universitare, Timişoara, 2007. 2. Bozorgnia, Z., Bertero V. (2004). "Earthquake engineering: from engineering seismology to performance-based engineering". CRC Press, ISBN 0-8493-1439-9.3. "The seismic design handbook, 2nd ed.", Farzad Naeim (ed.), Kluwer Academic Publishers, 2001, ISBN: 0-7923-7301-4.4. EN 1993-1-1 (2005) Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings. European Committee for Standardization (CEN)5. EN 1998-1:2004. Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings.6. EN 1998-3:2005. Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings.7. FEMA 356, 2000, "Prestandard and commentary for the seismic rehabilitation of buildings", prepared by the American Society of Civil Engineers for the Federal Emergency Management Agency, Washington, D.C. (FEMA Publication No. 356).8. Applied Technology Council (2017) Guidelines for nonlinear structural analysis and design of buildings. part I - general. National Institute of Standards and Technology, Gaithersburg, MD9. Deierlein G, Reinhorn A, Willford M (2010) NEHRP Seismic Design Technical Brief No. 4 - Nonlinear Structural Analysis for Seismic Design: A Guide for Practicing Engineers | NIST  |

**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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| * Course content provides the student with the knowledge and expertise necessary for advanced design of structures using nonlinear analysis. The course ensures acquisition of knowledge and skills that are in line with expectations of representatives of epistemic community, professional associations and representatives of employers.
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**10. Evaluation**

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| Type of activity | **10.1** Evaluation criteria[[13]](#footnote-14) | **10.2** Evaluation methods | **10.3** Share of the final grade |
| **10.4** Course |  Demonstrate clear comprehension of non-linear analysis principles. Present answers in a logical, coherent, and concise manner.  |  Written open-book examination, two-four subjects  | 50%  |
| **10.5** Applied activities  | **S:**  |   |   |
|  | **L:**   |   |   |
|  | **P:**  Correct interpretation of results and justification of adopted solutions. Clarity and organization of the design report.  |  Oral defense of the project |  50%  |
|  | **Pr:**   |   |   |
|  | **Tc-R[[14]](#footnote-15):**  |   |   |
| **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-16) |
| * The mark for each evaluated activities must accumulate a minimum score of 5 points out of 10
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| **Date of completion** | **Course coordinator****(signature)** | **Coordinator of applied activities****(signature)** |
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| **Head of Department** **(signature)**  | **Date of approval in the Faculty Council [[16]](#footnote-17)** | **Dean****(signature)** |
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1. The name of the faculty which manages the educational curriculum to which the discipline belongs [↑](#footnote-ref-2)
2. The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs. [↑](#footnote-ref-3)
3. The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated. [↑](#footnote-ref-4)
4. The educational classes of disciplines are: thoroughgoing study discipline (DA), advanced knowledge discipline (DCAV), synthesis discipline (DS) or complementary discipline (DC). [↑](#footnote-ref-5)
5. The applied activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr). [↑](#footnote-ref-6)
6. The year of study to which the discipline is provided in the curriculum . [↑](#footnote-ref-7)
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-8)
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-9)
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-10)
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-11)
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-12)
12. At least one title must belong to the staff teaching the discipline. [↑](#footnote-ref-13)
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-14)
14. Tc-R= Homework-Reports [↑](#footnote-ref-15)
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-16)
16. The approval is preceeded by discussing the study program’s board’s point of view with redgards to the syllabus. [↑](#footnote-ref-17)