# SYLLABUS [1]

## 1. Information about the program

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|---|---|
| **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]) | Civil Engineering / 60 |
| **1.5** Study cycle | Master |
| **1.6** Study program (name/code/qualification) | ADVANCED DESIGN OF STEEL AND COMPOSITE STRUCTURES |

## 2. Information about the discipline

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|---|---|---|---|---|---|---|---|
| **2.1** Name of discipline/ formative category[5] | Performance Based Seismic Design / DA | | | | | | |
| **2.2** Coordinator (holder) of course activities | Conf.dr.ing. Aurel Stratan | | | | | | |
| **2.3** Coordinator (holder) of applied activities[6] | As.dr.ing. Adriana Chesoan | | | | | | |
| **2.4** Year of study[7] | 1 | **2.5** Semester | 2 | **2.6** Type of evaluation | E | **2.7** Type of discipline[8] | DI |

## 3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [9]

| | | | | | |
|---|---|---|---|---|---|
| **3.1** Number of fully assisted hours / week | 4 of which: | **3.2** course | 2 | **3.3** seminar / laboratory / project | 2 |
| **3.1*** Total number of fully assisted hours / semester | 56 of which: | **3.2*** course | 28 | **3.3*** seminar / laboratory / project | 28 |
| **3.4** Number of hours partially assisted / week | - of which: | **3.5** training | - | **3.6** hours for diploma project elaboration | - |
| **3.4*** Total number of hours partially assisted / semester | - of which: | **3.5*** training | - | **3.6*** hours for diploma project elaboration | - |
| **3.7** Number of hours of unassisted activities / week | 3,6 of which: | additional documentary hours in the library, on the specialized electronic platforms and on the field | | | 0,5 |
| | | hours of individual study after manual, course support, bibliography and notes | | | 0,6 |
| | | training seminars / laboratories, homework and papers, portfolios and essays | | | 2,5 |
| **3.7*** Number of hours of unassisted activities / semester | 50 of which: | additional documentary hours in the library, on the specialized electronic platforms and on the field | | | 7 |
| | | hours of individual study after manual, course support, bibliography and notes | | | 8 |
| | | training seminars / laboratories, homework and papers, portfolios and essays | | | 35 |
| **3.8 Total hours / week** [10] | 7,6 | | | | |
| **3.8* Total hours /semester** | 106 | | | | |
| **3.9 Number of credits** | 7 | | | | |

## 4. **Prerequisites** (where applicable)

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| **4.1** Curriculum | • Structural dynamics and earthquake engineering<br>• Steel structures |

[1] The form corresponds to the Discipline File promoted by OMECTS 5703 / 18.12.2011 and to the requirements of the ARACIS Specific Standards valid from 01.10.2017.
[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] The code provided in HG no.140 / 16.03.2017 or similar HGs updated annually shall be entered.
[5] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[6] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[7] Year of studies in which the discipline is provided in the curriculum.
[8] Discipline may have one of the following regimes: imposed discipline (DI), optional discipline (DO) or optional discipline (Df).
[9] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[10] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

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| | • Reinforced concrete structures<br>• Finite element analysis |
| **4.2** Competencies | • Computer operation |

**5. Conditions** (where applicable)

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| **5.1** of the course | • Engaging in phone calls or personal discussions that may distract the attention of other participants are not allowed. |
| **5.2** to conduct practical activities | • Engaging in phone calls or personal discussions that may distract the attention of other participants are not allowed. Deadline for submitting the project is strict. |

**6. Specific competencies** acquired through this discipline

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| Specific competencies | • Identification of the structural and functional role of structural components of civil, industrial and agricultural constructions.<br>• Explaining the constructive composition of different categories of civil, industrial and agricultural constructions.<br>• Graphic representation and modeling of different types of civil, industrial and agricultural constructions for the purpose of drawing up specific technical documentation.<br>• Assessing the quality of civil, industrial and agricultural construction using sector-specific assessment criteria.<br>• Identification of building materials and types of structures in construction.<br>• Description of actions and load assignments by correlation with location factors.<br>• Using the calculation methods specific to the types of structures and the design methods for the components of a civil, industrial and agricultural construction for the purpose of drawing up a specific technical documentation. |
| Professional competencies ascribed to the specific competencies | • Recognition of building elements and structures in the field of civil engineering;<br>• Design of structural components in the field of civil engineering. |
| Transversal competencies ascribed to the specific competencies | • - |

**7. Objectives of the discipline** (based on the grid of specific competencies acquired - pct.6)

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|---|---|
| **7.1** The general objective of the discipline | • The course objective is to introduce advanced topics in seismic design and analysis of civil engineering structures.<br>• After completion of the course students should be capable of establishing a performance-based design framework for assessment of seismic performance of structures, as well as effectively use static and dynamic nonlinear analysis methods. |
| **7.2** Specific objectives | • Understanding the principles of multi-objective seismic performance design and assessment.<br>• Acquirement of knowledge on modelling of structural behavior in the inelastic range of response<br>• Acquirement of knowledge on nonlinear structural analysis methods (nonlinear static and nonlinear time-history analysis)<br>• Be able to assess the seismic performance of a structure based on nonlinear analysis methods. |

**8. Content** [11]

| **8.1** Course | Number of hours | Teaching methods [12] |
|---|---|---|
| Short history of seismic-resistant design) | 2 | Lecturing, conversation, explication, demonstration, web page, resources in digital format |
| Design procedure in modern seismic design codes) | 2 | |
| Performance based design: general framework and establishing performance objectives | 2 | |
| Methods of structural analysis | 4 | |
| Numerical evaluation of dynamic response | 2 | |
| Modelling of material nonlinearity for structural analysis under seismic action | 4 | |
| Evaluation of seismic performance of the structure) | 2 | |
| Target displacement in a nonlinear static analysis: the N2 method | 2 | |
| Engineering characterisation of ground motion. Factors affecting earthquake motion | 2 | |
| Seismic hazard analysis | 2 | |
| Design of nonstructural components | 2 | |
| Seismic response control | 2 | |
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Bibliography [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 1998-1:2004. Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings.
5. EN 1998-3:2005. Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings.
6. 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).

| **8.2** Applied activities [14] | Number of hours | Teaching methods |
|---|---|---|
| Design of a steel structure (moment-resisting frame, concentrically braced frame or eccentrically braced frame) using conventional code approach | 6 | Explication, example, experiment, simulation, problematization |
| Seismic performance assessment using nonlinear static and dynamic analyses within a performance-based design framework | 22 | |
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Bibliography [15]

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 1998-1:2004. Eurocode 8: Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings.
5. EN 1998-3:2005. Eurocode 8: Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings.
6. 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).

[11] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".
[12] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).
[13] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.
[14] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".
[15] At least one title must belong to the discipline team.

**9. Corroboration 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**

- Course content provides the structural engineer with the knowledge and expertise necessary for performance based seismic design, modern tool for assessing seismic response of engineering structures. Given that Romania is affected by seismic activity, 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.

**10. Evaluation**

| Type of activity | **10.1** Evaluation criteria [16] | **10.2** Evaluation methods | **10.3** Share of the final grade |
|---|---|---|---|
| **10.4** Course | Correct and complete answer to theoretical subjects | Written exam, composed of a synthesis of acquired knowledge | 50% |
| **10.5** Applied activities | **S:** | | |
| | **L:** Solutions of problem and correct carrying on of laboratory works | Explaining the work carried out | 50% |
| | **P**[17]**:** | | |
| | **Pr:** | | |
| **10.6** Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [18]) | | | |
| • Accumulating a score of 50% | | | |

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|---|---|---|
| **Date of completion** | **Course coordinator (signature)** | **Coordinator of applied activities (signature)** |
| 29.01.2019 | …… | …… |
| **Head of Department (signature)** | **Date of approval in the Faculty Council [19]** | **Dean (signature)** |
| …… | | …… |

[16] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

[17] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.

[18] It will not explain how the promotion mark is awarded.

[19] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.