**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | SCHOOL OF ENGINEERING |
| **ACADEMIC UNIT** | DEPARTMENT OF CIVIL ENGINEERING  |
|  | UNIVERSITY OF PATRAS |
| **POSTGRADUATE PROGRAM: TITLE** | Master’s Degree "Design of Resilient, Sustainable and Intelligent Infrastructures". Tracks:(A) Resilient Materials, Structures and Geotechnical Infrastructures,(B) Hydraulic and Environmental Engineering for Sustainable Infrastructures, and (C) Intelligent Systems in Transportation and Construction Project Management |
| **LEVEL OF STUDIES** | POSTGRADUATE PROGRAM |
| **COURSE CODE** | **Α16015** | **SEMESTER** | SPRING (B’) |
| **COURSE TITLE** | STRUCTURAL ANALYSIS FOR EXTREME ACTIONS |
| **INDEPENDENT TEACHING ACTIVITIES** *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits* | **WEEKLY TEACHING HOURS** | **CREDITS** |
|  | 3 | 7.5 |
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| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* |  |  |
| **COURSE TYPE***general background, special background, specialised general knowledge, skills development* | Specialised general knowledge |
| **PREREQUISITE COURSES:** | Undergraduate courses:“Mathematics – Linear Algebra”, “Mechanics of Materials”, “Matrix Structural Analysis”, “Structural Dynamics”, “Design of RC Linear Elements”, “[Repair and Strengthening of RC Structures](http://www.civil.upatras.gr/en/ProptixiakhEkpaideysh/Mathimata/EEtos/entry/287599c2-059f-4d82-9e74-96a7b8c78cfd/?PageNo=0)” |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Νο |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1767/ |

1. **LEARNING OUTCOMES**

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| **Learning outcomes** |
| *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.**Consult Appendix A* * *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
* *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
* *Guidelines for writing Learning Outcomes*
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| At the end of this course the student will have been familiar with knowledge related to:* Inelastic analyses of RC framed structures, taking into account material and geometric nonlinearities.
* Algorithms for calculating dynamic nodal and surface loads of building structures, resulting from special load actions such as explosion, tsunami waves, wind pressure and impact.
* Processing and interpretation of the results derived from inelastic analyses for the above specific load actions, as well as for seismic action and progressive collapse of buildings.
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| **General Competences**  |
| *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?* |
| *Search for, analysis and synthesis of data and information, with the use of the necessary technology* *Adapting to new situations* *Decision-making* *Working independently* *Team work**Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*  | *Project planning and management* *Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking**……**Others…**…….* |
| * Project planning and management
* Production of free, creative and inductive thinking
* Decision-making
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1. **SYLLABUS**

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| 1. Constitutive stress-strain laws and yield and failure criteria of brittle materials for inelastic analyses.
2. Modern methods of solving nonlinear equations.
3. Material and geometric nonlinearities.
4. Simulation of structures and applied loadings.
5. Analysis of building structures for extreme actions such as: earthquake, blast, tsunami waves, wind pressure, impact and progressive collapse.
6. Applications, using specialized software.
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1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY***Face-to-face, Distance learning, etc.* | Lectures in classroom |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | * Specialized software for structural analysis.
* Support of the learning process through the electronic platform eclass.
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| **TEACHING METHODS***The manner and methods of teaching are described in detail.**Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.**The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS* |

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| ***Activity*** | ***Semester workload*** |
| Lectures | 39 |
| Project | 60 |
| Independent Study | 88.5 |
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| *Course total*  | ***187.5*** |

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| **STUDENT PERFORMANCE EVALUATION***Description of the evaluation procedure**Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other**Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | Project (100%) |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*1. Course Notes by Μ. Sfakianakis.
2. Guidelines for Design of Structures for Vertical Evacuation from Tsunamis, FEMA P-646, 2012.
3. Calculation of Blast Loads for Application to Structural Components, JRC Report EUR 26456 EN, 2013.
4. State‑of‑the‑Art Review on Responses of RC Structures Subjected to Lateral Impact Loads, Archives of Computational Methods in Engineering, **vol. 28**, pp. 2477–2507, 2021.
5. Progressive Collapse Analysis of Structures, Numerical Codes and Applications, D. Isobe, Elsevier ed., 2018.
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