**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** | **GPOL\_A\_16103** | **SEMESTER** | Spring (B’) |
| **COURSE TITLE** | Experimental methods in structural engineering |
| **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** |
| Lectures | 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:** | No |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1526/ |

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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| Desired learning outcomes:* Familiarization with experimental testing
* Use of dimensional analysis for determining properties of scaled specimens
* Design of experimental setups
* Use of technologies available for structural testing
* Operational knowledge of testing systems.

Specific knowledge and competences:* Application of dimensional analysis techniques
* Design of experimental setups for static, dynamic and hybrid tests
* Use of innovative methods for distributed testing
* Design and organization of instrumentation
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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…**…….* |
| * Search for, analysis and synthesis of data and information, with the use of the necessary technology
* Decision making
* Working independently
* Working in an interdisciplinary environment
* Project planning and management
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1. **SYLLABUS**

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| * Basic knowledge for designing an experimental campaign scope of the testing, etc.
* Dimensional analysis, similitude requirements, true and distorted models, scaled tests
* Testing methods: static, dynamic, hybrid, artificial excitation
* Principles of designing test set-ups, planning and preparation.
* Servohydraulic testing systems: loading systems (actuators, servovalves, pumps), system control (control theory, PID control, etc)
* Sensors. Principles of operation, sensor characteristics, sensor mounting. converters
* Data collection, data acquisition (hardware and software), data analysis and presentation
* Structural monitoring, in-situ artificial vibration testing
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1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY***Face-to-face, Distance learning, etc.* | In class |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Open access software tools & platformsLaboratory equipmentSupport of the learning process using the e-class platform |
| **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 (3 hours per week) | 39 |
| Home study - literature search and review | 50 |
| Laboratory tests | 25,5 |
| Elaboration of experimental data - laboratory reports | 48 |
| Homeworks | 15 |
| Final exam preparation | 10 |
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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.* | Based on1. Homework (20%)
2. Laboratory exercises (60%)
3. Final exam (20%)
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1. **SUGGESTED BIBLIOGRAPHY**

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| * ACI, SP24, ‘Models for Concrete Structures’, 1970.
* ACI, SP73, ‘Dynamic Modelling of Concrete Structures’, 1982.
* Baker, W. et al., Similarity Methods in Engineering Dynamics, Elsevier, Amsterdam, 1991
* Brückner, Steffen, ‘Dimensional Analysis Toolbox for Matlab’ Ver. 1.01, [www.sbrs.net](http://www.sbrs.net), 2002.
* Harris, H., Sabnis, G. ‘Structural Modeling and Experimental Techniques’, CRC Press, 1999.
* Abrams, D.P., Scale Relations for Reinforced Concrete Beam-Column Joints, ACI Structural Journal, 1987.
* Alonso, A., Ramirez, J.L., Fernandez, J. Advanced Testing Techniques, 14th European Conf. on Earthqake Engineering, Ohrid, 2010.
* Blondet, M. And Esparza, C. ‘Analysis of shaking table-structure interaction effects during seismic simulation tests’, Earthq. Eng. and Struct. Dyn., 16, 1988, p. 473-490.
* Conte, J.P., and Trombetti, T.L., Linear Dynamic Modeling of a Uni-axial Servo-Hydraulic Shaking Table System. Earthq. Eng. and Struct. Dyn., 29(9), 1375-1404, 2000.
* Luco, J.E., Ozcelik, O., Conte, J.P. Acceleration tracking control of the NEES-UCSD shake table, Journal of Structural Eng., ASCE, 2009, doi:10.1061/(ASCE)ST.1943-54X.0000137.
* Plummer, A.R. High-bandwidth motion control for multi-axis servohydraulic mechanisms, Proc. Int. Mechanicl Eng. Congress and Exposition, IMECE, Washington, 2007.
* Kwon, O., Nakata, N., Elnashai, A.S. & Spencer, B.F. 2005. A framework for multi-site distributed simulation and application to complex structural systems. Journal of Earthquake Engineering, 9, 741-753.
* Mosqueda, G., Stojadinovic, B. & Mahin, S. A. 2005. Implementation and accuracy of continuous hybrid simulation with geographically distributed substructures. UCB/EERC 2005-02. Earthquake Engineering Research Center. University of California, Berkeley.
* Nakashima, M. & Masaoka, N. 1999. Real-time on-line test for mdof systems. Earthquake Engineering & Structural Dynamics, 28, 393-420.
* Bousias, S., Kwon, O-S, Evangeliou, N., Sextos, A. (2014) Implementation issues in distributed hybrid simulation, 6th World Conf. of Structural Control and Monitoring, Barcelona.
* Figliola, R. and Beasley, D., 2011 Theory and Design For Mechanical Measurements, International Student Version, 5th Edition
* Austerlitz, H., 2002 Data Acquisition Techniques Using PCs,
* Steven W. Smith, 1997, The Scientist and Engineer's Guide to Digital Signal Processing.
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