**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** | CIV1755 | **SEMESTER** | | AUTUMN (A’) | |
| **COURSE TITLE** | Risk and Reliability Analysis | | | | |
| **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 |
|  | | |  | |  |
| *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* | Special background (compulsory) | | | | |
| **PREREQUISITE COURSES:** |  | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** |  | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1755/ | | | | |

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* | |
| The postgraduate student familiarizes with the use tools from probability theory, to model risk and analyze the reliability of natural and engineered systems, for the design of Civil Engineering projects under conditions of uncertainty. | |
| **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 * Working independently * Working in an interdisciplinary environment * Decision making * Production of new research ideas | |

1. **SYLLABUS**

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| 1. Review of basic principles in probability theory and statistics: Quantification of uncertainty and risk in Civil Engineering (descriptive statistics). 2. Events and their properties, independence, total probability theorem, conditional probability theorem, Bayes’ theorem. 3. Random variables and their probability distribution functions. Mean value, variance, higher order moments. Important distribution models (Bernoulli, Poisson, uniform, exponential, gamma, normal, lognormal). Censored and truncated observations, hazard and reliability functions, mean residual lifetime. Functions of random variables. 4. Random vectors and their probability distribution functions. Propagation of uncertainty. Functions of random vectors: min/max functions, sums of variables. 5. Second moment (SM) characterization of random variables and vectors, covariance and autocorrelation functions, first order second moment (FOSM) propagation of uncertainty for random variables and vectors, conditional second moment (CSM) analysis for random variables and vectors. Multivariate normal distribution. 6. Introduction to system reliability: Reliability index and its calculation based on second moment properties of random vectors. 7. Estimation of distribution parameters: General principles, method of least squares, method of moments, maximum likelihood estimation. 8. Simple and multiple linear regression. 9. Application of the developed concepts and methods in Civil Engineering. |

1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face class lectures and problem solving |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Distribution of academic material through e-class. |
| **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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Class lectures and problem solving recitation sessions. | 39 | | Independent study | 149 | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | | *Course total* | ***188*** | |
| **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.* | * Problem sets * Final written examination |

1. **ATTACHED BIBLIOGRAPHY**

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| Langousis, Α. (2018) Risk and Reliability Analysis for Infrastructures, Department of Civil Engineering, University of Patras, Greece, 146 pages (in Greek)  Benjamin, J. R., and C. A. Cornell (1970) Probability, Statistics, and Decision for Civil Engineers, McGraw-Hill. |