**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** | A16014 | **SEMESTER** | | SPRING (B’) | |
| **COURSE TITLE** | Introduction to Structural Fire 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** |
|  | | | 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 | | | | |
| **PREREQUISITE COURSES:** | Design of Reinforced Concrete Elements/Structures, Structural Materials | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | English | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes | | | | |
| **COURSE WEBSITE (URL)** | <https://eclass.upatras.gr/courses/CIV1818/> | | | | |

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 aim of the course is to educate the Track A postgraduate students in basic concepts and principles of structural fire engineering.  At the end of this course the student will:   * be able to distinguish between the sciences of Structural Fire Engineering & Fire Safety in Buildings and understand main concepts and objectives thereof; * have a general knowledge of the principles of fire and the process of fire development in closed spaces; * have an understanding regarding fire severity and fire resistance (including test-related issues); * comprehend the main codified tools for the design of structural members under fire conditions; * be able to apply simplified design procedures for the design of reinforced concrete structural members under fire; * have an in-depth understanding of the effects of fire conditions on the most-used structural materials (steel, various types of concrete, masonry, timber and glass); * be versed in fire protection strategies and systems (passive and active); * have basic knowledge on the assessment and repair methods of fire damaged structures. | |
| **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…*  *…….* |
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1. **SYLLABUS**

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| 1. Structural Fire Engineering & Fire Safety in Buildings – Definitions & Objectives  2. Principles of Fire – Process of Fire Development  2.1 Room Fire  2.2 Standard and Parametric Fire Curves  2.3 Human Behavior  3. Fire severity & Fire Resistance  3.1 Fire Resistance Domains  3.1.1 Time Domain  3.1.2 Temperature Domain  3.1.3 Strength Domain  3.2 Fire Exposure Models  3.3 Fire Severity Estimation  3.4 Fire Resistance Assessment  3.4.1 Fire Resistance Tests  3.4.2 By Calculation  3.5 Fire Resistance of Structural Elements  4. Structures Exposed to Fire (Structural Design in Fire Conditions)  4.1 Material Properties in Fire  4.1.1. Steel  4.1.2 Concrete  4.1.3 Masonry  4.1.4 Timber  4.1.5 Glass  4.2 Behavior of Structures during Fire  4.2.1. Steel Structures  4.2.2 Reinforced Concrete Structures  4.2.3 Timber Structures  5. Design of Structural Members Exposed to Fire  5.1 Structural Steel Members  5.2 Reinforced Concrete Members  6. Fire Protection  6.1 Fire detection  6.2 Active Fire Protection  6.3 Passive Fire Protection  7. Assessment & Repair of Fire Damaged Structures |

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

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| **DELIVERY** *Face-to-face, Distance learning, etc.* | Face-to-face teaching and distance learning (when necessary) |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Support of the learning process through the e-class electronic platform, projection of PowerPoint presentations and videos |
| **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*** | | Lectures | 40 | | Seminar + quiz | 5 | | Study and analysis of bibliography | 20 | | Project\_1 | 20 | | Project\_2 | 35 | | One-on-One Tutoring & Instruction | 20 | | Individual study | 50 | | ***Course total*** | ***190*** | |
| **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.* | Ι. Written final test (20%) including:  - problem solving  - short-answer questions  - multiple choice questions    ΙΙ. 2 term projects (40%, each)  Language of evaluation: English |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*   * Buchanan, A.H. and Abu, A.K., 2017. Structural design for fire safety. John Wiley & Sons. * Purkiss, J.A. and Li, L.Y., 2013. Fire safety engineering design of structures. CRC press. * Eurocodes 2 to 6 & 9, Parts 1.2 * Khoury, G., Anderberg, Y., Both, K., Fellinger, J., Høj, N. and Majorana, C., 2007. Fib bulletin 38: fire design of concrete structures—materials, structures and modelling, state-of-the art report. Federation internationale du beton, Lausanne, Switzerland. * Taerwe, L., Bamonte, P., Both, K., Denoël, J.F., Diederichs, U., Dotreppe, J.C., Felicetti, R., Fellinger, J., Franssen, J.M., Gambarova, P.G. and Høj, N.P., 2008. fib bulletin 46: Fire Design of Concrete Structures–Structural Behaviour and Assessment. State-of-the art Report, International Federation for Structural Concrete (fib TG 4.3. 2), Lausanne, Switzerland. |