**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOLS** | School of Engineering |
| **ACADEMIC UNIT/UNITS** | [Department of Civil](http://www.upatras.gr/en/node/100) Engineering |
| **TITLE OF MASTER’S DEGREE** | Resilient, Sustainable and Smart Civil Infrastructures |
| **LEVEL OF STUDIES** |  |
| **COURSE CODE** | 6013 | **SEMESTER** | 1st  |
| **COURSE TITLE** | Optimization Methods |
| **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).* | Total |  |
| **COURSE TYPE***general background, special background, specialised general knowledge, skills development* | Specialised general knowledge, skill development |
| **PREREQUISITE COURSES:** | No |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek/English |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | Yes |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1756/ |

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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| By the end of this course, the graduate student will be able to:* + Design and develop mathematical and computational optimization models related to a number of applications in the disciplines of civil engineering, project and operations management, and operations research.
	+ Implement optimization models in software for problem solution.
	+ Evaluate comparatively alternative algorithms and optimization tools in relation to the problem under consideration.
* Create a framework of solutions to support decisions for the problem under consideration.
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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…**…….* |
| By the end of this course, the student will have developed the following general abilities (from the list above):* Search for, analysis and synthesis of data and information, with the use of the necessary technology
* Decision-making
* Working independently
* Team work
* Working in an interdisciplinary environment
* Production of new research ideas
* Project planning and management
* Production of free, creative and inductive thinking
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1. **SYLLABUS**

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| 1. Mathematical optimization, linear & integer programming, Simplex method.
2. Metaheuristics, evolutionary algorithms for optimization.
3. Genetic algorithms.
4. Ant colony optimization.
5. Particle swarm optimization.
6. Simulated annealing.
7. Harmony search.
8. Differential evolution.
9. Machine learning, artificial neural networks.
10. Fuzzy systems.
11. Multi-criteria optimization, analytic hierarchy process.
12. Applications and case studies.
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1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY***Face-to-face, Distance learning, etc.* | Face-to-face |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | PowerPoint presentations as part of the lectures, laboratory education in related software, systematic use of eclass platform for course announcements and material handling, student team forming, etc. |
| **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 |
| Study and analysis of bibliography | 60 |
| Project elaboration | 68,5 |
| Essay writing | 20 |
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| 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.* | Language of evaluation: Greek/EnglishMethods of evaluation:Homework (40%).Team project (40%).Project presentation (20%).Evaluation criteria are accessible to students in:<https://eclass.upatras.gr/courses/CIV1756/> |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:** Coello Coello, C.A., Lamont, G.B, and Van Veldhuizen, D.A. (2007) Evolutionary Algorithms for Solving Multi-Objective Problems, 2nd Edition, Springer Science, ISBN 978-0-387-33254-3, e-ISBN 978-0-387-36797-2
* Relevant internet publications (keywords: Evolutionary algorithms, Evolutionary optimization, Soft Computing)

*- Related academic journals:** Selection of academic journals based on the optimization problem
* Applied Soft Computing, Elsevier
* Soft Computing, Springer
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