**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.  Department of Civil Engineering.  School of Engineering | | | | |
| **LEVEL OF STUDIES** | POSTGRADUATE PROGRAM | | | | |
| **COURSE CODE** | **GPOL\_B\_16011** | **SEMESTER** | | AUTUMN (A’) | |
| **COURSE TITLE** | SUSTAINABLE WASTEWATER DISPOSAL | | | | |
| **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 and Tutorials | | | 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:** | There are no prerequisite courses. The students must have basic knowledge of Hydraulics, Chemistry, Physics and Applied Mathematics. | | | | |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek | | | | |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | YES | | | | |
| **COURSE WEBSITE (URL)** | https://eclass.upatras.gr/courses/CIV1617/ | | | | |

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* | |
| It is a postgraduate course for the study of the system of wastewater disposal mainly to water recipients, after their treatment in the biological treatment plant, as well as for the simulation of the flow and diffusion fields of this wastewater. A basic condition is the sustainable disposal of wastewater, i.e. the ability to dispose of wastewater at such rates that the recipient maintains its environmentally acceptable quality and does not affect the aquatic ecosystem, while the disposal continues for ever.  The course material aims to inform students about the basic principles that must be followed for environmentally sound design of the disposal system, so that the disposal can be done without degrading the aquatic environment and the ecosystem. Upon successful completion of the course the student will be able to:  • Know in general the regulations and the basic principles of operation of the system of disposal of wastewater to water recipients  • Understand the potential environmental impact of waste disposal and how to deal with it  • Evaluate the hydraulic and environmental characteristics, proposes, studies and designs the appropriate disposal system  • Participate in the preparation of studies of disposal systems and environmental impact assessment  • Monitor the implementation of studies and evaluates the operation of disposal systems.  Finally, the aim of the course is to acquire basic knowledge and skills, so that graduates of the postgraduate program can use them in their professional careers as doctoral candidates, doctors or researchers, or as designers or contractors of wastewater disposal systems. In particular, at the end of this course the student will have further developed the following skills:  • Ability to demonstrate knowledge and understanding of the essential points, concepts and mechanisms related to the design of wastewater disposal systems  • Ability to apply this knowledge and understanding to the description and resolution of unfamiliar wastewater disposal problems  • Ability to adopt and apply methodologies for predicting the diffusion and dispersion of pollutants in practical problems and wastewater disposal studies, such as by means of underwater pipelines • Ability to make decisions and properly manage wastewater disposal projects  • Ability to study, lifelong learning and continuing professional development, in an interdisciplinary environment  • Ability to use this knowledge for the elaboration of studies of disposal systems, as well as for interdisciplinary cooperation in problems and studies of interdisciplinary nature  • Promoting free, creative and inductive thinking, so that it has the ability to participate in research and programs, nationally or internationally, that require a high level of knowledge and seek original ideas and solutions. | |
| **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, analysis and synthesis of data and information, using the necessary technologies  • Adaptation to new situations  • Decision making  • Autonomous work  • Teamwork  • Work in an international environment  • Work in an interdisciplinary environment  • Production of new research ideas  • Project design and management  • Respect for the natural environment  • Promoting free, creative and inductive thinking | |

1. **SYLLABUS**

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| 1 Introduction  2. Philosophy of sustainable wastewater disposal  3. Quality of recipients  4. Pollution loads  5. Impact on the environment  6. Determination of minimum waste dilution  7. Self-cleaning of recipients  8. Diffusion of wastewater pollutants  9. Turbulent buoyant jets  10. Application of the integrative method in buoyant jets  11. Two-dimensional or circular buoyant jets  12. Application of curvilinear systems in inclined two-dimensional or circular buoyant jets  13. Interaction of buoyant jets  14. Design of a sustainable wastewater disposal system.  The elaboration of the work contributes to the final grade of the course by 40% and the final examination by 60%. In case of elaboration of a different topic per student, which is delivered partially per week, there may be an exemption from the final exam, when the total grade is over 7.5 (0.0-10.0). |

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

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| **DELIVERY** *Face-to-face, Distance learning, etc.* | In the classroom face-to-face or distance learning, depending on the circumstances |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | Support Learning through 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* | |  |  | | --- | --- | | ***Activity*** | ***Semester workload*** | | Lectures | 39 | | Tutoring Exercises for the consolidation of environmental concepts, the mathematical background for solving complex problems of diffusion-dispersion of pollutants and the understanding of the designing of the individual parts of the disposal system | 6 | | Individual tutorial work on a Theme | 5 | | Related video view | 3 | | Independent home work, elaboration and writing of a Theme | 78 | | Presentation of Themes | 3 | | Individual work at home of theoretical matter of the course | 53.5 | |  |  | |  |  | | *Course total* | ***187.5*** | |
| **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.* | The elaboration of the work contributes to the final grade of the course by 40% and the final examination by 60%.  In case of elaboration of a different topic per student, which is delivered partially per week, there may be an exemption from the final exam, when the total grade is over 7.5 (0.0-10.0).  The evaluation criteria are accessible on the course website on the online e-class platform. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:*  "Wastewater Disposal", P.C. Yannopoulos, Patras, 2017, p. 204. (Notes in Greek).  *- Related academic journals:*  In order to cover the necessary knowledge of chemical and biological processes the following book is proposed:  "Sewage Treatment", St. Tsonis, Papasotiriou Publications, Athens, 2004, p. 510. (in Greek), as well as related scientific reports and papers in scientific journals. |