# COURSE OUTLINE

## (1) General information

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|---|---|---|---|
| **FACULTY/SCHOOL** | TECHNOLOGY | | |
| **DEPARTMENT** | ENVIRONMENTAL SCIENCES | | |
| **LEVEL OF STUDY** | *Undergraduate* | | |
| **COURSE UNIT CODE** | NEW **COURSE** | **SEMESTER** | $5^{th} – 7^{th}$ |
| **COURSE TITLE** | MATHEMATICAL MODELING OF ENVIRONMENTAL SYSTEMS | | |

| **INDEPENDENT TEACHING ACTIVITIES in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits** | **WEEKLY TEACHNG HOURS** | **CREDITS** |
|---|---|---|
| **THEORETICAL BACKGROUND** | 4 | 4 |
| **LABORATORY PRACTICE** | - | - |
| **TOTAL** | 4 | 4 |

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| **COURSE TYPE Background knowledge, Scientific expertise, General Knowledge, Skills Development** | Scientific area: environmental management and restoration |
| **PREREQUISITE COURSES:** | No |
| **LANGUAGE OF INSTRUCTION &EXAMINATION/ASSESSMENT:** | Greek |
| **THE COURSE IS OFFERED TO ERASMUS STUDENTS** | Yes |
| **COURSE WEBSITE (URL)** | |

## (2) LEARNING OUTCOMES

***Learning Outcomes***

*The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail.*
*It is necessary to consult:*

***APPENDIX A***

- *Description of the level of learning outcomes for each level of study, in accordance with the European Higher Education Qualifications' Framework.*
- *Descriptive indicators 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 acquaint students with mathematical models and their methodology. Mathematics has been used for many thousands of years for the study, description and utilization of phenomena of the natural world that surrounds us, but even creations of the imagination. The great usefulness of mathematics results from the ability, through their use, to make predictions for the above phenomena, in other words to create models that represent the phenomena under study. This is exactly*

*the goal of mathematical modeling. That is, the development of the mathematical description of a phenomenon, a system or a process and their study using mathematical tools. These tools can be a system of equations, a set of numbers, an algorithm, a thought process, etc.*

*The aim of the course is:*

*1. Students should be able to understand the basic concepts that are developed in the lesson.*
*2. Students should be able to a) study and understand the behavior of complex systems using Mathematics, b) use and develop new, mathematical tools needed to solve a model, c) predict / simulate (prediction). / simulation) behaviors and properties of complex systems through mathematical models, d) to control the hypotheses of the model and to contribute to its improvement.*
*3. Students should be able to apply the knowledge they will gain in the lesson, to solve environmental problems.*

**General Competences**

*Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?*

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|---|---|
| *Search for, analysis and synthesis of data and information by the use of appropriate technologies,* | *Project planning and management* |
| *Adapting to new situations* | *Respect for diversity and multiculturalism* |
| *Decision-making* | *Environmental awareness* |
| *Individual/Independent work* | *Social, professional and ethical responsibility and sensitivity to gender issues* |
| *Group/Team work* | *Critical thinking* |
| *Working in an international environment* | *Development of free, creative and inductive thinking* |
| *Working in an interdisciplinary environment* | *……* |
| *Introduction of innovative research* | *(Other…….citizenship, spiritual freedom, social awareness, altruism etc.)* |
| | *…….* |

- *Search for, analysis and synthesis of data and information by the use of appropriate technologies,*
- *Decision-making*
- *Individual/Independent work*
- *Group/Team work*
- *Environmental awareness*
- *Critical thinking*
- *Development of free, creative and inductive thinking*

## (3) COURSE CONTENT

1. Introduction - Definitions

2. Mathematical modeling process - familiarization with mathematical modeling methods: Fourier analysis, use of computational packages, adaptation with the least squares method, etc.
3. Collection and organization of data, from experimental measurements, for a specific system-phenomenon
4. Creating a mathematical model of the system, through appropriate assumptions / assumptions
5. Solve the mathematical problem by using existing ones, or by creating new, mathematical tools
6. Check the model's predictions through experimental observations
7. Improving the model and the assumptions on which it is based
8. Repetitive exercises
1)

## (4) TEACHING METHODS-ASSESSMENT

<table>
<tr><td>MODES OF DELIVERY<br>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</td><td>• Lectures<br>• Semester projects - homework</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY<br>Use of ICT in teaching, Laboratory Education, Communication with students</td><td>• Powerpoint presentation.<br>• e-mail communication.<br>• e-class theory and exercises</td></tr>
<tr><td>COURSE DESIGN<br>Description of teaching techniques, practices and methods:<br>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc.<br><br>The study hours for each learning activity as well as the hours of self-directed study are given following the principles of the ECTS.</td><td>
<table>
<tr><th>Activity/Method</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Workshop</td><td>13</td></tr>
<tr><td>Laboratory work</td><td>-</td></tr>
<tr><td>Theory study</td><td>38</td></tr>
<tr><td>Weekly individual evaluation reports for laboratory exercises</td><td>10</td></tr>
<tr><td>Course total<br>(25 hours of workload per credit unit)</td><td>100</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS<br>Detailed description of the evaluation procedures:<br><br>Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.<br><br>Specifically, defined evaluation</td><td>• Final examinations<br>• Students should watch at least half seminars<br>• Work will be given during the semester to be assessed at a rate of 30% on the final grade.<br><br><u>Final Grade</u><br>70% in Final Exams + 30% in the semester projects</td></tr>
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|---|---|
| **criteria are stated, as well as if and where they are accessible by the students.** | |

## (5) SUGGESTED BIBLIOGRAPHY:

***-Suggested bibliography***

- G. Bergeles, Computational Liquid Mechanics, Athens, 2006
- Chr. Koutitas, Computer Hydraulics, Xanthi, 1992
- Introduction to Numerical Methods for Water Resources, W.L. Wood

***-Complementary bibliography***

Teacher's notes and the full lecture material, which are available through the asynchronous education platform