COURSE OUTLINE

1. COURSE INFORMATION

SCHOOL	Chemical and Environmental Engineering		
DEPARTMENT	Chemical and Environmental Engineering		
COURSE LEVEL	Graduate		
COURSE ID	**AB308**	**SEMESTER**	Winter
COURSE TITLE	Applied Mathematics for Environmental Engineers		

COURSE MODULES *in the case of credits being awarded in distinct parts of the course eg. Lectures, Laboratory Exercises, etc. If credit units are awarded uniformly for the whole course, indicate the weekly hours of teaching and the total number of credits.*	**INSTRUCTION HOURS PER WEEK**	**CREDITS**
Lectures	4	
Laboratories		
Tutorial Exercises	1	
Total	5	5
Add rows if needed. The teaching organization and teaching methods used are described in detail in (4).		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skills Development*	Scientific area
PREREQUISITES:	Calculus, Basic Probability & Statistics, Basic O.D.E.s
INSTRUCTION/EXAM LANGUAGE:	English
THE COURSE IS OFFERED TO ERASMUS STUDENTS:	Yes
COURSE URL:	EURECA PRO LMS Moodle URL: https://moodle.eurecapro.tuc.gr/course/view.php?id=82

2. LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course describe the specific knowledge, skills and competences of an appropriate level that students will acquire after successfully completing the course.

Refer to Appendix A.

- *Description of the Level of Learning Outcomes for each course of study in line with the European Higher Education Area Qualifications Framework*
- *Descriptive Indicators of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Learning Outcomes Writing Guide*

This is an introductory graduate course on the topics: ordinary and partial differential equations, Laplace and Fourier transforms, applications of o.d.es, estimation theory, hypothesis testing, simple and multiple linear regression, chi-square goodness of fit and independence, applications of Statistics, time series (decomposition and smoothing, applications of time series to forecasting knowledge necessary to an Environmental engineer.

Using this knowledge he/she can solve, by constructing mathematical models, real life environmental problems. During the lectures, the analytical theory (in each one of the subjects) is given and mathematical models/scenarios for environmental problems are being constructed.

SPSS, MINITAB, MATLAB software are also being introduced and implemented.

Co-funded by the Erasmus+ Programme of the European Union

The goals are:

- the study of different areas of Mathematics (O.D.E, Statistics, Time series) for (real life) problem solving
- the understanding of the difference between approximation/estimation and analytical methods,
- the familiarization of the students with specialized software programs and the use of these programs in solving real problems (scenarios).

General Competencies/Skills

Considering the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and below), which one(s) the course enhances?

Search, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project design and management
Respect for diversity and multiculturalism
Respect for the natural environment
Demonstration of social, professional and moral responsibility and sensitivity to gender issues
Exercise criticism and self-criticism
Promoting free, creative and inductive thinking

All of the above

3. COURSE SYLLABUS

Content

1st week: Ordinary differential equations. Initial value problems. Separable o.d.es, linear of 1st order

2nd week: Applications of 1st order o.d.es (population, mixing, decay, dating, chemical, environmental e.t.c models)

3rd week: Second and higher order o.d.es. Applications of 2nd order o.d.es to electricity/ circuits, mechanics e.t.c.

4th week: Laplace transforms. Use of Laplace transforms to the solution of o.d.es

5th week: Applications of Laplace transforms. Fourier transforms

6th week: Probability Review. Applications of Probability

7th week: Statistics Review. Estimation theory. Confidence intervals. Applications

8th week: Hypothesis testing. Applications

9th week: Simple and multiple linear regression. Applications

10th week: Chi-square goodness of fit test. Chi-square test of independence. Applications

11th week: Time series. Characteristics of a time series. Examples

12th week: Decomposition of a time series. Forecasting with decomposition.

13th week: Smoothing of a time series. Forecasting with smoothing.

4. TEACHING and LEARNING METHODS – ASSESSMENT

LECTURE METHOD *Face to face, distance learning, etc.*	Class lectures and/or distance learning
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *Use of ICT in Teaching, in Laboratory Exercises, in Communication with students*	• Power point presentations • Use of Specialized software • E-class support/ moodle course
TEACHING ORGANISATION *Describe in detail the way and methods of teaching.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Literature review & analysis, Tutoring, Practice (Placement), Clinical Exercise, Artistic Lab, Interactive teaching, Educational visits, Project work, project, etc.* *The student's study hours for each learning activity and the hours of non-guided study according to the ECTS principles are mentioned.*	

ACTIVITY	***Workload per semester (in Hours)***
Lectures	52
Tutorials	6
Lab assignments	6
Projects	8
Autonomous study	55
Course Total (25 hours' workload/ECTS credit)	125

ASSESSMENT METHODS *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Public Presentation, Laboratory Assignment, Clinical Examination of Patients, Artistic Interpretation, Other* *Well defined student assessment criteria are mentioned. Mention whether and how the students can access them.*	• Homework problems (30%): (5 weekly homework problems- use of software needed) • Final exam in the form of Project (70%): take-home real-life scenarios/data

5. DIGITIZATION (use of tools & software)

- SPSS,
- MINITAB,
- MATLAB
- software is being introduced and implemented

6. RECOMMENDED INTERNATIONAL LITERATURE

Ordinary differential Equations

- Elementary Differential Equations and Boundary Value Problems, William E. Boyce, Richard C. DiPrima, Douglas B. Meade, 11th Edition
- Differential equations Schaum's Outline, Richard Bronson, Gabriel Costa, 5th.

Probability and Statistics

- Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 7th Edition, EMEA
- First Course in Probability, Sheldon Ross, A, 10th edition, 2019, pub. Pearson.
- Introduction to Probability and Statistics Schaum's Outline, Lipschutz Seymour, John Schiller
- Theory and problems of Statistics and Econometrics, Schaum's Outline, Dominic Salvatore,

Derick Reagle, 2nd.

Time series

- Forecasting: Principles and Practice, Rob J Hyndman and George Athanasopoulos, 3rd ed.
- The analysis of time series. An introduction, Chatfield, C., Chapman & Hall.
- Practical Time Series Forecasting: A Hands-On Guide, by Galit Shmueli, 3rd ed.

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