COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Technology		
ACADEMIC UNIT	Department of Environmental Sciences		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**AY802**	**SEMESTER**	**8th**
COURSE TITLE	**MATHEMATICAL MODELLING of ENVIRONMENTAL SYSTEMS**		
INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**	
Teaching Hours	4	4	
COURSE TYPE	General background		
PREREQUISITE COURSES	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.uth.gr/courses/ENV_U_164/		

(2) LEARNING OUTCOMES

Learning outcomes

The aim of the course is to acquaint students with mathematical models and their methodology. Mathematics has been used for thousands of years for the study, description and utilization of phenomena of the natural world that surrounds us, but also creations of the imagination. The great usefulness of mathematics results from the ability, through its 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.

Upon successful completion of the course, students will have acquired the necessary knowledge, skills and competence, and will be able to:

- Comprehend the basic concepts that are developed in the course.
- Study and understand the behavior of complex systems using Mathematics.
- Use and develop new mathematical tools needed to solve a model.
- Predict and simulate behaviors and properties of complex systems through mathematical models.
- Control the hypotheses of the model and contribute to its improvement.
- Apply the knowledge acquired in the course to solve environmental problems.

General Competences

- Search for, analysis and synthesis of data and information by the use of appropriate technologies,
- Decision-making
- Working independently
- Team work
- Criticism and self-criticism
- Production of free, creative and inductive thinking
- Environmental awareness

(3) SYLLABUS

- Introduction – Definitions.
- Mathematical modeling process - familiarization with mathematical modeling methods: Fourier analysis, use of computational packages, adaptation with the least squares method, etc.
- Collection and organization of data from experimental measurements referring to a specific system-phenomenon.
- Creating a mathematical model of the system, through appropriate assumptions / presumptions.

- Solving mathematical problems by using existing mathematical tools and/or creating new ones.
- Checking the model's predictions through experimental observations.
- Study, analysis and optimization of an environmental system using simulation methods.
- Revision exercises.

(4) TEACHING and LEARNING METHODS – EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Use of PowerPoint slides • View material in video • Visiting and using material from websites • Communication with students via e-mail • Use of asynchronous distance learning (e-class)
TEACHING METHODS	
STUDENT PERFORMANCE EVALUATION	Students' performance is evaluated in the Greek language. The final grade is determined by: • A written exam (at the end of the semester) that contributes 70% to the final grade, applying one or more of the following evaluation methods: Multiple choice questions, short-answer questions, problem solving. • Students' participation in laboratory practice activities and the preparation and delivery of related written assignments (during the semester) that contribute 30% to the final grade. **Final Grade = 70% Exam Grade + 30% Assignments Grade**

Activity	***Semester workload***
Lectures	39
Study and analysis of bibliography	38
Essay writing and presentation preparing	13
Weekly individual reports, assessment of practice exercises	10
Course total (25 hours workload per credit)	100

(5) ATTACHED BIBLIOGRAPHY

- Karatzas, G., Papadopoulou, M. (2016) *Environmental Systems Optimization Methods.* Thessaloniki: Disigma Publications (in Greek).
- Sarris, I., Karakasidis, T. (2017) *Numerical Methods and Applications for Engineers.* Thessaloniki: TZIOLA Publications (in Greek).
- Schnoor Jerald, L. (2015) *Environmental Models.* Thessaloniki: TZIOLA Publications (in Greek).