

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF MATHEMATICS		
LEVEL OF STUDIES	POSTGRADUATE Studies in Mathematics		
COURSE CODE	B3	SEMESTER	A
COURSE TITLE	MATHEMATICAL MODELS IN PHYSICAL SCIENCES		
INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS	
	3	10	
COURSE TYPE	SPECIALISED GENERAL KNOWLEDGE		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.math.aegean.gr/index.php/en/academics/undergraduate-programs		

(2) LEARNING OUTCOMES

Learning outcomes
<p>Knowledge and understanding of the notion of mathematical modelling and of the basic steps for deriving mathematical models.</p> <p>Knowledge and understanding of the derivation of the most important equations of mathematical physics.</p> <p>Ability to derive and analyze mathematical models for climate change, water flow and of similar physical, chemical or biological systems.</p>
General Competences
<p>Search for, analysis and synthesis of data and information, with the use of the necessary technology</p> <p>Working independently</p> <p>Team work</p> <p>Working in an interdisciplinary environment</p> <p>Production of free, creative and inductive thinking</p>

(3) SYLLABUS

<p>Basic Principle of mathematical modelling</p> <p>Derivation of simple mathematical models. Pollution in a lake. Models for population dynamics. The logistic equation. Diffusion of technological innovations. Kinetics of chemical reactions. A model for a chemical reactor.</p> <p>Derivation of basic PDE's. Diffusion Equation. Heat Equation. Laplace equation. Wave equation. Euler Equation. Navier Stokes Equations. Maxwell Equations.</p> <p>Methods of Mathematical Modelling. Dimensional analysis. Perturbation Methods. Regular perturbation methods. Boundary layer theory.</p> <p>Examples of Mathematical Models.</p> <p>Models for climate change (Similarity solutions). Chemical Reactions, Michaelis-Menton Reaction.</p>
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Diffusion of pollution in a lake. Flow from a high chimney etc.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Communication with students via e-mail	
TEACHING METHODS	Activity	Semester workload
	Lectures	39
	Independent study	148.5
	Assignments	62.5
	Course total (25 per ECTS)	250
STUDENT PERFORMANCE EVALUATION	<p>Student evaluation is done in Greek through a written examination which includes short-answer equations and problem solving.</p> <p>For students with disabilities, evaluation takes place via oral exams.</p>	

(5) ATTACHED BIBLIOGRAPHY

1. Mathematical Models in Applied Mechanics - A. B. Tayler, Oxford Uni. Press
2. Jerald L. Schnoor - Environmental Modeling: Fate and Transport of Pollutants in Water, Air, and Soil, Wiley, John & Sons.
3. Applied Mathematics, J.D. Logan, Wiley, John & Sons.