COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPT. OF PHYSICS		
LEVEL OF STUDIES	Graduate level		
COURSE CODE	**M121**	**SEMESTER**	
COURSE TITLE	Mathematical Methods in Physics		

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**
	4	7
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*	General Background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE 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 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*

This course aims to provide graduate students with 1) a general overview of the basic mathematical methods used in Physical Applications and 2) the essential tools in symbolic manipulation with Mathematica, Mapple, Matlab or similar symbolic languages, which are used to solve advanced problems in Physics. At the end of the course, the student must have the skills to :

i) have an in-depth understanding of all the basic mathematical methods of solving the physical problems that have been encountered in the various fields of physics. Use symbolic codes to manipulate equations and give solutions.

ii) be familiar with all the classical functions that are solutions to the fundamental physical problems.

iii) be able to choose the appropriate methodology to solve a specific problem

iv) be able to handle new problems for various new physical systems, boundary conditions, etc, and the ability to combine or find methods in new physical applications.

v) have knowledge of symbolic programming and develop codes to solve advanced problems in physics

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…* *…….*
Autonomous Work Working in an interdisciplinary environment. Promote free, creative and inductive thinking.	

(3) SYLLABUS

1. Introduction to symbolic languages (Mathematica, Mapple, Matlab etc): Basic commands, functions, integrals, solving differential equations, plots, manipulating lists, etc.
2. Complex Analysis, Vector spaces, Hilbert spaces, Integral Transformations: Applications with symbolic programming: complex integration, residues, matrices, diagonalization, orthonormal bases etc.
3. Special Functions of Mathematics and Physics (Gamma, Theta, Riemann, etc.)
5. Theory of Differential Equations. Solution of Differential Equations by the method of separation of variables; solutions with computer code.
6. Non-homogenous Differential Equations. The Green method, Green's functions
8. Integral Equations, Applications in Quantum Physics.
9) Applications in Physics. Solving problems with symbolic manipulations (Mathematica, Maple etc)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Class Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Teaching in the classroom with blackboard. Using new technologies, such as the platform of ecourse to host the courses etc.
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*	(see table below)

Activity	*Semester workload*
Classroom lectures	65
Self study	72
Solutions of exercises and problems	34
exams	4
	175

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure*	1) Homework. Solving exercises and problems during the semester

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.*	2) Problems and Physics applications with symbolic manipulations in Mathematica and Matlab. 3) Final written and oral examinations at the end of the semester where students are asked to solve problems related to the courses that have been taught.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Γ.Κ. ΛΕΟΝΤΑΡΗΣ, ΜΑΘΗΜΑΤΙΚΕΣ ΜΕΘΟΔΟΙ ΦΥΣΙΚΗΣ

2. Ι.Δ. Βεργαδος Μαθηματικές Μέθοδοι Φυσικής

3. Arfken, Weber and Harris, Mathematical Methods for Physicists, 7th Edition.

4. M. Boas, Mathematical Methods in the Physical Sciences 3rd Edition

5. Whittacker and Watson,A Course Of Modern Analysis

6) Wolfram MATHEMATICA 11.