COURSE OUTLINE

• GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPT. OF PHYSICS		
LEVEL OF STUDIES	Graduate level		
COURSE CODE	**M125**	**SEMESTER**	2
COURSE TITLE	Computational 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*	Special Background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

• 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 a general overview of the basic tools for symbolic programming.

At the end of the course, the student must have the skills to

i) have an in-depth understanding of all the basic computational commands and techniques available to compose computing codes

ii) be able to choose the appropriate commands and generate several paragraph codes to solve a specific problem

iii) be able to write and run computer programs in symbolic languages to solve new problems for various new physical systems, boundary conditions, etc, and the ability to combine or find computational methods in new physical applications.

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.	

- **SYLLABUS**

1. Introduction to Symbolic Programming with Mathematica, Maple or other similar language
2. Basic Commands for Algebraic Computations, Functions and Graphics
3. Linear Algebra, Matrices, Solutions of Equations, Vector Calculus
4. Complex Calculus with Mathematica or Maple etc
5. Differentiation and Integration, Solving Differential Equations, Special Functions
6. Numerical Integration, Numerical Solutions of Partial Differential Equations
7. Solutions of Differential Equations using computer codes in Physics: Schrodinger Equation, The Hydrogen Atom etc
8. Lists, Data handling, Discrete Mathematics etc

- **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 computer. 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
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *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.*	1) Homework. Solving exercises and problems and presenting codes with symbolic manipulation during the semester 2) Final examinations at the end of the semester where students are asked to solve problems using symbolic programming.

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

- **ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

1. An Elementary Introduction to the Wolfram Language, by S Wolfram
2. Mathematica: A Problem-Centered Approach, by Roozbeh Hazrat
3. Mathematica for Scientists and Engineers: Using Mathematica to Do Science by Richard Gass