COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10YK021**	**SEMESTER**	**3**
COURSE TITLE	**COMPUTATIONAL 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**
Lectures (theory and exercises)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized Background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS192/

(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*

In this course the students acquire the necessary knowledge, skills and competences for the numerical solution of complex problems and the simulation of complex phenomena. Using examples mostly from physics, the course introduces the students to algorithmic thinking and provides them with the basic methodologies to solve problems that cannot be addressed analytically as well as the methods to evaluate the results uncertainties.

With the completion of the course the student is able to:

- Evaluate numerically roots of equations and systems.
- Employ numerical interpolation and fitting procedures on experimental data
- Calculate derivatives and integrals
- Solve differential equations
- Perform Mont Carlo simulations
- Evaluate the results of the calculations and estimate the uncertainties of the numerical solutions
- Propose the appropriate numerical scheme according to the problem

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…
…….

The course aims at the following general competences:

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Working independently
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Critical thinking
Time management
New Technology skills
Learning C/C++, python, MATLAB, programming language ...
Learning root or equivalent
Creativity
Self control skills
Meeting Deadlines and Keeping Schedules
Problem solving

(3) SYLLABUS

- Algorithms and their computer implementation. Numerical calculations and uncertainties. Random number generators. Inverse transform method. Rejection sampling. Frequency diagrams (histograms).
- Least squares method.
- Solution of equations in one variable. Solution of algebraic systems.
- Polynomial interpolation. Numerical differentiation. Numerical integration.
- Solution of ordinary differential equations.
- Introduction to numerical integration and simulation of physical phenomena by the Monte-Carlo method.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Yes Electronic communication with the students using ICT (Information and Communications Technology) Computer-aided lectures, use of Overhead Projectors, eclass platform
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*	

Activity	Semester workload
Lectures	26
Exercises	*26*
Individual Study/ Study and Analysis of bibliography / Preparation	40
Writing reports/ essays	55
Exams	3
Course Total	**150**

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.*	Final written exams in Greek Open-ended questions, Problem solving. Oral examination, when necessary. Written essays with submission deadlines.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography

- Αριθμητική Ανάλυση, Ν. Μισυρλής, Εκδόσεις ΤΣΟΤΡΑΣ (2022)
- Αριθμητικές Υπολογιστικές Μέθοδοι στην Επιστήμη και τη Μηχανική, Pozrikidis C, ΕΚΔΟΣΕΙΣ ΤΖΙΟΛΑ (2006)
- Αριθμητική Ανάλυση με εφαρμογές σε MATHEMATICA και MATLAB, Γ. Παπαγεωργίου, Χ. Τσίτουρας, ΕΚΔΟΣΕΙΣ Α. ΤΣΟΤΡΑΣ (2015)
- Υπολογιστική Φυσική, Κ. Αναγνωστόπουλος, Ηλεκτρονικό Βιβλίο (2016)
- Σημειώσεις Διδασκόντων