INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS						
SCHOOL	SCHOOL OF SCIENCE						
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS						
COURSE LEVEL	UNDERGRADUATE						
COURSE TITLE	**Advanced Scientific Computing**						
COURSE CODE	**ΘΠ18**		**Semester**	**7**	**ECTS**	**6**	
TEACHING HOURS per week	**THEORY**	**3**	**SEMINAR.**	**1**	**LABORATORY**		
COURSE TYPE	Track Compulsory (EYM)						

K	**E1**	**E2**	**E3**	**E4**	**E5**	**E6**
A	E					

URL	https://eclass.uoa.gr/courses/D185/
EXPECTED PRIOR KNOWLEDGE/ PREREQUISITES AND PREPARATION:	Recommended Compulsory K15 Numerical Analysis
TEACHING AND EXAMINATIONSLANGUAGE:	GREEK
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO

COURSE CONTENT
The subject of the course is quite broad for one semester since the area of Scientific Computing is developing very fast as it has a lot of applications in many sciences. Numerical simulation is a significant tool for the study of scientific problems which arise in sciences like Physics, Chemistry, Geology, Biology, Economics etc. Most of these problems end up with the solution of a system of Ordinary or Partial Differential equations which can only be solved numerically. The goal is the student to obtain the necessary knowledge in order to be able to develop not only the most efficient numerical algorithm but also its corresponding software for the study of scientific problems by simulation. The course covers the study of numerical solution methods for Ordinary and Partial Differential equations which consist the core of the Scientific Computations. Special emphasis is given on the practical application. In particular the syllabus consists of the following: **Part I** Numerical methods for the solution of Ordinary Differential Equations : methods of Euler, Taylor, Truncation and roundoff errors, Consistency, Convergence and Stability. Second, third and fourth order Runge

– Kutta methods, Errors and Stability. Multiple step methods: Adams-Bashforth, Predictor-Corrector, Consistency, Convergence and Stiffness. Boundary Value Problems : Method of finite differences. **Part II** Introduction to finite differences. Numerical solution of Parabolic Equations : One dimensional Parabolic equations, Direct methods, Crank-Nicolson, Convergence, Stability. Two dimensional Parabolic equations : Direct methods, Iterative methods (ADI). Three dimensional Parabolic equations. Numerical solution of Elliptic equations : Iterative methods (SOR, SSOR). Numerical solution of Hyperbolic equations : Direct and Iterative methods.
STUDENT LEARNING OBJECTIVES
Teaching-Learning Goals-Expected Learning Outcomes To introduce students to the development and implementation of numerical algorithms for the solution of ordinary and partial differential equations. Upon successful completion of the course the student will be able to: • Design and develop a numerical algorithm for an initial or a boundary value problem which involves an ordinary or a partial differential equation • Evaluate and compare the efficiency of two different algorithms for the numerical solution of the same problem • Develop scientific software for the simulation of physical phenomena

TEACHING AND LEARNING METHODS - ASSESSMENT	
TEACHING METHOD	In Class (Face to Face)
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Learning process supported by the e-class platform. In particular, slide presentation of course and laboratory lectures, Discussions, Announcements, Task assignments and submissions, Student groups, Laboratory assignments, External Links of electronic books, notes, chapters, lectures, international Laboratories and Job announcements. Email communication Live transmission of lectures Ability to track recorded lectures http://opencourses.uoa.gr/courses/DI108/
TEACHING ORGANIZATION *Describe in detail the way and methods of teaching:* *Enhanced Lectures,* *Online Lectures,* *Seminars,* *Tutorial,* *Laboratory,* *Laboratory Exercise,* *Study & analysis of literature,* *Practice (Positioning),*	The theory and the tutorials are presented by slides. Students are required to submit 4 individual assignments which require the design, development and evaluation of algorithms implemented in C and /or MatLab. The students have the possibility of taking advice through discussions in eclass or during office hours.

Interactive teaching, *Developing a project,* *Individual / group work* *Telework (reference to tools)etc.* *Details of the student's study hours for each learning activity and hours of non-guided study are shown to ensure that the total workload at the semester corresponds to the ECTS*	**Activity** / ***Student Workload*** *(hours)* Lectures: 39 Tutorial: 13 individual assignments: 50 Independent Study: 48 ***Total Course***: ***150***
ASSESSMENT OF STUDENTS *Description of the assessment process* *Assessment Methods, Formative or Concluding, Multiple Choice Test, Quick Response Questions, Test Development Questions, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Other / Other* *Fully defined evaluation criteria are mentionedand if and where they are accessible to students.*	The students are required to submit 4 individual assignments and take the final exam. The final exam is a problem solving type and covers the theoretical part of the course while the individual assignments require implementation of algorithms and cover the programming part. Students are eligible to access their written exam paper as well as their assignments and make comments on the evaluation. **Assessment methods** / ***Number*** / ***Percentage*** Written examination: 1: 80% Individual assignments: 4: 20%

LITERATURE AND STUDY MATERIALS / READING LIST

1. M. Vraxatis, Numerical Analysis : Ordinary Differential Equations, Kleidarithmos, 2012. https://service.eudoxus.gr/search/#s/%CE%92%CF%81%CE%B1%CF%87%CE%B1%CF%84%CE%B7%CF%82/0

2. Nikolaos Missirlis, Numerical Analysis : An algorithmic approach, Publication by National and Kapodistrian University of Athens, 2017. https://service.eudoxus.gr/search/#s/%CE%91%CF%81%CE%B9%CE%B8%CE%BC%CE%B7%CF%84%CE%B9%CE%BA%CE%AE%20%CE%91%CE%BD%CE%AC%CE%BB%CF%85%CF%83%CE%B7/0