NUMERICAL METHODS FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
DEPARTMENT	CIVIL ENGINEERING/ MSc APPLIED MATHEMATICS		
LEVEL OF STUDIES	**MSc - LEVEL 7**		
COURSE CODE		**SEMESTER**	2nd SEMESTER
COURSE TITLE	NUMERICAL METHODS FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	3	7,5
Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	Scientific area
PREREQUISITES:	NO
TEACHING & EXAMINATION LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass.duth.gr/courses/TMB361/

2. LEARNING OUTCOMES

Learning Outcomes

Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

After completing the course, postgraduate students will be able to:
• Identify the class of differential equation and the type of problem according to the initial and boundary conditions.
• To approximate the solution of a 2nd order partial differential equation by choosing the appropriate method according to the data of the problem.
• To adjust the number of computational operations by shaping the step within the area under investigation.
• To find the numerical solution of a problem according to some limitations and characteristics of a numerical method, such as accuracy, stability and computing time of its application.
• Construct and apply the methodology-algorithm for solving the initial-boundary value problem.
• To check the convergence and stability of a numerical method.

General Skills

- Search, analysis and synthesis of data and information, using the necessary technologies.
- Autonomous work.
- Production of free, creative and inductive thinking.
- Decision making.

3. COURSE CONTENT

Approximation of partial derivatives using Finite Differences. Classes of Partial Differential Equations and known problems. Initial and boundary condition problems. Direct and indirect methods. Numerical solution of Parabolic Equations, Elliptic Equations and Hyperbolic Equations. Convergence, stability.

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Distance learning
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT technologies in Teaching and Communication with students

TEACHING ORGANIZATION *The ways and methods of teaching are described in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.* *The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.*		
	Activity	**Workload/semester**
	Lectures	39
	Research & Analysis	0
	Review studies	108
	Examinations	3
	Total	150

STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam,*	Examinations

5. SUGGESTED BIBLIOGRAPHY

- Δουγαλής, Β. (2013). Finite element methods for the numerical solution of partial differential equations. Αθήνα. (Πανεπιστημιακές Σημειώσεις)

- Ciarlet, P. G. (2002). The finite element method for elliptic problems (Vol. 40). Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA

- "Αριθμητική επίλυση μερικών διαφορικών εξισώσεων", Π. Χατζηπαντελίδης, & Μ. Πλεξουσάκης, Κάλλιπος, (2015).

-Partial differential equations with numerical methods, S. Larsson, & V. Thomée, Springer-Verlag, Berlin, 2009.

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	Avrilia Konguetsof
Contact details:	akogkets@civil.duth.gr
Supervisors: (1)	NO
Evaluation methods: (2)	Written examination by distance learning methods
Implementation Instructions: (3)	• Failure to enter or entry at an unscheduled time will result in the student being disqualified from the exam. • Throughout the exam, examinees are connected to MS Teams and should have an open microphone so that there is uninterrupted audio contact between the examinee and the examiner. At the same time, they should immediately activate their microphone and camera in case they are asked for identification. • Required technological equipment: Ability to connect to the internet, use a camera, speakers, microphone, ability to scan/photograph the manuscript and create a pdf or compressed file in case of more than one page of response to a topic. • For the written exam, the examinees: (1) they will read the topics that will be posted in the eclass in the "Tasks" of the course one by one, (2) they will write their answer in Ms-Word (3) they will create a pdf or compressed zip/rar file and (4) they will upload it to eClass – Assignments - Submit Assignment, in a predetermined time (for each

| | topic will be given a time proportional to its difficulty and extent) CAUTION! The file must be readable, otherwise they cannot be corrected and will be rejected. • Within the framework of actions for the protection of personal data, it is prohibited to record the examination process in any way, as well as to record or publish or post on websites or share with third parties or transmit or distribute in any way all or part of the distance examination. Also, it is the students' responsibility to protect their personal data by showing only what is required on camera. • Non-compliance of examinees with the rules of the examination and a finding of fraud on their part will result in the application of the plagiarism provisions. In the case of inability to participate in a remote assessment, the decision of the Rector's Council of the IFT will be made. |

(34) Please write YES or NO

(35) Note down the evaluation methods used by the teacher, e.g.

6. *written assignment* or/and exercises
7. written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(36) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises:** the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and any other necessary information.

b) in case of **oral examination with distance learning methods:** the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.