a) General

School	ENGINEERING		
Academic unit	MECHANICAL ENGINEERING		
Level of studies	Undergraduate		
Course code	MM907E01	*Semester*	7
Course title	**Numerical methods of partial differential equations**		

Independent teaching activities	*Weekly teaching hours*	*ECTS*
Lectures	4	4.0
Laboratory exercises		

Course type	Knowledge deepening/consolidation
Course category	Compulsory Elective for Direction 1 & 2
Prerequisite courses	-
Language of instruction and examinations	Greek / English
Is the course offered to Erasmus students	Yes
Course website (url)	https://eclass.uniwa.gr/courses/MECH115/

b) Learning outcomes and general competences

b1. Learning outcomes

Upon successful completion of this course, the student will be able to:

- Recognize and describe the practical engineering applications where the usage of numerical methods of differential equations and computational techniques can be helpful to obtain solutions,
- Distinguish between various computational fluid mechanics and continuous mechanics methodologies and apply the most suitable for each case,
- Apply the most suitable numerical procedures to solve project of differential equations and to write a complete technical report,
- Evaluate the numerical results arouse in the solution of various practical fluid flow or structural problems and suggest possible optimal treatment.

b2. General competences

- Search for, analysis and synthesis of data and information with the use of the necessary technology
- Working independently
- Team work
- Working in an international environment

c) Syllabus

Ordinary and partial differential equations, Finite differences, meshing, body fitted boundary conditions, equations discretization, errors, consistency, stability and convergence conditions, direct and indirect numerical methods of one and multidimensional parabolic, hyperbolic and elliptic equations, FTCS, Crank-Nicolson, Upwind, Lax-Wendroff, MacCormack methods, ADI algorithm, numerical stability and von Neumann analysis, conservative equations, linearization of non-linear differential equations, Berger equation, Flux Vector Splitting method.

d) Teaching and learning methods - Evaluation

Delivery	Face-to-face, Laboratory and/or Distance learning.
Use of information and communications	- Commercial/free/open source software - Multimedia applications

technology	- MS Teams/Moodle/eclass	
Teaching methods	*Activity*	*Semester workload*
	Lectures	39
	Tutorials	13
	Laboratory exercises	0
	Computational exercises	13
	Individual work	65
	Course total	130
Student performance evaluation	Intermediate and final exams	

e) Suggested bibliography

1. Hofmann, J.D. (1992). Numerical methods for engineers and scientists. CRC Press.
2. Anderson, D.A., Tannehill, J.C. & Pletcher, R.H. (1997). *Numerical Heat Transfer & Fluid Flow*. Taylor & Francis.
3. Versteeg, H.K. & Malalasekera, W. (1995). *An introduction to computational fluid dynamics: The finite volume method*, Longman.
4. Chung, T.J. (1978). *Finite Element Analysis in Fluid Dynamics*, McGraw-Hill, New York.
5. Peyret, R. & Taylor, T.D. (1983). *Computational Methods for Fluid Flow*, Springer, New York.