a) General			
School	ENGINEERING		
Academic unit	MECHANICAL ENGINEERING		
Level of studies	Undergraduate		
Course code	MM109E03	*Semester*	9
Course title	**Introduction to computational fluid dynamics**		

Independent teaching activities	*Weekly teaching hours*	*ECTS*
Lectures	4	4.5
Laboratory exercises		

Course type	Knowledge deepening/consolidation
Course category	Compulsory Elective for Direction 1
Prerequisite courses	-
Language of instruction and examinations	Greek
Is the course offered to Erasmus students	Yes
Course website (url)	https://eclass.uniwa.gr/courses/MECH116/

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 computational fluid mechanics can be helpful to obtain solutions,
- Distinguish between various computational fluid mechanics methodologies and apply the most suitable for each case,
- Apply the most suitable numerical procedures to solve each project and to write a complete technical report,
- Evaluate the numerical results arouse in the solution of various practical fluid flow and heat transfer 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

The course objective is to familiarize the students with the method of computational fluid mechanics and to teach them the basic steps for the solution of simple flows. During the course, a comprehensive mathematical description of the governing equations of the flow and transport properties and the basic numerical methods for their solution is discussed. The basic equation of diffusion, advection-conduction are solved using the finite difference method and the solution is extended to flow equations. Elliptic, parabolic, and hyperbolic type of flows are solved by the suitable numerical techniques. Finally, a comprehensive introduction to other techniques like the finite element and spectral methods is discussed.

d) Teaching and learning methods - Evaluation

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

<table>
<tr><td>communications technology</td><td colspan="2">- Multimedia applications
- MS Teams/Moodle/eclass</td></tr>
<tr><td rowspan="7">Teaching methods</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Tutorials</td><td>13</td></tr>
<tr><td>Laboratory exercises</td><td>0</td></tr>
<tr><td>Computational exercises</td><td>13</td></tr>
<tr><td>Individual work</td><td>65</td></tr>
<tr><td>Course total</td><td>130</td></tr>
<tr><td>Student performance evaluation</td><td colspan="2">Intermediate and final exams</td></tr>
<tr><td colspan="3">e) Suggested bibliography</td></tr>
</table>

1. Anderson, D.A., Tannehill, J.C. & Pletcher, R.H. (1997). *Numerical Heat Transfer & Fluid Flow*. Taylor & Francis.
2. Versteeg, H.K. & Malalasekera, W. (1995). *An introduction to computational fluid dynamics: The finite volume method*, Longman.
3. Chung, T.J. (1978). *Finite Element Analysis in Fluid Dynamics*, McGraw-Hill, New York.
4. Peyret, R. & Taylor, T.D. (1983). *Computational Methods for Fluid Flow*, Springer, New York.
5. Patankar, S.V. (1980). *Numerical Heat Transfer and Fluid Flow*, Taylor and Francis.