<table>
<tr><td>Course Title</td><td colspan="5">Theory and applications of incompressible Newtonian and non-Newtonian fluids</td></tr>
<tr><td>Course Code</td><td colspan="5">MMK 518</td></tr>
<tr><td>Course Type</td><td colspan="5">COMPULSORY</td></tr>
<tr><td>Level</td><td colspan="5">MASTER/PHD</td></tr>
<tr><td>Year / Semester</td><td colspan="5">WINTER SEMESTER</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">An academic position vacancy has been announced to meet the teaching needs of this field</td></tr>
<tr><td>ECTS</td><td>8</td><td>Lectures / week</td><td>2 X 1,5 AN HOUR</td><td>Laboratories / week</td><td>NO</td></tr>
<tr><td>Course Purpose and Objectives</td><td colspan="5">The purpose of the course is the teaching of the basic principles of incompressible fluid flows kai training of the students to the solution of problems found in industry.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">The students will
• learn the basic principles of incompressible fluid mechanics at the macroscopic and differential level,
• be trained to the analytical and numerical solution of typical problems that often found in a professional career,
• be able to derive the governing equations for fluid flow and pertinent boundary conditions based on the problem of interest,
• find the analytical solution of the flow and
• use the finite elements method to solve numerically flow problems.</td></tr>
<tr><td>Prerequisites</td><td colspan="2">NO</td><td>Required</td><td colspan="2">NO</td></tr>
<tr><td>Course Content</td><td colspan="5">The course covers the basic principles of flow for Newtonian and non-Newtonian fluids as well as methods for solution of standard flow problems. The objective of the course is to cover in depth both the theory of incompressible fluids and the applications in several aspects of the human activity and technology including biological flows (e.g., blood), industrial processes (plastic and food technology), flows involved in hydrocarbons mining (with the use of fluids with special properties).
More specific the materials covered are:
(1) Basic physical laws such as conservation of mass, linear momentum and energy for open and closed systems,
(2) Application of these laws in differential form to study in detail fluid kinematics, such as flow streamlines, velocity potential, flow deformations, internal stresses, boundary conditions, etc.
(3) Constitutive description of Newtonian and non-Newtonian fluids and principles of Rheology,
(4) Dimensionless analysis of flow equations and in-depth discussion of important dimensionless numbers,
(5) Analytical solution of flows and their applications,
(6) Introduction to computational fluid mechanics and general description of basic computational methods such as a) finite differences, b) finite volumes and c) finite elements</td></tr>
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	In depth study of the principles of the finite elements method and its application for the solution of linear and non-linear problems of fluid mechanics with common applications. The course also involves a series of laboratory exercises.
Teaching Methodology	Lectures 3 hours per week / Tutorials or lab exercise 1 hour per week Lectures. The teaching methodology is based on the “deductive reasoning” method, which means that the theory and the applications of it are presented first in a general form and subsequently they are specialized for the particular problems. There is continuous communication with the instructor and active participation of the students in the class. During the first week of the semester the instructor hands in the Syllabus of the course to the students, which includes all information about the materials covered by the course, the learning outcomes, the evaluation and the office hours.
Bibliography	A Alexandrou ,Principles of Fluid Dynamics, Prentice Hall J. N. Reddy, An Introduction to the Finite Element Method, McGraw-Hill
Assessment	Homework assignments (10%), midterm exam (30%), final exam (60%)
Language	GREEK OR ENGLISH