<table>
<tr><td>Course Title</td><td colspan="5">Fluid Mechanics I</td></tr>
<tr><td>Course Code</td><td colspan="5">ME 202</td></tr>
<tr><td>Course Type</td><td colspan="5">Compulsory</td></tr>
<tr><td>Level</td><td colspan="5">BSc Level</td></tr>
<tr><td>Year / Semester</td><td colspan="5">2nd year / 4th semester</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Dr.-Ing. Paris A. Fokaides</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>3</td><td>Laboratories/week</td><td>1</td></tr>
<tr><td>Course Purpose</td><td colspan="5">Fluid mechanics is the branch of physics concerned with the mechanics of fluids and the forces on them. Fluid Mechanics has applications in a wide range of disciplines, including mechanical engineering. Fluid mechanics is an exciting and fascinating subject with unlimited practical applications ranging from microscopic biological systems to automobiles, airplanes, and spacecraft propulsion.

The objectives of this course are
- To cover the basic principles and equations of fluid mechanics
- To present numerous and diverse real-world engineering examples to give students a feel for how fluid mechanics is applied in engineering practice
- To develop an intuitive understanding of fluid mechanics by emphasizing the physics, and by attending laboratory exercises

By completion of the course, students will be able to analyse real case studies in fluid statics (fluids at rest) and fluid dynamics, where the effect of forces on fluid motion is examined.

Students are assumed to have an adequate background in calculus, physics and engineering mechanics.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">1. Understand the basic concepts of fluid mechanics and recognize the various types of fluid flow problems encountered in practice
2. Have a working knowledge of the basic properties of fluids and understand the continuum approximation
3. Have a working knowledge of viscosity and the consequences of the frictional effects it causes in fluid flow
4. Determine the variation of pressure in a fluid at rest
5. Calculate the forces exerted by a fluid at rest on plane or curved submerged surfaces
6. Analyze the rigid-body motion of fluids in containers during linear acceleration or rotation
7. Understand the role of the material derivative in transforming between Lagrangian and Eulerian descriptions
8. Distinguish between various types of flow visualizations and methods of plotting the characteristics of a fluid flow
9. Apply the mass equation to balance the incoming and outgoing flow rates in a flow system</td></tr>
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	10. Recognize various forms of mechanical energy, and work with energy conversion efficiencies 11. Understand the use and limitations of the Bernoulli equation, and apply it to solve a variety of fluid flow problems 12. Work with the energy equation expressed in terms of heads, and use it to determine turbine power output and pumping power requirements 13. Have a deeper understanding of laminar and turbulent flow in pipes and the analysis of fully developed flow 14. Calculate the major and minor losses associated with pipe flow in piping networks and determine the pumping power requirements 15. Understand the different velocity and flow rate measurement techniques and learn their advantages and disadvantages		
Prerequisites	AMAT122 Calculus and Analytic Geometry II	Corequisites	
Course Content	**1. Introduction and Basic Concepts** - The No-Slip Condition - Classification of Fluid Flows - System and Control Volume - Importance of Dimensions and Units - Mathematical Modeling of Engineering **2. Properties of Fluids** - Density and Specific Gravity - Vapor Pressure and Cavitation - Energy and Specific Heats - Coefficient of Compressibility and of Volume Expansion 44 - Viscosity - Surface Tension and Capillary Effect **3. Pressure and Fluid Statics** - Pressure at a Point and Variation of Pressure with Depth - The Manometer and Other Pressure Measurement Devices - Introduction to Fluid Statics - Hydrostatic Forces on Submerged Plane Surfaces - Hydrostatic Forces on Submerged Curved Surfaces - Buoyancy and Stability - Fluids in Rigid-Body Motion **4. Fluid Kinematics** - Lagrangian and Eulerian Descriptions - Fundamentals of Flow Visualization - Plots of Fluid Flow Data - Other Kinematic Descriptions		

	5. Mass, Bernoulli and Energy Equations - Conservation of Mass - Mass and Volume Flow Rates - Mass Balance for Steady-Flow Processes - Mechanical Energy and Efficiency - The Bernoulli Equation - Static, Dynamic, and Stagnation Pressures - Limitations on the Use of the Bernoulli Equation - General Energy Equation - Energy Analysis of Steady Flows **6. Flows in pipes** - Laminar and Turbulent Flows - The Entrance Region] - Laminar Flow in Pipes - Turbulent Flow in Pipes - Piping Networks and Pump Selection - Flow Rate and Velocity Measurement **Laboratory Exercises:** 1. Lab Exercise 1: Fluid Viscosity 2. Lab Exercise 2: Buoyant Force 3. Lab Exercise 3: Flow rate in a water channel 4. Lab Exercise 4: Venturi Meter 5. Lab Exercise 5: Friction Losses 6. Lab Exercise 6: Impact of a jet
Teaching Methodology	The teaching methodology of this course will be based on lecturing, demonstrating and collaborating. - Lecture notes, comprising of the fundamentals of each module of the course will be prepared and presented in class on a weekly basis. The notes will introduce the major concepts and will focus on specific learning outcomes of the course. - Demonstration activities including the solution of worked examples in class on a weekly basis, as well as laboratorial work will also be employed. For each fundamental concept, at least one worked example will be solved during lectures. The laboratory work will cover all major topics of the course, allowing the students to personally relate to the presented knowledge. - Collaborating teaching through classroom discussion and debriefing will also be encouraged during lectures. Besides from the notes taken by students in class, all of the course material will be made available through the class website and also through

	the eLearning platform. The instructor will also be available to students during office hours or by appointment in order to provide any necessary tutoring.
Bibliography	Textbook: Cengel, Y. A., & Cimbala, J. M. (2006). Fluid Mechanics Fundamentals and Applications. McGraw-Hill Education. References: Selected scientific papers from following journals: - Experiments in Fluids – Elsevier - Journal of Fluid Mechanics – Cambridge University Press - Fluid Dynamics Research – IOP Publishing - Physics of Fluids – AIP Publishing
Assessment	Students will be assessed through: - Biweekly quiz concerning the laboratory exercises - A midterm test at the 7th week of the course, examining the properties of fluids, the pressure and fluid statics, and the pressure kinematics - A final test at the end of the semester, in which all material will be examined. The weights of the course assessment are as follows: Lab Quiz: 20% Midterm Exams: 20% Final Exams: 60%
Language	English