Course Syllabus

Course: *Fluid Mechanics*

Department: *Engineering*

Host Institution: *University of Nicosia, Cyprus*

UNIVERSITY of NICOSIA | Global Semesters

Course Summary

Course Code	Course Title	ECTS Credits
MENG-280	Fluid Mechanics	6
Subject	**Contact Hours**	**Prerequisites**
Engineering	42-45	Calculus II
Department	**Level of Course**	**Language of Instruction**
Engineering	Upper-Division	English

Course Description

The main objectives of the course through lecture and laboratory exercises are to:

- Introduce student to the subject of fluid mechanics;
- Present the system and control volume approaches for analysing fluid behaviour;
- Explain the continuum hypothesis, viscosity, Newtonian & Non-Newtonian fluids;
- Outline the fundamentals of fluid statics, hydrostatics and floating bodies;
- Appreciate the utility of differential analysis;
- Familiarize attendees with the fundamental fluid flow equations;
- Cover fluid kinematics and dynamics;
- Express the Bernoulli equation and dimensional analysis;
- Introduce the Navier-Stokes equations;
- Introduce and explain the basic characteristics of turbulent flow and energy losses;
- Analyse lift generation and aerodynamics;
- Elaborate on the importance of compressible and isentropic fluid flow;
- Relate fluid mechanics to real-world and research applications, including a general introduction to experimental fluid mechanics and computational fluid dynamics.

Prerequisites *(if applicable)*

Calculus II

Learning Outcomes

After completion of the course students are expected to be able to:

- Recognise the characteristics of fluids and their behaviour;
- Utilize the system and control volume fluid methods of analysing flows;
- Distinguish between different systems of dimensions;
- Appreciate the notion of viscosity, Newtonian & non-Newtonian fluids;

- Tackle basic engineering problems associated with hydrostatic forces, buoyancy, and stability of floating & submerged bodies;
- Apply the conservation of mass & continuity equations;
- Understand fluid motion;
- Characterise rotational and irrotational flows;
- Understand fluid circulation and lift-generation;
- Discern the subtleties of stream functions and the velocity potential;
- Apply the Bernoulli and energy equations to understand fluid behaviour;
- Use dimensional analysis and non-dimensionalisation;
- Appreciate the importance of Navier-Stokes equation;
- Comprehend the basic features of turbulent flow and energy losses;
- Calculate lift generation and basic aerodynamic parameters;
- Provide hands on laboratory experience through a basic laboratory experiment (e.g. hydrostatic pressure, flow in Venturi tubes, pressure & energy losses).

Course Outline

Week 1-

- Types of fluids (liquid & gases). The Lagrangian & Eulerian descriptions for system and control volume fluid methods.
- Dimensions, units, and systems of dimensions for fluid mechanics. The Continuum hypothesis and velocity fields (steady & unsteady flows).

Week 2-

- Newtonian & non-Newtonian fluids the influence of Viscosity. Pressure, hydrostatic forces, buoyancy, floating & submerged bodies.
- The Integral and differential types of analyses.

Week 3-

- Conservation of mass & continuity equation. Motion and deformation of fluid elements.
- Fluid vorticity, rotational and irrotational flows.

Week 4-

- Midterm
- Circulation and lift-generation. Stream function and the velocity potential.

Week 5-

- Bernoulli and energy equations.
- Introduction to dimensional analysis and non-dimensionalisation.

Week 6-

- Description of the Euler and Navier-Stokes equations and introduction to turbulent flows.
- Final examination.

Evaluation and Grading

Midterm, Final exam and project assignment

Readings and Resources

Required Texts:

Y. A. Çengel and J. M. Cimbala, Fluid Mechanics: Fundamentals and Application, McGraw Hill, 2017, ISBN 125-9-69-653797-81259696534

Optional Reading:

White M. Frank, Fluid Mechanics, 7th ed., McGraw-Hill, 2009, ISBN 978-0-07-352934-9

Katz Joseph, Introductory Fluid Mechanics, Cambridge University Press, 2010, ISBN 978-0-521-19245-3

Other Academic Policies

Class attendance is compulsory. If unable to attend a class, students must inform the course lecturer in advance. A maximum of 20% excused absences is tolerated; however beyond this percentage, students will be withdrawn from the course. Moreover, any work missed due to absence must be completed on return to class.