Sabanci University
Faculty of Engineering and Natural Sciences

ME307 Fluid Dynamics

Fall 2020

SCOPE

Course is a standard presentation of the subject at the undergraduate level to study motion of fluids and their interaction with solids. The scope includes properties of fluids such as density, viscosity and surface tension, basic physical models to calculate pressure in hydrostatic fluids and inviscid flows, flow rate and pressure drop in viscous pipe flows, drag and lift forces on solid objects in flows, application of conservation laws on control volumes, basic similitude analysis, turbomachinery such as pumps and turbines and open-channel flows.

OBJECTIVES

The course aims to teach students the basic mathematical models based on conservation laws of fluids and the use of such models in engineering problems that are dealt with in hydrostatics, aerodynamic objects, pipe networks, turbomachinery and alike.

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to understand fundamental aspects of fluid mechanics and mechanisms of fluidic devices such as pumps, compressors, flow meters, and pressure measurement devices, and solve certain problems in fluid statics, internal and external flows.

TEACHING METHODS

Online synchronous lectures focus on the delivery of fundamental material with the help of slides and on-slide notes. Students must turn on cameras during lectures to demonstrate their attendance as well as active participation.

Recitation hours will be dedicated to problem solving.

TEXTBOOK & RECOMMENDED READINGS

The following standard textbooks will be used throughout the course. Students must read and complete the examples in the text to learn the material presented in the course.

Fundamentals of Fluid Mechanics, BR Munson, DF Young, TH Okiishi, Wiley
Fluid Mechanics, F.M. White, McGraw-Hill

There are several texts on the subject some of which are available in the library.

GRADING

In-class quizzes: 20%. Quizzes will be held at least once a week or more.
Two online midterm exams: 20 % each. Students must have webcams and make sure turn them towards their desk. Make-up oral exams will be held if necessary.
Online final exam: 25 %
Take-home quizzes (aka homework): 15 % (disciplinary action if cheating, plagiarism & collusion)

Attendance is required, attending less than 70% of the lectures is a letter grade down, less than 50% is an F. (Quiz responses and participant lists in online lectures will be used as attendance)

ACADEMIC HONESTY

Cheating, plagiarism and collusion in all aspects of grading (midterm and final exams, take-home quizzes and attendance) are serious offenses and will be subject to disciplinary action. In particular, but not limited to, **copying** solutions from a classmate or from any source available in written form will not be tolerated.

SCHEDULE

Reading assignments are provided in the last column of the table for guidance in your preparation to lectures and exams.

SUGGESTED PREPARATION

Try to form study groups of 2-3 people. Discuss how the homework problems and other problems at the end of each chapter can be solved. Don't do the homework together. You should be able to solve any of the problems at the end of each chapter. In-class problem solving during lectures will be very limited, don't rely on it. Lectures will have emphasis on the flow phenomena, physics, assumptions, equations that describe the phenomena and very basic examples. Recitation hours will have emphasis on the solution of selected problems only. Homework will complement the recitations. Problems in the exams will have the same difficulty as the homework, and will be based on the concepts taught in lectures.

Week	Date	Subject
1	W	Introduction: Syllabus, motivation for fluid mechanics
	F	Properties of fluids: Viscosity, compressibility, surface tension; shear stress, and dimensional homogeneity.
2	W	Fluid Statics: Pressure, pressure measurement, hydrostatic force
	F	Buoyancy force
3	W	Elementary fluid dynamics: The Bernoulli equation
	F	Streamlines, forces on streamlines, stagnation, flowrate measurement
4	W	Examples of the Bernoulli equation.
	F	Fluid kinematics and streamlines
5	W	Control volume analysis, conservation of mass
	F	Conservation of momentum and energy (Bernoulli),
6	W	Conservation of angular momentum
	F	Inviscid flow, Potential flows
7	W	Differential analysis of fluid flow: Kinematics, Continuity, Conservation of Linear Momentum
	F	Conservation of Linear Momentum
8	W	Viscous flow
	F	Laminar flows **Midterm I will be held approximately in the 8 the week during recitation hours.**
9	W	Dimensionless groups in fluid mechanics
	F	Viscous pipe flow
10	W	Dimensional analysis and losses
	F	Pipe flow examples, flow measurement
11	W	General characteristics of external flows and boundary Layers
	F	Drag force
12	W	Lift force
	F	Design of turbomachinery **Midterm II will be help approximately in the 12th week during recitation hours.**
13	W	Design of turbomachinery, Centrifugal Pumps
	F	Axial and mixed flow pumps, fans and turbines
14	W	Thermodynamics relationships of gasses
	F	Mach number and speed of sound, isentropic compressible flows