

Çankaya University
Faculty of Engineering
Mechanical Engineering Department
ME 303 FLUID MECHANICS I

Instructor:

Prof. Dr. Haşmet TÜRKÖĞLU

Teaching Assistant:

Res. Assist. Eyüp KOÇAK

Office Hour: Monday 14:30 or by appointment (Zoom meeting)

Course Content:

Introduction, fundamental concepts and fluid properties, description and classification of fluid motion, fluid statics, buoyancy and stability, concepts of system and control volume, derivation and application of basic equations in integral form for a control volume, laminar and turbulent flows in pipes and ducts, major and minor losses, analysis of pipe systems.

Textbook:

Introduction to Fluid Mechanics, R. W. Fox, P. J. Pritchard and A. T. McDonald, John Wiley & Sons, Inc., Ninth Edition.

Reference Books:

1. Introduction to Fluid Mechanics, Donald F. Young, Bruce R. Munson, Theodore H. Okiishi and Wade W. Huebsch, John Wiley & Sons, Inc., Fifth Edition.
2. Mechanics of Fluids, M. C. Potter and D. C. Wiggert, Prentice Hall, Second Edition.

Course Objective:

To introduce basic properties of fluids and importance of fluid mechanics in engineering applications. To teach formulation and application of basic methods employed for analysis of engineering problems involving fluids.

Course Outcomes:

1. Students know basic fluid properties, fundamental laws and methods used for analysis of fluids at rest and in motion.
2. Students will be able to derive and use the equation of fluid statics.
3. Students will be able to use the fundamental laws and basic principles to derive the fundamental equations in integral form.
4. Students will be able to use integral equations for flow analysis.
5. Students will be able to analyze the flows in pipe systems.

COURSE PLAN

Week	Topics
1	INTRODUCTION: Definition of fluid, fluid mechanics in engineering, scope of fluid mechanics, methods of analysis, dimensions and units.
2	FUNDAMENTAL CONCEPTS: Definition of continuum, fluid as a continuum, velocity field, timeline, pathline, streakline and streamline. Stress field.
3	FUNDAMENTAL CONCEPTS: Viscosity, Newtonian and non-Newtonian fluids, vapor pressure and surface tension, description and classification of fluid motion.
4	FLUID STATICS: The basic equation of fluid statics, analysis of hydrostatic force on plane submerged surfaces.
5	FLUID STATICS: Analysis of hydrostatic force on curved submerged surfaces. Buoyancy and stability.
6	FLUID STATICS: Analysis of fluids in rigid-body motion.
7	BASIC EQUATIONS FOR A SYSTEM: Conservation of mass, momentum, moment of momentum and energy equations.
8	BASIC EQUATIONS IN INTEGRAL FORM FOR A CONTROL VOLUME: Derivation of Reynolds transport equation. Derivation and application of conservation of mass for a control volume.
9	BASIC EQUATIONS IN INTEGRAL FORM FOR A CONTROL VOLUME: Derivation and application of momentum equations for a control volume.
10	BASIC EQUATIONS IN INTEGRAL FORM FOR A CONTROL VOLUME: Derivation and application of moment of momentum and conservation of energy equations for a control volume.
11	ANALYSIS OF INTERNAL INCOMPRESSIBLE FLOW: Derivation of extended Bernoulli equation. Calculation of major and minor head losses and usage of tables and graphs.
12	ANALYSIS OF INTERNAL INCOMPRESSIBLE FLOW: Flow analysis in serial system of pipes.
13	ANALYSIS OF INTERNAL INCOMPRESSIBLE FLOW: Flow analysis in parallel system of pipes.
14	ANALYSIS OF INTERNAL INCOMPRESSIBLE FLOW: Analysis of pipe networks, analysis of interconnected reservoir systems.

Assessment Criteria:

Quizzes: 15% (Best 4 out of 5 quizzes)	
Attendance: 5%	
Midterm Exam: 40% (2 exams)	
Final Exam: 40% (in class)	

NOTES:

1. All the lectures will be in class according to the scheduled program.
2. Class notes will be uploaded on the course weonline page. Every student should print the class notes and have it ready during the lectures.
3. In the notes, some of the derivations and problem solutions left blank to be completed in the class (lecture). In lectures, these derivations and problem solutions will be completed. Students are expected to take notes during the lectures on blank spaces left.
4. Every student **MUST** be able to use weonline well, should be able to download and upload files.

