

# Fluid Mechanics I, II

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**Prerequisites** Dynamics, Mathematics

## Topics Covered

1. Basic concepts
2. Static Fluids
3. Control Volume Theorems (Integral Approach): Linear Momentum Theorem, Angular Momentum Theorem, First and Second Laws of Thermodynamics
4. Mass Conservation
5. Differential Approach of Fluid Flow: Navier-Stokes Equation
6. Inviscid Flow (Differential Approach): Euler's Equation, Bernoulli's Integral, and the Effects of Streamline Curvature
7. Potential Flow, Lift, Drag, and Thrust
8. Similarity and Dimensional Analysis
9. Internal Viscous Flow
10. Navier-Stokes Equation and Viscous Flow
11. Boundary Layers, Separation and the Effect on Drag and Lift
12. Vorticity and Circulation
13. Surface Tension and its Effect on Flows
14. Compressible steady Flow
15. Introduction to Turbulence (**if time**)

The main purpose of this course is to help students develop a mastery of the underlying principles and the ability to solve, quickly and efficiently, a variety of real fluid mechanics problems from first principles. The lectures present and illustrate the fundamental laws and the methods and modeling approximations that form the basis of fluid mechanics.

## Textbooks

The suggested text is: Robert W. Fax, A. T. McDonald, *Introduction to Fluid Mechanics*. This book is strongly recommended and readings from it will be assigned.

Another book is: Frank M. White, *Fluid Mechanics, Fourth Edition*

The following book is required for all students, as the source of most assigned homework problems: Shames, *Mechanics of Fluids*

## Homework Problems

Homework problems are indicated in the course outline for each topic. Detailed solutions for some of the problems will be prepared by the Teaching Assistant.

It is necessary for all students to solve and turn in the homework problems.

## Examinations

There will be two midterm exams during the term, announced well in advance. There will be a three-hour final exam. Quizzes and the exam will permit a limited number of pages of **open notes** (and a calculator and a book of mathematical formulas and tables). No other books will be allowed.

The quizzes and the exam will not present you with routine problems, but will probe for mastery of the underlying material and for skill in modeling problems in the simplest possible realistic terms.

## Grading

Activities	Percentages	Activities	Percentages
Mid Term 1	20 %	Quiz, Homework	10 %
Mid Term 2	20 %	Final Exam	50 %