## Chapter I: Introduction

1.1 Brief History of Fluid Mechanics
1.2 Definition of a Fluid
1.3 Basic Equations
1.4 Method of Analysis
1.5 Dimensions and Units

## Chapter II: Fundamental Concepts

2.1 Fluids and Continuum Concept
2.2 Characteristics of a Fluid
2.3 Viscosity
2.4 Newtonian versus Non-Newtonian Fluids
2.5 Characteristics of a Flow
2.6 Important Dimensionless Parameters
2.7 Description and Classification of Fluid Motions

## Chapter III: Fluid Statics

3.1 Basic Equations
3.2 Hydrostatic Force on a Plane Submerged Surface
3.3 Hydrostatic Force on Curved Submerged Surfaces
3.4 Hydrostatic Force on Submerged Bodies (Buoyancy Forces)
3.5 Fluids in Rigid-Body Motions

## Chapter IV: Control Volume Formulation

4.1 Basic Laws for a System
4.2 Reynolds Transport Theorem
4.3 Lagrangian vs. Eulerian viewpoints
4.4 Conservation of Mass
4.5 Momentum Equation for Inertial Control Volume
4.6 Momentum Equation for Control Volume with Rectilinear Acceleration
4.7 The Angular Momentum for Fixed Control Volume
4.8 The Angular Momentum for Rotating Control Volume

## Chapter V: Differential Formulation

5.1 Continuity Equation
5.2 Stream Function for 2-D Incompressible Flow
5.3 Motion of a Fluid (Kinematics)
5.4 Material Derivative
5.5 Lagrangian vs. Eulerian viewpoints (Revisited)
5.6 Fluid Rotation
5.7 Circulation
5.8 Potential Function
5.9 Fluid Deformation
5.10 Momentum Equations (Navier-Stokes Equations)

**Chapter VI: Incompressible Inviscid Flow**

6.1 Euler's Equation
6.2 Euler's Equation in Streamline Coordinates
6.3 Bernoulli Equation
6.4 Static, Stagnation and Dynamic Pressures
6.5 Energy and Hydraulic Grade Lines
6.6 Unsteady Bernoulli Equation
6.7 Bernoulli Equation for Irrotational Flow

**Chapter VII: Potential Flow**

7.1 Velocity Potential
7.2 Governing Equation and Bondary Conditions
7.3 Elementary Plane Flows
7.4 Superposition of Elementary Plane Flows

**Chapter VIII: Dimensional Analysis and Similarity**

8.1 Motivation
8.2 The Principle of Dimensional Homogeneity
8.3 The Rayleigh Method
8.4 Buckingham Pi Theorem
8.5 Important Dimensionless Group
8.6 Flow Similarity and Model Studies
8.7 Complete and Incomplete Similarity
8.8 Dimensionless Navier-Stokes Equation

**TEXT: Class Notes**

**Grading: The following weights will be used for grading:**

| | |
|---|---|
| Homeworks and Quizzes | 10% |
| Midterm | 30% |
| Final Exam | 60% |
| Total | 100% |

**List of References:**


- *Fluid Mechanics*, V. Esfahanian, University of Tehran Publications, (In Persian).
- *Introduction to Fluid Mechanics*, R. W. Fox and A. T. McDonald, John Wiley & Sons.
- *Fundamentals of Fluid Mechanics*, B. R. Munson, D. F. Young and T. H. Okishi, John Wiley & Sons.
- *Mechanics of Fluids*, I. H. Shames, McGraw Hill.
- *Fluid Mechanics*, F. M. White, McGraw Hill.