# **Table of Contents**

## Fundamental Concepts

- 1-1. Introduction
- 1-2. Characteristics of Matter
- 1-3. Systems of Units
- 1-4. Calculations
- 1-5. Problem Solving
- 1-6. Basic Fluid Properties
- 1-7. Viscosity
- 1-8 Viscosity Measurement
- 1-9. Vapor Pressure
- 1-10. Surface Tension and Capillarity

#### Fluid Statics

- 2-1. Pressure
- 2-2. Absolute and Gage Pressure
- 2-3. Static Pressure Variation
- 2-4. Pressure Variation for Incompressible
- 2-5. Pressure Variation for Compressible Fluids
- 2-6. Measurement of Static Pressure
- 2-7. Hydrostatic Forces on Plane Surfaces
- 2-8. Hydrostatic Forces on an Incline Plane or Curved SurfaceDetermined by Projection
- 2-9. Buoyancy
- 2-10. Stability

- 2-11. Constant Accelerated Translation of a Liquid
- 2-12. Steady Rotation of a Liquid.

#### Kinematics of Fluid Motion

- 3-1. Types of Flow Description
- 3-2. Types of Fluid Flow
- 3-3. Graphical Descriptions of Fluid Flow
- 3-4. Fluid Acceleration
- 3-5 Streamline Coordinates
- 3-6. The Reynolds Transport Theorem

### Conservation of Mass

- 4-1. Rate of Flow and Average Velocity
- 4-2. Continuity Equation

## Energy of Moving Fluids

- 5-1. Eulers Equations of Motion
- 5-2. The Bernoulli Equation
- 5-3. Applications of Bernoullis Equation
- 5-4. Energy and the Hydraulic Gradient
- 5-5. The Energy Equation

#### Fluid Momentum

- 6-1. The Linear Momentum Equation
- 6-2. The Angular Momentum Equation
- 6-3. Propellers
- 6-4. Applications for Control Volumes Having Rectilinear Accelerated Motion

- 6-5. Turbojets
- 6-6. Rockets

### Differential Fluid Flow

- 7-1. Differential Analysis
- 7-2. Kinematics of Differential Fluid Elements
- 7-3. Circulation and Vorticity
- 7-4. Conservation of Mass
- 7-5. Equations of Motion of a Fluid Particle
- 7-6. The Euler and Bernoulli Equations
- 7-7. The Stream Function
- 7-8. The Potential Function
- 7-9. Basic Two-Dimensional Flows
- 7-10. Superposition of Flows
- 7-11. The Navier-Stokes Equations
- 7-12. Computational Fluid Dyanmics

## Dimensional Analysis and Similitude

- 8-1. Dimensional Analysis
- 8-2. Important Dimensionless Numbers
- 8-3. The Buckingham Pi Theorem
- 8-4. Similitude

### Viscous Flow Within Enclosed Surfaces

- 9-1. Steady Laminar Flow between Parallel Plates
- 9-2. Navier-Stokes Solution for Steady Laminar Flow Between Parallel Plates

- 9-3. Steady Laminar Flow Within A Smooth Pipe
- 9-3. Laminar and Turbulent Shear Stress Within a Smooth Pipe
- 9-4. Navier-Stokes Solution for Steady Laminar Flow Within a Smooth Pipe
- 9-5. The Reynolds Number
- 9-6. Laminar and Turbulent Shear Stress Within a Smooth Pipe
- 9-7. Fully Developed Flow From an Entrance
- 9-8. Turbulent Flow Within a Smooth Pipe

### Analysis and Design for Pipe Flow

- 10-1. Resistance to Flow in Rough Pipes
- 10-2. Losses Occurring From Pipe Fittings And Transitions
- 10-3. Single Pipeline Flow
- 10-4. Pipe Systems
- 10-5. Flow Measurement

### Viscous Flow Over External Surfaces

- 11-1. The Concept of the Boundary Layer
- 11-2. Laminar Boundary Layers
- 11-3. The Momentum Integral Equation
- 11-4. Turbulent Boundary Layers
- 11-5. Laminar and Turbulent Boundary Layers
- 11-6. Drag and Lift
- 11-7. Pressure Gradient Effects
- 11-8. The Drag Coefficient
- 11-9. Methods for Reducing Drag

# 11-10. Lift and Drag on an Airfoil

### *Turbomachinery*

- 12-1. Types of Turbomachines
- 12-2. Axial-Flow Pumps
- 12-3. Ideal Performance for Axial-Flow Pumps
- 12-4. Radial-Flow Pumps
- 12-5. Turbines
- 12-6. Pump Performance
- 12-7. Cavitation and Net Positive Suction Head
- 12-8. Pump Selection Related to the Flow System
- 12-9. Turbomachine Similitude

### Open Channel Flow

- 13-1. Types of Flow in Open Channels
- 13-2. Wave Celerity
- 13-3. Specific Energy
- 13-4. Open Channel Flow Over a Rise
- 13-5. Open Channel Flow Through a Sluice Gate
- 13-6. Steady Uniform Channel Flow
- 13-7. Gradual Flow With Varying Depth
- 13-8. The Hydraulic Jump
- 13-9. Weirs

### Compressible Flow

14-1. Thermodynamic Concepts

- 14-2. Wave Propagation Through a Compressible Fluid
- 14-3. Types of Compressible Flow
- 14-4. Isentropic Stagnation Properties
- 14-5. Isentropic Flow Through a Variable Area
- 14-6. Isentropic Flow Through Converging and Diverging Nozzles
- 14-7. Normal Shock Waves
- 14-8. Shock Waves in Nozzles
- 14-9. Oblique Shocks
- 14-10. Compression and Expansion Waves
- 14-11. Compressible Flow Measurement