

No	Information of every subject	
1	Unit name:	Fluid Mechanics I
2	Code:	ME-41016
3	Classification:	Engineering subject
4	Credit value:	2.5
5	Semester/ Year Offered:	1/2
6	Pre-requisite:	EM in Differentiate, Integrate, Basic Engineering Thermodynamics Engineering Mechanics (Statics)
7	Mode of delivery:	Lecture, Practical
8	Practical	20%
	Mid-term/ final Examination	70%
	Viva	5%
	Tutorial	5%
9	Academic staff teaching unit:	
10	<p>Course outcome of unit:</p> <p>a. To solve the shear stress and various forces and various circumstances</p> <p>b. To apply manometry for measurements of pressure.</p> <p>c. To calculate the hydrostatic forces and moments on planar and curved submerged and floating surfaces.</p> <p>d. To solve the dynamic fluid forces using the linear momentum equation (Newton's second laws of motion)</p>	
11	<p>Synopsis of unit:</p> <p>This course is an introduction of fluid mechanics and emphasizes fundamental concepts a problems solving techniques. Topic to be covered includes fluids properties, fluid static, fluid kinematic, control volume analysis, dimensional analysis, internal flow (pipe flow) and differential analysis.</p>	
12	<p>Topics and Contact Hours:</p> <p>1 Properties of Properties of Fluids</p> <p> 1.1 Development of Fluid Mechanics</p> <p> 1.2 Definition of Fluid</p> <p> 1.3 Dimensions and Units</p> <p> 1.4 Mass, Density, Specific Weight and Specific Gravity</p>	

- 1.5 Viscosity
- 1.6 Bulk Modulus
- 1.7 Gas Law
- 1.8 Isothermal, Adiabatic and Polytropic Process
- 1.9 Vapour Pressure
- 1.10 Surface Tension Capillary Fluids
- 1.11 Capillary

2 Pressure Measurement

- 2.1 Pressure
- 2.2 Pascal's Law
- 2.3 Pressure Variation with Depth of Liquid
- 2.4 Pressure Variation with Depth in a Compressible Fluid
- 2.5 Pressure Variation with Altitude in the atmosphere
- 2.6 Hydraulic Jack
- 2.7 Absolute, Gauge and Vacuum Pressure
- 2.8 Measurement of Atmospheric Pressure
- 2.9 Measurement of Gauge Pressure
- 2.10 Other Types of Gauges
- 2.11 Manometers

3 Hydrostatic Forces on Surfaces

- 3.1 Total Hydrostatic Pressure
- 3.2 Center of Pressure
- 3.3 Hydrostatic Pressure on Inclined Planes
- 3.4 Lateral Position of the Center of Pressure
- 3.5 Hydrostatic Pressure on Curved Surfaces
- 3.6 Gravity Dams
- 3.7 Lock Gates
- 3.8 Total Pressure and Center of Pressure for Layered Liquids

4 Buoyancy and Flotation

- 4.1 Principle of Buoyancy
- 4.2 Stability of Floating Bodies

- 4.3 Analytical Method for Determination of Metacentric Height
- 4.4 Experimental Method for Determination of Metacentric Height
- 4.5 Floating Body Anchored at Base
- 4.6 Floating Body with Bilge Water (or) Liquid Ballast
- 4.7 Transverse oscillations of a floating body

7 Dynamics of Fluid Flow

- 7.1 Introduction
- 7.2 General Energy Equations
- 7.3 Euler's Equation
- 7.4 Derivation of Bernoulli's Equation from Euler's Equation
- 7.5 Bernoulli's Equation as Energy Equation
- 7.6 Bernoulli's Equation for Real Fluids
- 7.7 Application of the Bernoulli Equation
- 7.8 Impulse Momentum Equation
- 7.9 Application of Impulse Momentum Equation
- 7.10 Sudden Enlarge in a Pipe
- 7.11 Jet Propulsion
- 7.12 Jet Propulsion of Ships
- 7.13 Propellers
- 7.14 Vortex Motion
- 7.15 Forced Vortex Motion
- 7.16 Free Vortex Motion
- 7.17 Radial Flow of a Liquid
- 7.18 Spiral Vortex Motion
- 7.19 Jet Trajectory

11 Fundamentals of Flow through Pipes

- 11.1 Introduction
- 11.2 Reynolds' Experiment on Flow through Pipes
- 11.3 Darcy- Weisbach Equation
- 11.4 Definition
- 11.5 Empirical Formulae

- 11.6 Minor Losses
- 11.7 Pipe Discharging from a Reservoir
- 11.8 Pipe Connecting Two Reservoirs
- 11.9 Pipes in Series
- 11.10 Pipes in Parallel
- 11.11 Flow through a By –pass
- 11.12 Siphon
- 11.13 Pipes connecting Three Reservoirs
- 11.14 Branch Mains
- 11.15 Pipe Network
- 11.16 Loss of Head in a pipe with varying Discharge
- 11.17 Loss of Head in Non- Circular Conduits
- 11.18 Transmission of Power
- 11.19 Flow through a Nozzle Fitted to a pipe
- 11.20 Flow in Pipe Bends
- 11.21 Equivalent Pipe Length
- 11.22 Time of Discharge from one Reservoir to the Other
- 11.23 Water Hammer
- 11.24 Loss of Head in Tapering Pipe
- 11.25 Pipe Line with a Pump or a Turbine

12 Fundamentals of Flow through Open Channels

- 12.1 Introduction
- 12.2 Types of Open Channels
- 12.3 Types of Flow
- 12.4 Definitions
- 12.5 Chezy's Formula
- 12.6 Determination of Chezy's C
- 12.7 Manning's Formula
- 12.8 Most Efficient Cross-section
- 12.9 Rectangular Channels
- 12.10 Trapezoidal Channels
- 12.11 Economical Side Slopes of Trapezoidal Section

- 12.12 Triangular Channels
- 12.13 Circular Channels
- 12.14 Open Channel Section for Constant Velocity
- 12.15 Velocity Distribution in Open Channels
- 12.16 Measurement of Velocity
- 12.17 Measurement of Discharge
- 12.18 Measurement of Discharge in Irregular Channels
- 12.19 River Bends

14 Dimensional Analysis

- 14.1 Introduction
- 14.2 Dimensions
- 14.3 Units
- 14.4 Dimensional Homogeneity
- 14.5 Application of the Principle of Dimensional Homogeneity
- 14.6 Dimensional Analysis
- 14.7 Rayleigh's Method
- 14.8 Buckingham's π Theorem
- 14.9 Dimensional Analysis of a General Flow Problem
- 14.10 Comparison of the Rayleigh and Buckingham Methods
- 14.11 Superfluous Variables
- 14.12 Omitted Variables
- 14.13 Uses of Dimensional Analysis
- 14.14 Limitations of Dimensional Analysis

15 Hydraulic Similitude

- 15.1 Introduction
- 15.2 Similitude
- 15.3 Force Ratios
- 15.4 Models of Submerged Objects
- 15.5 Models of Hydraulic Structures
- 15.6 Ship Models

	<p>15.7 Pressure Conduit Models</p> <p>15.8 Distorted Models</p> <p>15.9 Models of River and Open Channels</p> <p>15.10 Scale Effect</p> <p>15.11 Uses and Limitations of Hydraulic Similitude</p> <p>20 Uniform Flow in Open Channels</p> <p>20.1 Introduction</p> <p>20.2 Definitions</p> <p>20.3 Conveyance (K)</p> <p>20.4 Non- Dimensional Forms of the Conveyance Curves</p> <p>20.5 Problems of Uniform Flow Computation</p> <p>20.6 Total Energy in Open Channels</p> <p>20.7 Specific Energy</p> <p>20.8 Criterion of Critical Depth</p> <p>20.9 Critical Depth in Rectangular Channels</p> <p>20.10 Section Factor for Critical Flow</p> <p>20.11 Critical Depth in Non-Rectangular Channels</p> <p>20.12 Computation of Critical Flow</p> <p>20.13 Control Sections</p> <p>20.14 Channel Transitions</p> <p>20.15 Flow Measurement</p>
14	<p>Main references:</p> <p>Fluid Mechanics, Hydraulics and Hydraulic Machines by Dr. K.R.ARORA</p>
15	<p>Additional references:</p> <p>Fundamentals of Fluid Mechanics (6th Edition)</p> <p>Bruce r. Munson</p> <p>Donald f. Young</p> <p>Fundamentals of Fluid Mechanics (Fundamentals and Applications)</p> <p>By YUNUS A.SENGEL</p> <p>JOHN M. CIMBALA</p>

