

Subject Code: 01ME0301
Subject Name: Fluid Mechanics
B.Tech. II Year – (Sem-3) Mechanical & Automobile Engineering
Type of course: Science

Prerequisite: NIL

Rationale: Understanding the fluid flow phenomena and different types of flow.

Teaching and Examination Scheme:

| Teaching Scheme(Hours) | | | Credits | Evaluation Scheme | | | | | Total Marks |
|-------------------------|----------|-----------|---------|-------------------|----|-----|-----------------|----------------|-------------|
| Theory | Tutorial | Practical | | Theory Marks | | | Practical Marks | | |
| | | | | ESE (E) | IA | CSE | Viva (V) | Term Work (TW) | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

COURSE OUTCOME

- 1** To identify the fundamentals of Fluid mechanics and define the terminology.
- 2** To distinguish between the types of fluid flow.
- 3** Apply the basic equation of fluid statics on the plane, curved surfaces, manometers,
- 4** Application of continuity and momentum equation, Bernoulli equation.
- 5** Apply principles of dimensional analysis and similitude to simple problems and use of dimensionless parameters.
- 6** Ability to analyze fluid flow problems with the application of momentum and energy equation and analyze pipe flow problems.

| SR NO | CONTENTS | TOTAL HOURS | WEIGHTAGE |
|-------|--|-------------|-----------|
| 1 | PROPERTIES OF FLUID AND PRESSURE AND HEAD: Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, density, viscosity, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus. Pascal's Law and Hydrostatic law, Pressure measurement- manometers and piezometers. | 6 | 12 % |

| | | | |
|---|--|----|------|
| 2 | STATIC FORCES ON SURFACES AND BOUYANCY: Fluid static, action of fluid pressure on surface, resultant force and center of pressure - plane surface ,plane surface immersed in a liquid, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacenter, relative to the center of buoyancy. | 8 | 16 % |
| 3 | FLUID KINEMATICS AND FLUID DYNAMICS: Fluid kinematics: Fluid flow and different types of flow , Lagrangian and Eulerian description of fluid flow - Velocity and acceleration of fluid particles - Stream, streak and path lines, Continuity equation (one, two and three dimensional forms) ,Velocity Potentials and Stream Functions Fluid dynamics: Euler's equation of motion along a stream line - Bernoulli's equation. Practical applications of Bernoulli's equation in flow measurement devices like venturimeter, orificemeter and pitot tube, elementary Theory of notches, Concept of impulse momentum equation & angular momentum principle with applications. | 11 | 22 % |
| 4 | TWO-DIMENSIONAL IDEAL FLUID FLOW: Rotational and ir-rotational flow, circulation and vorticity, streamlines and the stream functions, velocity potential and potential flow, relation between stream function and velocity potential; flow nets, stream function and velocity potential for uniform flow, vortex flow. | 5 | 10 % |
| 5 | VISCOUS FLOW AND TURBULANT FLOW: Reynolds number, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, movement of piston in dash pot, methods of measurement of viscosity, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes. | 10 | 20 % |
| 6 | FLOW THROUGH PIPES: Darcy-Weisbach equation, major and minor losses in pipes, pipe friction, parallel, series and branched pipes. | 6 | 10 % |
| 7 | COMPRESSIBLE FLOW: Basic equations for one dimensional, compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties. | 6 | 10 % |

Distribution of Theory Marks

| R Level | U Level | A Level | N Level | E Level |
|---------|---------|---------|---------|---------|
| 15 | 20 | 25 | 25 | 15 |

Legends: R: Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, **and E:** Evaluate

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
5. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd
6. Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.
7. Laboratory Manual Hydraulics and Hydraulic Machines by R V Raikar

List of the Experiment

- 1 Verification of Bernoulli's theorem.
- 2 To determine the Friction factor for the different pipes.
- 3 To determine the loss coefficients for different pipe fittings.
- 4 To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturi meter and Nozzle meter.)
- 5 To measure the velocity of flow using Pitot tube.
- 6 To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular or V notch)
- 7 To determine the different types of flow Patterns by Reynolds's experiment
- 8 To determine the viscosity of fluid by viscometer (Redwood or Saybolt).
- 9 To determine metacentric height of floating body.
- 10 To understand pressure measurement procedure and related instruments/devices.

List of Open Source Software/learning website:

1. <http://nptel.iitm.ac.in>
2. <http://media.efluids.com/galleries/all>