2/4 B.Tech. THIRD SEMESTER

CE3T6 **FLUID MECHANICS** **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Pre-requisites: Engineering mathematics, physics, engineering mechanics

Learning objectives:

- To understand the fundamental concepts in the field of fluid mechanics, pipe flow and measuring devices.
- Gain knowledge of different types of flows and flow equations.

Course outcomes:

At the end of course the student will be able to:

1. Determine the fluid pressure and use various devices for measuring fluid pressure.
2. Calculate hydrostatic force and use of law of conservation mass to fluid flow.
3. Apply Bernoulli's equation to fluid flow problems and boundary layer theory to determine lift and drag forces on a submerged body.
4. Apply appropriate equations and principles to analyze pipe flow problems
5. Use of different fluid flow measuring devices.

UNIT I

INTRODUCTION:
Dimensions and units – Physical properties of fluids specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion pressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressure- measurement of pressure. Pressure gauges, Manometers: differential and Micro Manometers.

UNTI – II

HYDROSTATIC FORCES:
Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure. Derivations and problems.

FLUID KINEMATICS:
Description of fluid flow, Stream line, path line and streak lines and stream tube. Classification of flows : Steady, unsteady, uniform, nonuniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, flow net analysis.

UNIT – III

FLUID DYNAMICS:
Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, (Navier – Stokes equations (Explanatory) Momentum equation and its application – forces on pipe bend.
Boundary layer – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarmen momentum integral equation, laminar and turbulent Boundary layers no

deviations BL in transition, separation of BL, control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

UNIT – IV

LAMINAR FLOW:
Reynold's experiment – Characteristics of Laminar & Turbulent flows. Flow between parallel plates, Flow through long tubes, flow through inclined tubes.
CLOSED CONDUIT FLOW:
Laws of Fluid friction – Darcy's equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line. Pipe network problems, variation of friction factor with Reynold's number – Moody's Chart.

UNIT – V
MEASUREMENT OF FLOW:
Pitot tube, Venturi meter and orifice meter – classification of orifices, flow over rectangular, triangular and trapezoidal and stepped notches - –Broad crested weirs.

Learning resources

Text books:

1. Fluid Mechanics, (18th edition) by Modi, P.N. and Seth S.M., Standard book house, 2011.
2. Introduction to Fluid Machines, (2nd edition) by Som, S.K. and Biswas G., Tata McGraw-Hill, 2006.
3. Introduction to Fluid Machines by Edward,J., Jr.Shaughnessy, Ira M. Katz and James Schaffer, P., Oxford University Press, New Delhi, 2009.

Reference books:

1. Fluid Mechanics (4th edition) by Douglas, J.F., Gaserek, J.M. and Swaffirld, J.A. (Longman), Delhi Pearson Education, 2005.
2. Fluid Mechanics, (6th edition) by Frank White, Tata McGraw-Hill, 2009.
3. Fluid Mechanics, (2nd edition) by Mohanty, A.K., Prentice Hall of India Pvt. Ltd., New Delhi, 1994.
4. A text of Fluid mechanics and hydraulic machines, (7th edition) by Laxmi Publications (P) ltd., New Delhi, 2000.

e-learning resources:

http://nptel.ac.in/courses.php

http://jntuk-coeerd.in/