2/4 B.Tech. THIRD SEMESTER

CE3T6 **FLUID MECHANICS** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Objectives:

- To understand the fundamental concepts in the field of fluid mechanics, pipe flow and measuring devices.

Learning outcomes:

At the end of course the student will have:

- Understanding of the applications of various properties of fluid and their inter-relationship.
- Knowledge of the fluid pressure and hydrostatic force and features and functions of various devices for measuring fluid pressure.
- Ability to use various devices to measure the velocity and discharge of fluid.
- Knowledge regarding various theories:
    1. Explaining the behaviour and performance of fluid in motion.
    2. Dealing with the flow phenomenon of fluid through pipe.

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.

UNTI – III
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 – IV
FLUID DYNAMICS - I:
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.

UNIT – V
FLUID DYNAMICS - II:
Approximate Solutions of Navier - Stoke's Equations – 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 – VI
LAMINAR FLOW:
Reynold's experiment – Characteristics of Laminar & Turbulent flows. Flow between parallel plates, Flow through long tubes, flow through inclined tubes.

UNIT - VII
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 – VIII
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.