**II Year - I Semester** | **L T P C**
**20CE3005** | **3 0 0 3**

# FLUID MECHANICS

**Course Learning objectives**

- To understand the properties of fluid sand fluid statics
- To derive the equation of conservation of mass and its application
- To solve kinematic problems such as finding particle paths and streamlines
- To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
- To analyze laminar and turbulent flows
- To understand the various flow measuring devices
- To study in detail about boundary layers theory

**Course Outcomes:**

Upon successful completion of this course the students will be able to:

- Understand the various properties of fluids and their influence on fluid motion.
- Calculate the forces that act on submerged planes and curves and to Identify and analyze various types of fluid flows.
- Analyze a variety of problems in fluid dynamics
- Analyze various types of flow problems through closed conduits and to draw simple hydraulic and energy gradient lines.
- Measure the quantities of fluid flowing in pipes, tanks and channels and to understand the concepts of Boundary layer and solve problems on boundary layer.

**SYLLABUS**

**UNIT I**

**Introduction:** Dimensions and units – Physical properties of fluids – specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures-measurementofpressure.Manometers:DifferentialManometers.

**UNTI II**

**Hydrostatics:** Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

**Fluid Kinematics:** Description of fluid flow, Streamline, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, 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-Momentum equation and its application –forces on pipe bend.

**UNIT IV**

**Laminar Flow And Turbulent Flows**: Reynolds's experiment–Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates.

**Closed Conduit Flow:** Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynolds's number

**UNIT V**

**Measurement of Flow:** Pitottube, Venturimeter and Orificemeter–classification of orifices, small orifice and large orifice, flow over rectangular, triangular, and trapezoidal notches –Broad crested weirs.

**Boundary Layer Theory**: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, laminar and turbulent Boundary layers(no deviations)-, separation of BL, flow around submerged objects-Drag and Lift.

**Text Books:**


1. Fluid Mechanics, P.N. Modi and S.M.Seth, Standard book house, New Delhi
2. A text of Fluid mechanics and hydraulic machines, R.K.Bansal-Laxmi Publications(P)ltd., New Delhi


**References**:


1. Mechanics of Fluids, Merle C.Potter, David C.Wiggert and Bassem H.Ramadan, CENGAGE Learning
2. Fluid Mechanics and Machinery, C.S.P.Ojha, R.Berndtsson and P.N. Chandramouli, Oxford Higher Education.