**17CE2102- FLUID MECHANICS – I**

**(Civil Engineering)**

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| **Course Category** | Professional Core | **Credits** | 4 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3-2-0 |
| **Prerequisite** | Engineering Mathematics-II | **Sessional Evaluation** | 40 |
| **Semester End Exam. Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To impart knowledge on fluid properties and types of pressure. 2. To understand the pressure and buoyancy acting on submerged and floating bodies. 3. To study the theories of fluid flow and its pressure variations. 4. To understand the basics of fluid properties, pressure and buoyancy. 5. To learn about fluid pressure and its measurements. 6. To learn about open channel flow and uniform flow. | |
| **Course Outcomes** | CO1 | Understand the properties of fluid, differentiate type of pressures. |
| CO2 | Compute hydrostatic pressure acting on surface apply the concept of buoyancy and flotation to determine the stability of floating bodies. |
| CO3 | Apply conservation laws to derive governing equations of fluid flows and measurement. |
| CO4 | Apply principles of dimensional analysis to design models. |
| CO5 | Analyze and design the open channel with uniform flow condition. |
| CO6 | Analyze and design the open channel with gradually varied flow and rapidly varied flow. |
| **Course Content** | **UNIT - I**  **PROPERTIES OF FLUIDS:** Introduction– Units, properties of fluids – Density, specific weight, specific volume andspecific gravity – Thermodynamic Properties –Equation of perfect gas – Viscosity –Kinematic viscosity, dynamic viscosity –Compressibility and elasticity – Surface tension and capillarity – Liquid droplet, Hollow bubble, liquid jet – Vapour pressure and cavitation.  **FLUID PRESSURE AND ITS MEASUREMENT:** Fluid pressure at a point; Pressure variation in a fluid at rest – Pascal's Law – Atmospheric, absolute, gauge and vacuum pressures – Measurement of pressure –Simple manometers anddifferential manometers.  **UNIT– II**  **HYDROSTATIC FORCES ON SURFACES:** Total pressure and centre of pressure on Plan surface – Vertical, horizontal and inclined – Total pressure and centre of pressure on curved surfaces – Total pressure and centre of pressure on lock gates.  **BUOYANCY AND FLOTATION:** Buoyant force and centre of buoyancy – Metacentre and Meta centric height – Stability of submerged and floating bodies – Determination of Meta centric height – Metacentric height for floating bodies containing liquid – Time period of transverse oscillation of a floating body.  **UNIT - III**  **FUNDAMENTALS OF FLUID FLOW:** Introduction– Velocity of fluid particles – Types of fluid flow – Description of the flow pattern – Basic principles of fluid flow –Continuity equation – Acceleration of a fluid particle – Rotational and irrotational motions – Circulation and Vorticity – Velocity potential – Stream function; Streamlines, equipotential lines – Flow net – Methods of drawing flow nets – Use of flow net – Limitations of flow net.  **EQUATION OF MOTION AND ENERGY EQUATION:** Forces acting on fluid motion; Euler's equation of motion – Bernoulli's equation from the principle of conservation of energy – Energy correction factor – Application of Bernoulli's equation – Venturi meter, Orifice meter, Nozzle meter, Pitot tube – Impulse – Momentum equations, Momentum correction factor.  **UNIT - IV**  **DIMENSIONAL ANALYSIS:** Derived quantities; Dimensional homogeneity –Methods of dimensional analysis –Rayleigh's method, Buckingham's Pie theorem – Repeating variable – Model analysis – Similitudes – Forces acting on fluid – Dimensional numbers – Model laws – Classification of models.  **UNIT– V**  **OPEN CHANNEL FLOW – INTRODUCTION:** Types of channels – Classification of flows – Velocity distribution – One dimensional method of flow analysis – Pressure distribution – Equation of continuity – Energy equation – Momentum equation – Specific energy –Critical depth – Section factor.  **UNIFORM FLOW IN OPEN CHANNEL:** Chezy’s equation – Darcy-Weisbach friction factor – Manning's formula – Velocity-shear distribution –Manning's roughness coefficient – Hydraulically efficient channel section – Critical slope.  **UNIT– VI**  **GRADUAL VARIED FLOW (GVF) IN OPEN CHANNEL:** Differential equation of GVF – Classification of flow properties – Analysis of flow profile – Transitional depth – GVF differential equation.  **RAPIDLY VARIED FLOW (RVF) IN OPEN CHANNEL:** Momentum equation formulation for jump – Hydraulic jump in a horizontal rectangular channel – Non-rectangular channel – Sloping floor – Use of the jump as an energy dissipator. | |
| **Textbooks**  **and Reference books** | **TEXTBOOKS:**   1. Hydraulics and Fluid Mechanics Including Hydraulics machines by Dr. P.N. Modi, Dr. S.M. Seth, and Standard book house publications. 2. Hydraulics and Fluid Mechanics Including Hydraulics machines A.K. Jain, Khanna Publications. 3. Subramanya.K, Flow in Open channel, Tata McGraw Hill Publications, New Delhi.   **REFERENCE BOOKS:**   1. F M White, Fluid Mechanics, Tata McGraw Hill Publication. 2. Fluid Mechanics – Fundamentals and Applications by Yunus A. Cengel, Jhon M. Cimbala, Tata McGraw Hill Publications. 3. A Textbook of Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Laxmi Publications. 4. Chow V.T. Open Channel Hydraulics, Blackburn Press. | |