**17CE2201 -**

**FLUID MECHANICS – II**

**(Civil Engineering)**

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| **Course Category** | Professional Core | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 2-2-0 |
| **Prerequisite** | Fluid Mechanics – I | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To study the theories of pipe flow and its losses and analyze the flow through pipes. 2. To study the concepts of differentiate among various types of flows in pipe. 3. To understand the theory of boundary layer, drag and lift concepts. 4. To understand the rate of flow in pipe and its measuring devices. 5. To learn the basic principles and working conditions of turbines and pumps. 6. To understand design criteria of centrifugal pump. | |
| **Course Outcomes** | CO1 | Analyze and design flow through the pipes. |
| CO2 | Differentiate and analyze the various types of flow in pipes. |
| CO3 | Explain the boundary layer concept and compute the drag and lift acting on a body. |
| CO4 | Compute the rate of flow through various measuring devices. |
| CO5 | Understand the concept of impact-of-jet, working principle of turbine. |
| CO6 | Explain the purpose of various elements of turbines and understand the concepts of pumps. |
| **Course Content** | **UNIT- I**  **FLOW THROUGH PIPES:** Introduction – laws of fluid friction– Froude's experiments – Equation for head loss in pipes due to friction – Darcy-Weisbach equations – Energy losses in pipes – Hydraulic gradient line and energy gradient line – Flow through long pipes – pipes in series or compound – Equivalent pipe – pipes in parallel – Flow through bye-pass – Branched pipes – Siphon – Power transmitted through pipe – Water hammering in pipes – Pipe network - Hardy cross method.  **UNIT- II**  **LAMINAR AND TURBULENT FLOW IN PIPES:** Reynolds’s Experiment - Types of flow – Steady laminar flow in circular pipes - Hagen-Poiseuille Law – Flow of viscous fluid through circular pipe – Flow of viscous fluid between two parallel plates – Characteristics of turbulent flow, Hydrodynamically smooth and rough boundaries. Velocity distribution for turbulent flow in hydrodynamically smooth and rough pipes.  **UNIT- III**  **BOUNDARY LAYER FLOW:** Definitions of technical terms – Drag force on a flat plate – Turbulent boundary layer – Analysis of turbulent boundary layer – Total drag – Separation of boundary layer – Methods of preventing the separation.  **FLUID FLOW AROUND SUBMERGED OBJECTS - DRAG AND LIFT:** Introduction – force exerted by a flowing fluid on a stationary body – Expression for drag and lift – drag on sphere – Terminal velocity of a body – Drag on a cylinder – Development of lift on a circular cylinder – Development of lift on airfoil.  **UNIT- IV**  **FLOW THROUGH ORIFICES AND MOUTHPIECES:** Definitions – Classifications of orifices and mouthpieces: Sharp-edged orifices – Experimental determination of the coefficient for an orifice: Flow through large vertical orifice – Flow under pressure through orifices – Flow through submerged orifice- Time of emptying and filling tank through orifice – Flow through external cylindrical mouthpiece - convergent divergent mouth piece - Internal mouth piece.  **FLOW OVER NOTCHES AND WEIRS:** Introduction – Classification of notches and weirs – Flow over a rectangular sharp-crested weir or notch – Calibration of rectangular weir or notch – Empirical formula for discharge over rectangular weirs – Ventilation of weirs – Flow over a triangular weir or triangular notch – Flow over a trapezoidal notch or weir – Broad crested weir.  **UNIT– V**  **IMPACT OF JETS:** Force exerted by the jet on a stationary and moving - vertical - inclined - curved - hinged plates – Force exerted by a jet on unsymmetrical moving plate – series vanes – radial curved vanes.  **HYDRAULIC TURBINES – I:**Turbines – Layout of a hydro-electric power plant – definitions of technical terms – Classification of hydraulic turbines – pelton wheel - velocity triangle and work done– design – radial flow reaction turbines - main parts, inward radial turbine, degree of reaction, outward radial flow reaction turbine – Francis turbine - important relations.  **UNIT- VI**  **HYDRAULIC TURBINES – II:** Axial flow reaction turbine - Kaplan turbine – Draft tube - types, theory, efficiency of draft tube – Specific speed - derivation of specific speed, significance of specific speed – Unit quantities - unit speed, unit discharge, unit power – use of unit quantities – Characteristic curves of hydraulic turbines – Governing of turbines.  **CENTRIFUGAL PUMPS:** Main parts of centrifugal pumps – work done – definitions of terms – minimum speed for starting a centrifugal pump – multistage centrifugal pump – specific speed – model testing – priming – characteristic curves – cavitation – maximum suction lift – net positive suction head. | |
| **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. A Textbook of Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Laxmi Publications.   **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 Text book of Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S. Chand Publications. | |