Course Title: FLUIDS MECHANICS

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III

Subject Code	15CV33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems	**5 Hours**	**L2,L3**
Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.	**5 Hours**	**L2,L3**

Module -2		
Hydrostatic forces on Surfaces : Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems. **Fundamentals of fluid flow (Kinematics):** Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.	**3 Hours** **7 Hours**	**L2,L4** **L2,L4**
Module -3		
Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends. **Applications:** Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems	**10 Hours**	**L2,L4**
Module -4		
Orifice and Mouthpiece: Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems). **Notches and Weirs**: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.	**3 Hours** **7 Hours**	**L1,L2** **L2,L4**

Module -5		
Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems.	**7 Hours**	**L2,L4**
Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems	**3 Hours**	**L2,L4**

Course outcomes:

After successful completion of the course, the student will be able to:

1. Possess a sound ***knowledge*** of fundamental properties of fluids and fluid continuum
2. ***Compute*** and solve problems on hydrostatics, including practical applications
3. ***Apply*** principles of mathematics to represent kinematic concepts related to fluid flow
4. ***Apply*** fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
5. ***Compute*** the discharge through pipes and over notches and weirs

Program Objectives (as per NBA)

- *Engineering Knowledge.*
- *Problem Analysis.*
- *Interpretation of data.*

Question paper pattern:

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum Three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under a module.
- The students shall answer Five full questions selecting one full question from each module.
- If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill,New Delhi

Reference Books:

1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition
5. Mohd.Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press