

19CE203 FLUID MECHANICS

Hours Per Week :

| | | | |
|---|---|---|---|
| L | T | P | C |
| 3 | - | 2 | 4 |

Total Hours :

| | | | | | | | | |
|----|---|----|-------|--------|----|----|---|----|
| L | T | P | WA/RA | SSH/HS | CS | SA | S | BS |
| 45 | - | 30 | 20 | 48 | 6 | 12 | 3 | 5 |



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COURSE DESCRIPTION AND OBJECTIVES:

The main objective of this course is to make the student aware of basic ideas of fluid mechanics. At the end of this course the student shall have a reasonable knowledge to design and analyse a simple water distribution network.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes | POs |
|-----|--|-----|
| 1 | Explain the various basic concepts and properties of fluids and their flows Understand | 1 |
| 2 | Determine hydrostatic forces on different surfaces and Buoyancy | 2 |
| 3 | Analyze the fluid for kinematics and dynamics | 2 |
| 4 | Apply moment equation in various flow measuring devices | 1 |
| 5 | Analyse and Classify various types of flow phenomena | 2 |

SKILLS:

- ✓ Differentiate between Newtonian and Non Newtonian fluids
- ✓ Determine fluid pressure using different types of gauges
- ✓ Determine hydrostatic forces on a body immersed in a fluid
- ✓ Use flow measuring devices like pitot tube

UNIT I: L-9,T-3

FLUIDS: Definition, Classification of Fluids – Newton's Law of Viscosity.

PROPERTIES OF FLUIDS: Units of measurement, Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity, Cavitation, Boiling Point, Triple Point and Vapour Pressure.

MEASUREMENT OF PRESSURE: Pressure at a point in a static fluid, Newton's Law of Pressure, Atmospheric pressure, Gauge pressure, Vacuum pressure, Absolute pressure, Manometers, Bourdon pressure gauge

UNIT II: L-9,T-3

HYDROSTATIC FORCES: Forces acting on immersed plane surfaces, Center of pressure, Forces on curved surfaces.

BUOYANCY: Conditions of equilibrium for floating bodies, Archimedes' Principle, Meta-center and meta-centric height, Experimental and analytical determination of meta-centric height.

UNIT III: L-9,T-3

FLUID KINEMATICS: Types of Flows, Steady and unsteady flows, Uniform and non-uniform flows, Stream lines, path lines, Stream tubes, Principles of conservation of mass, Equation of continuity, Acceleration of fluid particles, local and convective, Rotational and irrotational motions, Free and forced vortex, Velocity potential and stream function, Flow net.

FLUID DYNAMICS: Euler's equations of motion and integration of Euler's equations, Bernoulli's equation for incompressible fluids.

UNIT IV: L-9,T-3

FLOW MEASURING DEVICES: Pitot tube, Venturimeter, Orifice meter, Orifices and mouth pieces, Time of emptying of tanks by orifices, Sharp edged rectangular, Triangular and trapezoidal notches, Francis formula, Velocity of approach, End contractions, Cipoletti Weir.

MOMENTUM EQUATION AND ITS APPLICATION: Development of momentum equation by control volume concept, Momentum correction factor, Applications, Forces on pipe bend.

UNIT V: L-9,T-3

ANALYSIS OF PIPE FLOW: Darcy's equation, Minor losses, Pipes in series, Pipes in parallel, Total energy line and hydraulic gradient line, Hardy-Cross Method for Pipe Network design, Siphon, Water hammer.

LAMINAR FLOW: Reynolds' experiment, Characteristics of laminar flow, Steady laminar flow through circular pipe (Hazen Poiseuille's equation).

TURBULENT FLOW IN PIPES: Characteristics of turbulent flow, Prandtl's mixing length theory, Hydro dynamically smooth and rough boundaries, Velocity distribution, Friction factor for pipe flow, Variation of friction factor with Reynolds number, Moody's chart.

TEXT BOOKS:

1. P. N. Modi and S. N. Seth, "Hydraulics and Fluid Mechanics", 20th edition, Standard book house, New Delhi, 2013.
2. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 9th edition, Laxmi Publications, New Delhi, 2005.

REFERENCES:

1. V. L. Streeter and E.B. Wylie, "Fluid Mechanics", 9th edition, McGraw-Hill Publications, 2011.
2. S. K. Som and G. Biswas, "Fluid Mechanics", 2nd edition, Tata Mc Graw Hill, 2008.
3. John F. Douglas, Janusz M. Gasiorek and John A. Swaffield, "Fluid Mechanics", 5th edition, Pearson Education Publishers, 2005.