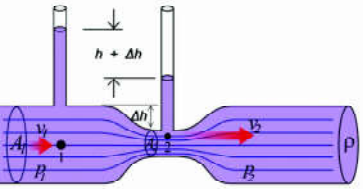


# 16CE202 FLUID MECHANICS

Hours Per Week :

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

Total Hours :

| L | T | P |
|---|---|---|
| 45 | - | 30 |

| WA/RA | SSH/HSH | CS | SA | S | BS |
|---|---|---|---|---|---|
| 20 | 48 | 6 | 12 | 3 | 5 |

## Course Description and Objectives:

This course deals with the basic concepts of fluid flow, basic equations of continuity, energy and momentum. In addition, this course offers the knowledge on various flow measuring devices. The objective of this course is to provide knowledge on basic properties of fluid in static and kinematic state and study of laminar and turbulent flow through pipes.

## Course Outcomes:

The student will be able to:

- gain insights into properties of fluids like viscosity, density, specific weight etc,
- understand basic definitions related to fluids and fluid mechanics.
- measure pressure in fluid-flowing pipes and vessels.
- handle various kind of pressure measuring instruments.
- apply continuity equation and energy equations in flow measurements.

## 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 - 1** **L-09**

**FLUIDS:** Definition, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids.

**PROPERTIES OF FLUIDS:** Units of measurement, Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity.

**MEASUREMENT OF PRESSURE:** Pressure at a point in a static fluid, Pressure variation in an incompressible static fluid, Atmospheric pressure, Gauge pressure, Vacuum pressure, Absolute pressure, Manometers, Bourdon pressure gauge.

**UNIT - 2** **L-09**

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

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

**UNIT - 3** **L-09**

**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 - 4** **L-09**

**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, Cippoletti weir.

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

**UNIT - 5** **L-09**

**ANALYSIS OF PIPE FLOW:** Darcy's equation, Minor losses - Pipes in series, Pipes in parallel, Total energy line and hydraulic gradient line; Hydraulic power transmission through a pipe, Siphon, Water hammer.

**LAMINAR FLOW:** Reynolds experiment, Characteristics of laminar flow, Steady laminar flow through a circular pipe (Hazen poiseuilles 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.

**ACTIVITIES:**

- *Measure weight and volume to calculate specific weight, mass density and specific gravity of various fluids such as water, petrol, oil etc.*
- *Measure pressure at different points of a tank containing two or three immiscible liquids using a simple manometer.*
- *Prepare a model of hydraulic lift to demonsrate the concept of Pascal's law.*
- *Measure the depth of immersion of a floating object using the buoyancy principle.*

## LABORATORY EXPERIMENTS

**LIST OF EXPERIMENTS** Total hours: 30

1. Calibration of Venturimeter.
2. Calibration of Orifice meter.
3. Friction factor for a given pipe line.
4. Head loss due to sudden contraction in a pipeline.
5. Verification of Bernoulli's equation.
6. Coefficient of discharge of Mouthpiece.
7. Coefficient of discharge of Orifice.
8. Discharge by V-Notch.
9. Discharge by Rectangular – Notch.

**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.

**REFERENCE BOOKS:**

1. V. L. Streeter and E.B.Wyile, "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, John A. Swaffield, "Fluid Mechanics", 5th edition, Pearson Education Publishers, 2005.