# FLUID MECHANICS

**IV Semester: CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| ACEB06 | Core | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

## I. COURSE OVERVIEW:

This course provides students with an introduction to principal concepts and methods of fluid mechanics. Topics covered in the course include pressure, hydrostatics, and buoyancy; open systems and control volume analysis; mass conservation and momentum conservation for moving fluids; viscous fluid flows, flow through pipes; dimensional analysis; boundary layers, and lift and drag on objects. Students will work to formulate the models necessary to study, analyze, and design fluid systems through the application of these concepts, and to develop the problem solving skills essential to good engineering practice of fluid mechanics in practical applications.

## II. OBJECTIVES:

**The course should enable the students to:**

I Understand and study the effect of fluid properties on a flow system.

II Apply the concept of fluid pressure, its measurements and applications.

III Explore the static, kinematic and dynamic behavior of fluids.

IV Assess the fluid flow and flow parameters using measuring devices.

## III. COURSE OUTCOMES:

**After successful completion of the course, students should be able to:**

| | | |
|---|---|---|
| CO 1 | **Recall** basic principles and concepts of Fluid Mechanics for ascertaining differences between solids and fluids. | Remember |
| CO 2 | **Classify** the fluids based on Newton's law of viscosity for calculating shear and viscosity of incompressible fluids. | Understand |
| CO 3 | **Interpret** the principles of manometer and pressure for measuringgauge and differential pressures in fluids. | Understand |
| CO 4 | **Make use of** hydrostatic forces and Archimedes principle for locating the point of application of force on various types of floating and immersed bodies. | Apply |
| CO 5 | **Utilize** the conservation laws in differential forms for determining velocities, pressures and acceleration in a moving liquid. | Apply |
| CO 6 | **Explain** velocity potential, stream function for estimating thepossibility of the flow. | Understand |

## IV. SYLLABUS:

| MODULE – I | BASIC CONCEPTS AND DEFINITIONS | Classes: 09 |
|---|---|---|

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

| MODULE – II | FLUID STATICS | Classes: 09 |
|---|---|---|

Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U -Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

| MODULE – III | FLUID KINEMATICS | Classes: 10 |
|---|---|---|

Classification of fluid flow: steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, ideal and real fluid flow, one, two and three dimensional flows;

Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two and three - dimensional continuity equations in Cartesian coordinates.

| MODULE – IV | FLUID DYNAMICS | Classes: 09 |
|---|---|---|

Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced;

| MODULE – V | DIMENSIONAL ANALYSIS | Classes: 08 |
|---|---|---|

Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

**Text Books:**

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010.
2. P M Modi and S M Seth, "Hydraulics and Fluid Mechanics", Standard Book House, 2014.

**Reference Books:**

1. K. Subramanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill.
2. R.L. Daugherty, J.B. Franzini and E.J. Finnemore, "Fluid Mechanics with Engineering Applications", International Student Edition, Tata Mc Graw Hill.

**Web References:**

1. http://nptel.ac.in/courses/112105171/1
2. http://nptel.ac.in/courses/105101082/
3. http://nptel.ac.in/courses/112104118/ui/TOC.htm

**E-Text Books:**

1. http://engineeringstudymaterial.net/tag/fluid-mechanics-books/
2. http://www.allexamresults.net/2015/10/Download-Pdf-Fluid-Mechanics-and-Hydraulic-Machines-by-rk-Bansal.html
3. http://varunkamboj.typepad.com/files/engineering-fluid-mechanics-1.pdf