Course Type	Course Code	Name of Course	L	Т	P	Credit
ESO 2	CEE202	Fluid Mechanics and Machines	3	0	0	9

## **Course Objective**

This course deals with the basic concepts of fluid mechanics and machines for engineering applications.

## **Learning Outcomes**

Upon successful completion of this course, students will be able:

- To understand the properties and behaviour of different types of fluids.
- To apply the concepts of conservation of mass, momentum and energy for solving fluid flow problems.
- To understand the working principle of common fluid machines, particularly hydraulic machines.

Unit No.	Topics to be Covered	Lectures	Learning Outcome
1	<ul><li>Fundamental Concepts: Introduction, Properties of fluid, Newtonian and non-Newtonian fluids.</li><li>Fluid Statics: Pascal's law, pressure variation in a static fluid, hydrostatic forces on plane and curved surfaces, buoyancy, conditions of equilibrium.</li></ul>	7	Understand the concepts required to analyse fluids. Knowledge to analyse and measure the pressure acting on fluid at rest.
2	<ul> <li>Fluid Kinematics: Classification of fluid flow, methods of describing fluid motion, discharge, continuity equation, flow net, vorticity.</li> <li>Fluid Dynamics: Forces acting on fluid in motion, Euler's equation, Bernoulli's theorem and applications – venturi meter, orificemeter, pitot tube.</li> </ul>	9	To know the concepts required to analyse the fluid motion and the forces associated with it. Knowledge about the methods of flow measurement in pipes.
3	<ul> <li>Dimensional Analysis and Model Studies: Dimensional analysis - Rayleigh's method, Buckingham's П- theorem method, model &amp; prototype, model studies – similarity types, model laws</li> <li>Laminar Flow: Hagen-Poiseuille equation for flow through a circular pipe, Darcy's law, boundary layer, lift and drag</li> <li>Turbulent Flow: Variation of turbulent fluctuations, Prandtl's mixing length theory.</li> <li>Flow through Pipes: Reynolds experiment, loss of energy in pipes, Darcy - Weisbach equation for loss of head in pipes, flow through pipes in series, flow through pipes.</li> </ul>	11	Understanding the methodology for application of the dimensional analysis and model study to understand and solve complex problems associated with fluid flow. To know the various types of flows in pipes. An overview of different flow conditions in pipes.
4	<b>Impact of Jet:</b> Impulse- momentum principle, impact of jet on stationary and moving flat surfaces and curved surfaces. <b>Hydraulic Turbines:</b> Types, Pelton, Francis and Kaplan turbines. <b>Hydraulic Pumps:</b> Types, Centrifugal pump, Reciprocating pump, single acting and double acting reciprocating pump.	15	Understanding the applications of impact of jet on stationary and moving surfaces. To know the working principle of turbines and pumps.

## **Text Books:**

- 1. Som, S.K., Gautam Biswas and Suman Chakraborty (2012). Introduction to Fluid Mechanics and Fluid Machines, 3rd Edition, Tata McGraw Hill Edu. Pvt. Ltd., India.
- 2. Ojha,C.S.P., Berndtsson, R. and Chandramouli, P.N. (2010). Fluid Mechanics and Machinery, 1st Edition, Oxford University Press, India.

## **Reference Books:**

- 1. Cengel, Y.A. and Cimbala, J.M. (2014), Fluid Mechanics, 3rd Edition, McGraw Hill Education Pvt. Ltd., India.
- 2. Fox, R.W. and McDonald, A.T. (2016), Fluid Mechanics, 9th Edition, Wiley, India.