

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Fluid Mechanics and Hydraulic Machines
Course Code:	2ET1010402T
Pre-requisite Course:	Elements of Mechanical Engineering, Applied Thermodynamics

Course Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyze the flow in water pumps and turbines

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
04	03	01	-	04	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Properties of Fluid: Definition of fluid; Newton's law of viscosity; Units and dimensions; Physical properties of fluids; Control volume; Continuity equation and momentum equation; Incompressible flow; Bernoulli's equation and its applications	05	20
2	Dimensional Analysis: Dimensionally homogeneous equations; Buckingham Pi Theorem; Calculation of dimensionless parameters. Similitude and complete similarity; Model scales; Basic boundary layer theory and analysis	07	20
3	Fluid Kinematics: Different approaches; Reynolds transport theorem; Flow visualization; Types of flow; Strain rate, stream line, streak line, path lines and stream tubes; Continuity equation in Cartesian coordinates in 3D forms; Velocity and acceleration of fluid particles; Velocity potential function and stream function	06	20
4	Momentum Equation: Momentum equation; Navier Stoke equation; Development of Euler's equation; Bernoulli's equation and application; Steady and unsteady flow through orifice; Orifice placed in pipe; Venturimeter; Flow over triangular and rectangular notches; Pitot tube	04	10
5	Laminar and Turbulent Flow: Viscous/Laminar flow – Plane Poiseuille flow and Couette flow; Laminar flow through circular pipes; Loss of head and power absorbed in viscous flow; Turbulent flow – Reynolds experiment; Frictional losses in pipe flow; Shear stress in turbulent flow; Major and minor losses (Darcy's and Chezy's equation); Flow through siphon pipes; Branching pipes and equivalent pipe	05	10

6	Rotodynamic Machines: Euler's equation; Theory of Rotodynamic machines; Various efficiencies; Velocity components at entry and exit of the rotor; Velocity triangles; Centrifugal pumps – working principle, work done by the impeller and performance curves; Cavitation in pumps; Reciprocating pump – working principle	07	10
7	Hydraulic Turbines: Classification of water turbines; Heads and efficiencies; Velocity triangles; Axial, radial and mixed flow turbines; Pelton wheel, Francis turbine and Kaplan turbines – working and design principles	06	10

Reference Books:

1. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing
2. S. K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill
3. Kumar, D. S., "Fluid Mechanics and Fluid Power Engineering" S.K.Kataria & Sons Publication
4. R. K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines," Laxmi Publication
5. F.M. White, "Fluid Mechanics," Tata McGraw Hill
6. P.J. Pritchard, A.T. McDonald and R.W. Fox, "Introduction to Fluid Mechanics," Wiley India
7. Mechanics of Fluids, Shames, McGraw Hill Book Co., New Delhi

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ce85/preview

Course Learning Outcomes (CLO):

CLO	Description	Bloom's Taxonomy Level
CLO1	Able to explain the effect of fluid properties on a flow system.	1 Remembering
CLO2	Able to identify type of fluid flow patterns and describe continuity equation.	2 Understanding
CLO3	To analyze a variety of practical fluid flow and measuring devices and utilize FluidMechanics principles in design.	3 Applying
CLO4	To select and analyze an appropriate turbine with reference to given situation in powerplants.	3 Applying 4 Analyze
CLO5	To estimate performance parameters of a given Centrifugal and Reciprocating pump.	4 Analyze 5 Evaluating
CLO6	Able to demonstrate boundary layer concepts.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M	H	M			L							M	
CLO2	M	H	H	H									M	
CLO3	M	M	M	L		L				L	L		M	
CLO4			M	M	M	L	M		M			M		M
CLO5			M	M	M				L			L		M
CLO6		M	M	M								L		M

H: High, M: Medium, L: Low