

Branch Name:	CIVIL ENGINEERING
Program Code:	ET106
Course Title:	Fluid Mechanics and Hydraulics
Course Code:	2ET1060303T
Pre-requisite Course:	Basic Knowledge of Mathematics and Applied Physics.

Course Objectives:

CO-1: To develop a basic knowledge about the properties of fluids, their behavior under static and dynamic conditions.

CO-2: To enable the students to apply the basic principles of Fluid Mechanics and computational fluid dynamics to solve real life problems

CO-3: To inculcate the importance of fluid flow measurement and its applications in Industries.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Unit No	Topic	Total Hours	Weight age (%)
01	Fluids, their Properties & Measurements: Introduction, fluid properties, viscosity, surface tension, capillarity, compressibility, bulk modulus, vapor pressure Newton's law of viscosity, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature; classification of fluids, pressure at a point, pressure head, Pascal's Law, hydrostatic law, pressure variation in a fluid at rest, different types of pressures and its measurements, hydrostatic paradox.	06	15
02	Hydrostatic forces on surfaces and Buoyancy: Fluid static, total pressure & centre of pressure and its practical applications, vertical, horizontal & inclined plane surface immersed in liquid, forces on a curved surface, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical and experimental method of metacentric height, stability conditions of equilibrium of a floating & submerged bodies	08	18
03	Fluid Kinematics: Introduction, types of fluid flow, analyzing fluid flow and its motion, velocity & acceleration of a fluid particles, rate of flow or discharge, continuity equation in 2D and 3D flow in Cartesian coordinates system, velocity potential function & stream function, rotational and irrotational flow, flow net, circulation and vorticity, Source, Sink and Doublet.	05	18
04	Fluid Dynamics and its Applications: Introduction Euler's equation of motion along a stream line, Bernoulli's equation from Euler's equation, it's assumptions, Bernoulli's theorem/equation & its practical applications i.e. venturimeter, orifice meter, pitot tube, momentum equation and its application, momentum correction factor, kinetic energy correction factor.	06	18

05	Measurement of Flow: orifices & mouthpieces and its classification, hydraulic co-efficient i.e. C_d , C_r , C_c etc. and its experimental determination, flow through all types of orifices and mouthpieces, time of emptying a tank through an orifice and mouthpiece. notches & weirs and its classification, discharge through various types of notches and weirs, time of emptying a reservoir or a tank with notches & weirs, velocity of approach	08	18
06	Flow Immersed Past Bodies and Compressible Flow Drag and lift, types of drag, drag on sphere, cylinder, flat plate and Airfoil, effect of drag, development of lift, magnus effect, circulation and lift characteristics of airfoils, Basic equations for one dimensional compression,, Mach number, propagation of sound wave, stagnation properties.	06	08
07	Hydraulic Machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter and air lift pump	03	05

Reference Books:

1. Fluid Mechanics and Hydraulic Machines by Dr. R.K.Bansal, Laxmi Publications Pvt. Ltd., New Delhi
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S.Chand and Company Ltd., New Delhi
3. Fluid Mechanics by A.K. Jain, Khanna Publishers, New Delhi
4. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth, Standard Book House, New Delhi
5. Theory and Applications of Fluid Mechanics by K Subramanya, McGraw Hill Publication
6. Fluid Mechanics by Victor L. Streeter, E. B. Wylie by, McGraw Hill Publication
7. Hydraulic Fluid Mechanics and Fluid Machines by Ramamrutham S., Dhanpat Rai Publication.

Course Learning Outcomes (CLO):

After successful completion of the course, student will be able to

1. understand basic properties of fluids, their estimations and analysis for civil engineering applications.
2. understand the basics of kinematics and dynamics of fluid flow for solving civil engineering problems.
3. analyze the theory of impact of jet and understand the basics of compressible flow
4. understand the basic functioning of various hydraulic machines.

Web Material Links:

<https://nptel.ac.in/courses/105101082>

<https://nptel.ac.in/courses/105103095>

<https://nptel.ac.in/courses/105103192>

Course Learning Outcomes (CLO):

After successful completion of the course the students shall be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	understand basic properties of fluids, their estimations and analysis for civil engineering applications.	L1, L2, L3, L4 and L6
CLO2	understand the basics of kinematics and dynamics of fluid flow for solving civil engineering problems.	L1, L2 and L4
CLO3	analyze the theory of impact of jet and understand the basics of compressible flow	L1, L2, L3 AND L5
CLO4	understand the basic functioning of various hydraulic machines.	L1, L2, L3, L4, L5 and L6

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1	H	M	H	M			L				M	M	H	M	
CLO2	H	H	M	M			M					M	M	M	
CLO3	M	M	M			L	M				L	M	M	M	
CLO4	M			L	M	M	L				M		M		

H: High, M: Medium, L: Low