

Subject Code: 1ET1060304	Subject Title: Fluid Mechanics
Pre-requisite Subject	Basic Knowledge of Mathematics and Applied Physics.

Course Objective:

1. To develop a basic knowledge about the properties of fluids, their behavior under static and dynamic conditions.
2. To enable the students to apply the basic principles of Fluid Mechanics to solve real life problems

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total (T+P)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
01	Properties of fluids: Introduction, properties of fluids, viscosity, compressibility, surface tension, capillarity, Newton's law of viscosity, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature; compressibility and elasticity, classification of fluids, Basic concept applicable to fluid mechanics.	2	08
02	Pressure and its measurement: Fluid pressure at a point, Pascal's Law, hydrostatic law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, gauge pressure, measurement of pressure, hydrostatic paradox, piezometer, simple manometers, differential manometers.	4	10
03	Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure, vertical, horizontal & inclined plane surface submerged in liquid, total pressure & centre of pressure on lock gates, practical applications of total pressure and center of pressure.	4	08
04	Buoyancy & floatation: Introduction, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical method of metacentric height, conditions of equilibrium of a floating & submerged bodies, oscillation of a floating body, related problems.	4	10
05	Kinematics of Fluid Flow: Introduction, methods of describing fluid motion, types of fluid flow i.e. steady & unsteady, uniform & non-uniform, laminar & turbulent, compressible & incompressible, rotational & irrotational & one, two & three dimensional flows, rate of flow or discharge, continuity equation in three dimensions, velocity & acceleration, velocity potential function & stream function, flow net, Source, Sink and Doublet.	5	15
06	Dynamics of fluid flow: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, it's assumptions, Bernoulli's equation for real fluid, practical applications of Bernoulli's equation i.e. venturimeter, orifice meter, pitot tube, introduction to various types of dimensionless numbers i.e. Reynolds, Froude's, Euler's, Weber's, Mach's, momentum equation and its application, momentum correction factor, Energy correction factor, free liquid jets.	7	15
07	Orifice and mouthpieces: Introduction, classification of orifices and mouthpieces, flow through an orifice and mouthpieces, 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.	5	10

08	Notches and Weirs: Introduction, classification of notches and weirs, discharge through various types of notches and weirs, time of emptying a reservoir or a tank with notches & weirs, velocity of approach, end contractions. cippoletti notch or weir.	4	10
09	Flow Immersed Past Bodies Drag and lift, types of drag, drag on sphere, cylinder, flat plate and Airfoil, Karman vortex street, effect of drag, development of lift, magnus effect, circulation and lift characteristics of airfoils.	4	08
10	Compressible Flow Basic equations, Mach number, Mach cone, area-velocity relationship, propagation of sound wave, stagnation properties.	3	06

Course Outcome:

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

- understand technical properties of fluids, their estimations and analysis for civil engineering applications.
- understand the basics of kinematics and dynamics of fluid flow for solving civil engineering problems.
- calibrate fluid flow measuring devices like venturimeter, orificemeter, notches, weirs, orifice, mouthpieces.
- understand the concept of drag and lift on various objects.
- know the basics of compressible fluid flow.

List of Reference Books:

1. R. K. Bansal, A Text Book of Fluid mechanics & Hydraulic Machines, Laxmi Publications.
2. Ramamrutham S., Hydraulic Fluid Mechanics and Fluid Machines, Dhanpat Rai.
3. R. K. Rajput, Text book of Fluid Mechanics and Hydraulic Machines, S. Chand & Co.
4. K.L. Kumar, Engineering Fluid mechanics, S. Chand & Company Ltd.
5. P.M. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House
6. A.K. Jain, Fluid Mechanics, Khanna Publishers.

List of Experiments:

1. Study of various properties of fluids.
2. Study of pressure measurement devices.
3. Experiment of Buoyancy and Determination of Meta centric height.
4. To verify Bernoulli's theorem
5. To calibrate and study different flow meter i.e. venturi meter, orifice meter.
6. Determine Hydraulic coefficients of a small circular orifice.
7. To measure the flow using Rectangular and V notch.
8. Drag on immersed objects.

Study Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
2. <http://nptel.iitm.ac.in/video.php?subjectId=105101082>
3. <http://www.mvsengineering.com>
4. <http://nptel.iitm.ac.in/courses/IIT-MADRAS/Hydraulics/index.php>
5. <http://nptel.iitm.ac.in/video.php?subjectId=105103096>