

Subject Code: 1ET1010402	Subject Title: Fluid Mechanics
Pre-requisite Subject	Elements of Mechanical Engineering

Course Objective:

This course will help student to

1. To provide a strong foundation in Fluid Mechanics to the students
2. To Understand the conservation principles of mass, momentum, and energy for fluid flow
3. To apply the basic applied-mathematical tools that support fluid dynamics

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	
4	-	2	5	70	30	30	20	150

Subject Contents				
Sr. No.	Topic	Total Hours	Weight (%)	
01	Fluid Properties: Ideal Fluid, Continuum, Properties of Fluid, Classification of Fluids, Newton's law of viscosity, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus.	06	10	
02	Fluid Statics: Hydrostatic law, Pascal's law, Pressure at a point, Pressure head, absolute and gauge pressures, measurement of pressure- manometry – simple, differential, inclined manometers etc., Forces on Areas –Horizontal, Inclined and Vertical, Centre of Pressure, Forces on Curved Surfaces, Buoyant Forces, Stability of Floating and Submerged Bodies, Relative Equilibrium under Linear Acceleration and Constant Rotation, Meta-centric height.	08	20	
03	Dimensional Analysis: Dimensions, Dimensional Homogeneity, Dimensional analysis using Rayleigh's method, Buckingham- π Theorem, Dimensional Grouping, Non - Dimensional Numbers, Geometrical, Kinematics and Dynamic Similarity. Model analysis, Model laws, Undistorted and Distorted models.	06	10	
04	Fluid Kinematics: Types of flow (steady vs. unsteady, uniform vs. non-uniform, laminar vs. turbulent, One, Two and Three dimensional, compressible vs. incompressible, rotational vs. Irrotational), Stream lines, path lines, streak lines, velocity components, convective, local and total acceleration, velocity potential function, stream function, Flow Nets, continuity equation in Cartesian co-ordinates, Differential and Integral Approach Applied to Conservation of Mass, Momentum and Energy	08	20	

	Principles.		
05	Fluid Dynamics: Introduction to Navier-Stokes' equation, Euler's equation of motion along a stream line, Bernoulli's equation, Application of Bernoulli's equation to Pitot tube, Venturi meter, Orifice meter, Rotameter, Triangular Notch and Rectangular Notch. Viscous Flow: Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates.	08	15
06	Laminar and Turbulent Flows: Concepts of Laminar and Turbulent Flows, Laminar Flow Through Round Pipes, Laminar Flow between Parallel Plates for Moving and Stationary plates, Measurement of Viscosity. Concept of Eddy Viscosity, Moody's Chart. Compressible Flow: Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties.	06	10
07	Pipe Systems: Major and Minor losses in pipes, Losses in Fittings, Power Transmission Through Pipes, Pipes connected in Series and Parallel, Branched Pipes, Total Energy line and Hydraulic Gradient Lines.	04	5
08	Boundary Layer Theory: Concept of Boundary Layer, Boundary Layer over Flat Plates and Tubes, Boundary Layer Parameters, Boundary Layer, Thickness, Momentum Thickness, Displacement Thickness. Introduction to Computational Fluid Dynamics: Introduction to CFD Methodology (Elementary Treatment); Use of EES for problem solving; Flow visualization tapes.	06	10

Course Outcome:

The student will be able to

1. Understand the basic concept of fluid mechanics.
2. Apply statics, dynamics and various approaches to fluid mechanics problems.
3. Correlate fundamentals of fluid mechanics with various mechanical systems.

List of References:

1. White, F. M., "Fluid Mechanics" McGraw Hill Publication
2. Kumar, D. S., "Fluid Mechanics and Fluid Power Engineering" S.K.Kataria & Sons Publication
3. Bansal R. K., "Fluid Mechanics and Hydraulic Machines" Laxmi Publications
4. Mohanty, A. K., "Fluid Mechanics", Prentice Hall India Publication
5. Rajput, R.K., "A Textbook of Fluid Mechanics", 3rd Ed., S Chand & Co. Ltd.
6. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publication House
7. Som, S. K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill P Ltd.
8. Kundu, P.K and Cohen, I.M., "Fluid Mechanics", Academic Press, Elsevier
9. Rathakrishnan, E, "Fluid Mechanics- An Introduction", Prentice Hall of India P Ltd.

Website:

<http://nptel.ac.in/courses/112104118/>

List of Practical:

1. To understand pressure measurement procedure and related instruments/devices.
2. To determine metacentric height of floating body.
3. Verification of Bernoulli's theorem.
4. To measure the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Orifice meter, Venturi meter and Rotameter.)
6. To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular, V notch)
7. To determine the different types of flow Patterns by Reynolds's experiment.
8. To determine the Friction factor for the different pipes.
9. To determine the loss coefficients for different pipe fittings.
10. To determine the viscosity of fluid by viscometer (Redwood or Saybolt)
11. To Perform numerical analysis on flow through pipe with varying Reynolds Number