

## ME184: Fluid Mechanics

Teaching Scheme			Credits	Marks Distribution				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	
3	0	2	5	70	30	30	20	150

### Course Content:

Sr. No.	Topics	Teaching Hrs.
1	<p><b><u>Properties of Fluids:</u></b></p> <p>Introduction, solids, liquids and gases, hypothesis of continuum, Newton's law of viscosity, Newtonian and non-Newtonian fluids, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and bulk modulus.</p>	03
2	<p><b><u>Pressure and Head:</u></b></p> <p>Fluid static, fluid pressure at a point, Pascal's Law, pressure variation in a fluid at rest, absolute, gauge, atmospheric and vacuum pressures, Measurement of pressure by Manometers.</p>	03
3	<p><b><u>Hydrostatic Forces on Surfaces:</u></b></p> <p>Total pressure and center of pressure, resultant force and center of pressure on a plane horizontal surface submerged in liquid, resultant force and center of pressure on a plane vertical surface submerged in liquid, resultant force and center of pressure on a plane inclined surface submerged in liquid, forces on a curved surface due to hydrostatic pressure</p>	04
4	<p><b><u>Buoyancy and Floatation:</u></b></p> <p>Buoyancy and center of buoyancy, meta-center and metacentric height, conditions of equilibrium of floating bodies and submerged bodies, determination of the metacentric height by experimental and analytical methods.</p>	03

- 5 **Fluid Kinematics:** 06
- Introduction, types of fluid flow, frames of reference, discharge and mean velocity, continuity equation, continuity equations in three dimensions, velocity and acceleration, streamlines and the stream functions, velocity potential and potential function, relation between stream function and velocity potential; flow nets, linear translation, linear deformation, angular deformation, circulation and vorticity, stream function and velocity potential for uniform flow, vortex flow.
- 6 **Fluid dynamics:** 06
- Introduction, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid –Bernoulli's theorem, kinetic energy correction factor, principle of venturimeter and orificemeter, pitot tube, theory of small orifices discharging to atmosphere, theory of large orifices, elementary theory of notches and weirs, Momentum equation, momentum correction factor.
- 7 **Dimensional Analysis and Similarities:** 04
- Dimension, Units, dimension reasoning, dimensional quantities, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham  $\pi$ -theorem, dimensionless numbers, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, kinematic similarity, model testing-Model laws, Undistorted and Distorted models.
- 8 **Viscous Flow:** 04
- Reynolds experiment, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, Navier-Stokes equation of motion, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing , movement of piston in dash pot.
- 9 **Turbulent Flow:** 03
- Introduction to major and minor losses in flow through pipe, expression for coefficient of friction -Darcy Weishbach Equation, Moody diagram, resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.

10 **Boundary Layer flow:** 03

Boundary Layer Theory-Formation, growth and separation of boundary layer-Integral momentum principles to compute drag force on flat plate.

11 **Compressible Flow:** 03

Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties.

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**Total Hrs. 42**

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**Reference Books:**

1. Frank .M. White, “*Fluid Mechanics*”, McGraw Hill Publishing Company Ltd.
2. Streeter V.L. and Benjamin Wylie, “*Fluid Mechanics*”, Mc Graw Hill Book Co., New Delhi.
3. D.S. Kumar, “*Fluid Mechanics and Fluid Power Engineering*”, S.K.Kataria & Sons
4. R.K. Bansal, “*Fluid Mechanics and Hydraulic Machines*”, Laxmi Publications
5. Munson, “*Fundamentals of Fluid Mechanics*”, Wiley India Pvt. Ltd
6. A. K. Mohanty, “*Fluid Mechanics*”, PHI Learning Pvt. Ltd.
7. Shames, “*Mechanics of Fluids*”, McGraw Hill Book Co., New Delhi
8. Yunus Cengel & John Cimbala, “*Fluid Mechanics: Fundamentals and Applications*”, Tata McGraw Hill, New Delhi.