ME206: FLUID MECHANICS
CREDITS = 6 (L=4, T=0, P=2)

Course Objective:

To understand properties of fluids and analyze their behavior under static and dynamic conditions.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
4	0	2	6	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Properties of Fluids:** 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.	03
2	**Fluid Statics:** **Pressure and Head:** 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, pressure measurements using Elastic Pressure Transducers, Force Balance Pressure gauge, Electrical Pressure Transducers. **Hydrostatic Forces on Surfaces:** 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. **Buoyancy and Floatation:** 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.	15

Unit No.	Topics	Teaching Hours
3	**Fluid Kinematics:** 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.	06
4	**Fluid dynamics:** 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. **Viscous Flow:** 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, methods of measurement of viscosity. **Turbulent Flow:** Introduction to major and minor losses in flow through pipe, expression for coefficient of friction -Darchy Weishbach Equation, Moody diagram, resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.	16
5	**Dimensional Analysis and Similarities:** Dimension, Units, dimension reasoning, dimensional quantities, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem, dimensionless numbers, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, kinematic similarity, model testing-Model laws, Undistorted and Distorted models.	05
6	**Boundary Layer flow:** Boundary Layer Theory-Formation, growth and separation of boundary layer-Integral momentum principles to compute drag force on flat plate. **Compressible Flow:** Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties.	07
	TOTAL	**52**

List of References:

1. Frank .M. White*, "Fluid Mechanics",* McGraw Hill Publishing Company Ltd.
2. Streeter V.L., 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. 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.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Analyze fluid properties for given applications.
2. Analyze fluid statics based problems.
3. Analyze fluid in motion problems.
4. Analyze fluid friction in pipes and fluid measurement problems.
5. Apply the concept of dimensional analysis.
6. Apply the concept of Boundary Layer and Compressible fluid Flow.