

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - MECHANICAL ENGINEERING
SEMESTER: III

Subject Name: **Fluid Mechanics**

Sr. No.	Course content
1.	<p>Fluids and their Properties: Fluids, Shear stress in a moving fluid, Difference between solid and fluid, Newtonian and Non-Newtonian Fluid, Liquids and Gases, Molecular structure of material, the continuum concept of a fluid, density, viscosity, causes of viscosity in gases, causes of viscosity in a liquid, Surface tension, capillary, vapor pressure, cavitation, compressibility and the bulk modulus, Equation of states of a gas constant, Specific heats of a gas, Expansion of a gas.</p>
2.	<p>Pressures and Head: Statics of a fluid system, pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox, pressure measurements by manometers, forced vortex.</p>
3.	<p>Static Forces on Surface and Buoyancy: Action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure, resultant force and center of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy, periodic time of oscillation.</p>
4.	<p>Motion of Fluid Particles and Streams: Fluid flow, different types of flow, frames of reference, real and ideal fluids, analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system.</p>
5.	<p>The Energy Equation and its Application: Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, changes of pressure in tapering pipe, principle of venturi meter, pipe orifices, Limitation on the velocity of flow in a pipeline, theory of small orifices discharging to atmosphere, theory of large orifices, Elementary theory of notches and weirs, flow in a curved path, pressure gradient and change of total energy across the streamlines.</p>
6.	<p>Two-Dimensional Ideal Fluid Flow: Rotational and ir-rotational flow, circulation and vorticity, streamlines and the stream functions, velocity potential and potential flow, relation between stream function and velocity potential; flow nets, stream function and velocity potential for uniform flow, vortex flow.</p>

7.	<p>Dimensional Analysis and Similarities: Dimensional analysis, dimensions and units, dimension reasoning, dimensional quantities, Fundamental and derived units and dimensions, dimensions of derivative and integrals, use of dimensional reasoning to check calculations, units of derived quantities, conversion from one system of unit to another, conversion of dimensional constants, dimensional homogeneity, dimensional analysis using the indicial method-Rayleigh's method, dimensional analysis using group method-Buckingham _ theorem, significance of dimensionless group, use of dimensionless groups in experimental investigation, geometric similarity, dynamic similarity, Kinematic similarity, Model testing-Model laws, Undistorted and Distorted models.</p>
8.	<p>Viscous Flow: Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe-HAGEN-POISEVILLE LAW, 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.</p>
9.	<p>Compressible Fluid Flow: Basic Thermodynamic relations, Basic thermodynamic processes, Basic equations for one dimensional compression, stagnation properties, pressure wave propagation and sound velocity, Flow through nozzles.</p>
10.	<p>Turbulent Flow: Characteristics of diff. types of flow, expression for coefficient of friction - Darchy Weichback Equation, moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.</p>

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons.
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan.
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput , S. Chand & Co.
4. Theory and Applications of Fluid Mechanics by K.Subramanya, TMH outline series, Tata McGraw Hill Publishing Company Ltd.
5. Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
6. Mechanics of Fluids by Shames, McGraw Hill Publishing Company Ltd.