GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: V

MECHATRONICS ENGINEERING

Subject Name: **Fluid Mechanics & Machines**
Subject Code: **152003**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
4	0	2	6	70	30	50

Sr. No.	Course Content
1.	**Introduction:** Objective of the course, Solids, Liquids and gases, Ideal and real fluids, Continuum, Units and dimensions.
2.	**Properties of Fluid:** Density, Specific gravity, Evaporability and vapour pressure, Viscosity, Surface tension and capillarity effect, Compressibility and Bulk Modulus of Elasticity, Newtonian and non-Newtonian fluids.
3.	**Fluid Statics:** Pressure, Pascal's law, Hydrostatic law, Pressure variation for an incompressible fluid, Atmospheric, Gauge, Absolute and negative pressure, Force on a horizontal submerged plane surface, Force on a vertical plane submerged surface, Force on an inclined submerged plane surface, Conditions for floating, Archimedes's principle, Reason for buoyancy and three possibilities, Applications of buoyancy and floatation, Stability of floating bodies, Mathematical treatment and conditions for stability, Metacentre and its application, Metacentric height calculation.
4.	**Fluid Kinematics:** Description of fluid flow, Classification of fluid flow, Stream-lines, Path-lines and streak lines, Acceleration of a fluid particle, Motion of fluid particles, Motion of fluid particles along a curve path, Continuity equation, Continuity equation in polar co-ordinates, Rotational flow, Rotation and vorticity, Stream function, Potential function, Circulation.
5.	**Fluid Dynamics:** Control volume and control surface, Energy and its forms, Euler's equation along a streamlines, Euler's equation in Cartesian co-ordinates, Bernoulli's theorem, Practical applications of Bernoulli's equation, Momentum of fluids in motion, Moment of momentum equation.

6.	**Laminar and Turbulent Flow in Pipes:** Reynolds number, Relation between shear stress and pressure gradient, Laminar flow in circular pipes - Hagen Poiseuille law, Flow of viscous fluid through an annulus, Loss of head due to Friction in pipe Flow-Darcy Equation, Characteristics of Turbulent Flow, Major and Minor head losses.
7.	**Boundary Layer Theory and Flow Around Submerged Body:** Boundary layer definitions and characteristics, Laminar and turbulent boundary layer, Total drag due to laminar and turbulent layers, Boundary layer separation and its control, Force exerted by a flowing fluid on a body, Expressions for drag and lift.
8.	**Turbines:** Impulse and reaction turbines, Pelton turbine, Work done and efficiency of a Pelton wheel, Effective head, Available power and efficiency, Francis turbine, Propeller and Kaplan turbines, Draft tube.
9.	**Pumps:** Pump classification and selection criterion, Pump applications, Centrifugal pumps, Pressure changes in a pump, Velocity vector diagrams and work done, Multistage pump, Net positive suction head, Cavitations in centrifugal pumps, Priming, Classification of reciprocating pumps, Operation of reciprocating pump, Discharge co-efficient, Volumetric efficiency and slip, Work and power input, Indicator diagrams, Air vessels, Centrifugal pumps versus reciprocating pumps.
10.	**Hydraulic Similarity & Model Testing:** Unit quantities, Specific speed and normal relationships, Performance characteristics of turbine and pump.
11.	**Blowers, Compressors, Steam and Gas Turbines:** Stalling and surging.

List of Experiments:

1. Verification of Bernoulli's Theorem.
2. Determination of coefficient of discharge of an orificemeter and a venturimeter.
3. Determination of friction factor for Major and Minor Losses.
4. Effect of Reynold's number on the flow pattern.
5. Impact of jet on vanes.
6. Performance testing of a CF Pump and a reciprocating Pump.
7. Performance testing of Impulse Turbine.
8. Performance testing of Francis Turbine.
9. Performance testing of a CF Blower.
10. To study different types of wind tunnels.
11. Profiles of NASA Air foil.

Reference Books:

1. Fluid Mechanics and Machinery, Agrawal S. K, Tata McGraw Hill.
2. Turbines, Compressors & Fans, S. M Yahya, Tata McGraw Hill.
3. Fluid Mechanics, Streeter V. L. McGraw Hill International Edition.
4. Fluid Mechanics and Hydraulic Machines, Rajput R. K, S. Chand & Company Ltd.
5. Fluid Mechanics and Fluid Power Engineering, Kumar D.S, S.K. Kataria & Sons.