

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Civil Engineering

Subject Name: **Applied Fluid Mechanics**

Subject Code: **160602**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
3	0	2	5	70	30	50

Module I :

Sr. No	Course Content	Total Hours.
1.	<p>Behavior Of Real Fluids:</p> <p>Governing Equations of Fluid Dynamics, Navier-Stokes equation of motion-Initial and boundary conditions.</p> <p>Steady Viscous Flow: Couette Flow, Hagen-Poiseuille flow between parallel plates and tubes, Flow around a cylinder</p> <p>Turbulent Flow: Reynolds equations of motion for turbulent flow-Prandtl's mixing length theory -Turbulent flow in pipes –velocity distribution from Prandtl's hypothesis.-smooth and rough boundaries.</p> <p>Unsteady Flow in pipes: oscillation of liquids- water hammer equations.</p>	10

Module II :

Sr. No	Course Content	Total Hours.
1.	<p>Boundary Layer:</p> <p>Boundary layer concept-laminar and turbulent boundary layer growth over a flat plate, Von-Karman momentum integral equation- Separation of boundary layer</p> <p>Regimes of external flow-wakes and drag-Drag on immersed body-sphere-cylinder-bluff body-Lift and Magnus effect.</p>	9

Module III :

Sr. No	Course Content	Total Hours.
1.	<p>Open Channel Flow:</p> <p>Basic concept of open channel flow- Steady uniform flow-Velocity distribution- Optimum shape of cross section for uniform flow- Energy equation-specific energy-specific energy diagram-discharge diagram-Application of specific energy and discharge diagrams</p> <p>Non-Uniform steady flow-equations for gradually varied flow- Direct Step method, Rapidly varied flow- Hydraulic jump- Location of hydraulic jump- flow under sluices-Water surface profiles.</p>	10

Module IV :

Sr. No	Course Content	Total Hours.
1.	<p>Turbomachinery:</p> <p>Water Turbines: Impulse turbine-Reaction turbines- Significance of specific speed-Unit quantities, Concept of performance characteristics for water turbines</p> <p>Centrifugal pumps: Pumps in series and parallel, Specific speed, Unit quantities, and characteristics curves, Cavitation in turbines and pumps.</p> <p>Ventilation System: Ventilation requirements, Natural and Mechanical ventilation.</p>	10

Module V :

Sr. No	Course Content	Total Hours.
1.	<p><i>Dimensional Analysis and Similitude:</i></p> <p><i>Dimensional Analysis:-</i></p> <p>Fundamental dimensions-Physical Quantity and Dimensions-Dimensional Homogeneity- Non Dimensional parameters, π-Theorem dimensional analysis, Choice of variables, Determination of Dimensionless parameters. Model Similitude-Physical models- geometric-kinematic and dynamic similarity, Model studies.</p>	9

Laboratory Assignments:

1. Experiments on Analogy- Analog Methods: Electrical Analogy-Viscous Analogy
2. Experiments Related to Pipe Flow: Friction Factor And Reynolds Number, Water Hammer Pressure Wave Propagation
3. Experiments Related to Turbulent Flow: Anemometry, Boundary Shear Stress
4. Experiments on Boundary Layer:
 - a. Use of Wind Tunnel For Pressure Distribution Around a Cylinder/ Airfoil
 - b. Determination of Drag Coefficient For Various Objects
5. Experiments Related to Open Channel Flow:
 - a. Velocity Distribution in Open Channel
 - b. Uniform Flow in Open Channel
 - c. Standing Wave or Hydraulic Jump
6. Experiments on Rotodynamic Machines
 - a. Performance Characteristics of Centrifugal Pump
 - b. Performance Characteristics of Water Turbines
7. Similitude and Model Studies
8. Numerical Experiments: Computer programming and simulation

Text Books:

1. Dr. A.K. Jain, Fluid Mechanics, Khanna Publishers, New Delhi
2. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi
3. K L Kumar, Engineering Fluid Mechanics, Eurasin Pub. House New Delhi

Reference Books:

1. Victor L. Streeter, E. B. Wylie Fluid Mechanics , McGraw Hill Publication
2. Ven Te Chow , Open Channel Hydraulics , McGraw Hill Publication
3. Hunter Rouse ,Engineering Hydraulics, John Wiley & Sons, New York
4. Frank M White, Fluid Mechanics , McGraw Hill Publication