

Branch Name:	Civil Engineering
Semester/Year:	Semester VI/ Third Year
Subject Title:	Applied Fluid Mechanics
Subject Code:	1ET1060604
Pre-requisite:	Fluid Mechanics

Course Objective:

- To take up important concepts of fluid flows to the civil engineers managing and designing systems of various fluid flows.
- To develop a student's skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	04	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	<u>Flow Through Pipes:</u> Introduction-Major and minor energy losses-hydraulic gradient line and total energy line-pipes in series and parallel-pipe networks- hydraulic transmission of power.	5	15
2	<u>Behavior of Real Fluids:</u> Introduction-Forces acting on fluid in motion-Continuity equation-Energy equation-Momentum equation- Navier-Stokes equation of motion- Initial conditions and boundary conditions.	2	5
3	<u>Steady Viscous Flow:</u> Reynold's Experiment-Couette flow- Hagen-Poiseuille equation-flow between parallel plates.	2	5
4	<u>Turbulent Flow:</u> Prandtl's mixing length theory- velocity distribution- Smooth and rough boundaries- water hammer equations.	2	5
5	<u>Boundary Layer:</u> Boundary layer concept-Laminar and turbulent boundary layer growth over a flat plate-Von-Karman momentum integral equation-Separation of boundary layer.	4	10

6	<u>Flow Through Open Channel:</u> 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-Application of specific energy and discharge diagrams.	7	15
7	<u>Non-Uniform Steady Flow in Open Channel:</u> Equations for gradually varied flow- Direct Step method, Rapidly varied flow- Hydraulic jump- Location of hydraulic jump- flow under sluices- Water surface profiles.	4	10
8	<u>Water Turbines:</u> Impulse turbine-Reaction turbines- Significance of specific speed-Unit quantities-Concept of performance characteristics for water turbines.	4	10
9	<u>Centrifugal Pumps:</u> Pumps in series and parallel, Specific speed, Unit quantities, and characteristics curves, Cavitations in turbines and pumps-Introduction to Ventilation System.	4	10
10	<u>Dimensional Analysis and Similitude:</u> 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.	8	15

Course Outcome:

After successful completion of the course the students shall be able to:

1. Analyze fluid flow through pipes in series, parallel and also pipe networks under laminar and turbulent flow conditions
2. Analyze and design streamlined objects considering boundary layer effects.
3. Analyze open channel flow and design optimal sections; calculate forces on sluice gates considering specific energy and momentum principle.
4. Understand, analyze and study the performance characteristics of hydraulic machines like pumps, turbines etc...
5. Carry out model studies for fluid flow problems

List of Experiments:

1. Reynold's Experiment
2. Pipe friction
3. Viscous flow through parallel plates
4. Experiments on Boundary Layer :
 - a. Use of Wind Tunnel For Pressure Distribution Around a Cylinder/Airfoil
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 Hydraulic Machines
 - a. Performance Characteristics of Centrifugal Pump
 - b. Performance Characteristics of Water Turbines like Pelton Wheel, Kaplan, Francis etc...
7. Component parts of Hydroelectric Power Plant.
8. Similitude and Model Studies

List of Reference Books:

1. Fluid Mechanics and Hydraulic Machines by Dr. R.K.Bansal, Laxmi Publications Pvt. Ltd., New Delhi
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput, S.Chand and Company Ltd., New Delhi
3. Fluid Mechanics by A.K. Jain, Khanna Publishers, New Delhi
4. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth, Standard Book House, New Delhi
5. Theory and Applications of Fluid Mechanics by K Subramanya, McGraw Hill Publication
6. Fluid Mechanics by Victor L. Streeter, E. B. Wylie by, McGraw Hill Publication

E-Resources :

1. <http://nptel.ac.in/>