B.E. Semester: V

Department of Civil Engineering

Subject Name: Applied Fluid Mechanics (CV502-N)

Course Category: Program Course Core (PCC)

A. Objectives of the Course:

- 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

B. Teaching & Evaluation Scheme:

Teaching Scheme				Credit	Evaluation Scheme					Total Marks
L hrs	T hrs	P hrs	Total Hrs		Theory		IE	CIA	Pra/Viva	
					Hrs	Marks	Marks	Marks	Marks	
3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus:

1. Behaviour of Real Fluids:

Governing Equations of Fluid Dynamics, Navier-Stokes Equation of Motion, Initial and Boundary Conditions,

Steady Viscous Flow: Couette Flow, Hagen-Poiseuille Flow between Parallel Plates and Tubes, Flow Around a Cylinder

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

Unsteady Flow in Pipes: Oscillation of Liquids-Water Hammer Equations

2. Boundary Layer:

Boundary Layer Concept – Laminar and Turbulent Boundary Layer Growth Over a Flat Plate Von-Karman Momentum Integral Equation- Separation of Boundary Layer, Regimes of External Flow-Wakes and Drag-Drag On Immersed Body-Sphere Cylinder – Bluff Body – Lift And Magnus Effect

3. Open Channel Flow:

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

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

4. Turbo Machinery:

Water Turbines: Impulse Turbine-Reaction Turbines – Significance of Specific Speed – Unit Quantities, Concept of Performance Characteristics for Water Turbines

Centrifugal Pumps: Pumps in Series and Parallel, Specific Speed, Unit Quantities, and Characteristics Curves, Cavitations in Turbines and Pumps

5. Dimensional Analysis and Similitude:

Dimensional Analysis: 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

D. Lesson Planning:

Unit No	Title of the Unit	Minimum Hours	Weightage (%)
1	Behaviour of Real Fluids	12	25
2	Boundary Layer	09	20
3	Open Channel Flow	09	20
4	Turbo Machinery	07	15
5	Dimensional Analysis and Similitude	08	20
	Total:	**45**	**100**

E. List of Practical/Assignments:

Unit No	Title of the Unit
1	To determine Manning's co efficient of roughness N for the bed of given flume
2	To determine the discharge coefficients of broad crested weir and to measure the water surface profile for flow over broad crested weir
3	To study the measurement of water surface profile for a hydraulic jump
4	To study the flow over a hump placed in an open channel
5	To calibrate the Ogee spillway
6	Experiments on Analogy- Analog Methods: Electrical Analogy-Viscous Analogy
7	Similitude and Model Studies

F. Instructional method and pedagogy (Continuous Internal Assessment Scheme CIA):

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical and tutorial which carry 05 marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in tutorial rooms carries 05 marks.
- Viva voce will be conducted at the end of the semester of 05 marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.

G. Students Learning Outcomes:

On the successful completion of this course

- Concepts of fluid flow that will make the base to learn the subject hydraulics and will also impart a better understanding to the design concepts of various structures holding or dealing with fluids

H. Recommended Study Materials:

a. Text book & Reference Books:

1. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi
2. Bansal, R.K., Fluid Mechanics, Laxmi Publications
3. Streeter, V.L. and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1985, New York
4. Subramanya, K., Theory and Applications of Fluid Mechanics, Tata-McGraw Hill Publishing Co., 1993, New Delhi
5. Shaughnessy, E.J., Katz, I.M. and Schaffer, J.P., Introduction to Fluid Mechanics, SI edition, 2005, Oxford University Press, New Delhi
6. White, F.M. Fluid Mechanics, McGraw Hill, New York
7. Kumar, D.S., Fluid Mechanics, S.K.Kataria & Sons
8. Rajput, R.K., Fluid Mechanics, S. Chand & Co. publications
9. Modi, P.N. and Sheth, Fluid Mechanics & Hydraulic Machines, Standard Book House
10. Ramamurtham, S., Hydraulic Fluid Mechanics & Fluid Machines, Dhanpatrai Publishing Co.
11. Garde, R.J. and Mirajgaoker, A.C., Engineering Fluid Mechanics, New Chand & Sons

b. Web Materials:

1. http://nptel.iitm.ac.in
2. http://www.mvsengineering.com