B.E. (Civil) Semester: VI

Subject Name: Applied Fluid Mechanics (CV601)

A. 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.

B. Teaching /Examination Scheme:

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract/ Tut.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
03	00	02	05	04	03	70	30	20	30	150

C. Detailed Syllabus:

1. **Behavior 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, 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:

Sr. No.	Title of the Unit	Minimum Hours	Weightage
1.	Behavior 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%
		45	100%

E. List of Experiments

Experiment No.	Name of Experiment
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

Tutorials shall be based on the above mentioned course content.

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 and practical which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms Carries Marks
- Internal exam of 30 marks will be conducted as a part of Mid semester evaluation.
- Experiments shall be performed in the field related to course contents.
- The course includes a practical, where students have an opportunity to build an appreciation for the concept being taught in lectures.

G. Students Learning Outcomes:

- On the completion of the course one should be able to understand.
- 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. 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