

B.E.Semester : III

Civil Engineering

Subject Name: *Fluid Mechanics (CV303)*

A. Course objective:

- To develop students understanding of the basic principles of fluid mechanics.
- To take up the basic concepts of fluids and fluid flows as they are essential in all engineering disciplines and specially to the civil engineers managing various fluids with all the sub disciplines of the field.
- To provide the student with a specific knowledge regarding fluid-flow phenomena observed in mechanical engineering systems, such as flow in a pipe and flow measurement.

B. Teaching /Examination Scheme

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

C. Detailed Syllabus

- 1. Introduction to Fluids:** Definition, Ideal fluids, real fluids, Newtonian and non-Newtonian fluids. Properties of Fluids: Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity, Control volume concept
- 2. Hydrostatics:** Pressure and its measurement, fluid pressure at a point, Pascal's law, pressure and its relation with height, atmospheric, absolute, gauge and negative pressure, measurement of pressure through piezo-meter and various types of manometer. Total pressure, intensity of pressure, centre of pressure. Pressure on horizontal, vertical, inclined and curved surface. Buoyancy, centre at Buoyancy, Meta

centre and Meta centre height. Condition of equilibrium of floating and submerged body. Experimental and analytical method to determine Meta-centric height. Pressure in case of accelerated rigid body motion.

3. **Fluid Kinematics** Types of fluid motion, methods of describing fluid flow - Lagrangian and Eulerian method, Inviscid flows, velocity and acceleration, flow rate, Continuity equation, Potential flows, flow lines, velocity potential and stream function, Flownet its characteristic and utility, circulation and vorticity, Vortex flow - forced vortex flow, free vortex flow, equation of motion for vortex flow, equation of forced vortex flow and free vortex flow
4. **Fluid Dynamics** Energy processed by a fluid body, Types of forces, Forces influencing fluid motion, head-energy correction factor, Euler and Bernoulli's equations, application of Bernoulli's equation, Flow measurement, momentum of fluid in motion, momentum equation and momentum correction factor , Application of momentum equation, forces on a pipe bend, free jets
5. **Measurement of Flow:** Orifice & Mouth piece Classification, hydraulic coefficients, experimental determination of hydraulic coefficient, discharge through all types of orifice & mouthpiece, time of emptying the tank through orifice and mouthpiece , Notches and Weirs Classification, discharge through various types of Notches and weirs, time of emptying a reservoir or a tank with notches & weirs, Orifice meter Venturimeter ,Nozzles and bendmeter,
6. **Flow Through Pipes** Introduction, Major and minor losses of energy in pipes, hydraulic gradient, total energy line, pipes in series, pipes in parallel, flow through branched pipes, and hydraulic transmission of power.

D. Lesson Planning

Sr. No.	Title of the Unit	Minimum Hours	Weightage
1.	Introduction to Fluids	04	09%
2.	Hydrostatics:	08	17%
3.	Fluid Kinematics0	09	20%
4.	Fluid Dynamics	09	20%
5.	Measurement of Flow	09	20%
6.	Flow Through Pipes	06	14%

LIST OF EXPERIMENTS (Any Eight)

1. Experiment of Hydrostatic Pressure (relation $P = wh$)
2. Experiment of Buoyancy and determination of Meta centre height
3. **Notch Apparatus:** To measure the flow using different notches.
4. **Bernoulli's Apparatus :** To verify Bernoulli's theorem
5. **Losses in Pipe fitting apparatus:** To determine loss coefficients for different pipe fittings
6. **Reynold apparatus:** To study laminar and turbulent flow and it's visualization on reynold's apparatus
7. **Pipe Friction apparatus:** To determine Fluid friction factor for the given pipes
8. **Venturi & Orifice Meter Apparatus:** To calibrate and study different flow meter, i.e. venturi meter, orifice meter, **Nozzel Meter**
9. **Pitot Static Tube:** To study and measure velocity of flow using Pitot tube.

E. 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.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- One internal exam of 30 marks is conducted as a part of Mid semester evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 7 experiments will be carried out in the laboratory related to course contents.

F. Student learning outcome

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.
- The student will be able to recognize the particular flow regime that is present in a typical engineering system.
- The student will demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system.

E. Recommended Study Material:

A . Reference Books:

1. Fluid Mechanics V.L Streeter,. and E.B Wylie,, , McGraw Hill, 1985, New York
2. Theory and Applications of Fluid Mechanics, K Subramanya , Tata-McGraw Hill Publishing Co, 1993, New Delhi.
3. Introduction to Fluid Mechanics E.J Shaughnessy,, I.M Katz,. and J.P Schaffer,. SI edition, 2005, Oxford University Press, New Delhi
4. Fluid Mechanics , F.M., White, 5th Edition, McGraw Hill, New York.
5. Fluid mechanics By Dr.D.S.Kumar
6. Fluid mechanics & Hydraulic Machines By Dr.P.N.Modi & Sheth
7. Fluid mechanics By Dr.A.K.Jain
8. Hydraulic Fluid mechanics & Fluid Machines By S.Ramamurthan
9. Engineering Fluid Mechanic By R.J.Garde & A.C.Mirajgaoker
10. Bansal, R.K., Fluid Mechanics, Laxmi Publications

B . Web Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm

2. <http://nptel.iitm.ac.in/video.php?subjectId=105101082>
3. <http://www.mvsengineering.com>
4. <http://nptel.iitm.ac.in/courses/IIT-MADRAS/Hydraulics/index.php>
5. <http://nptel.iitm.ac.in/video.php?subjectId=105103096>