Subject Code: 01ME2301
Subject Name: Fluid Mechanics
B. Tech. Year - II (Semester - 3)

Type of course : Fundamental

Prerequisite : NIL

Rationale : To provide fundamental knowledge of fluids, its properties and behavior under various conditions

Course Outcome :

After completion of this course, student will be able to

1. Determine the fluid properties and flow parameters
2. Analyse various hydraulic systems by applying the fundamental laws of fluid statics
3. Distinguish between different types of fluid flows and solve the fluid flow governing equations by taking suitable assumptions
4. Evaluate major and minor losses in pipes
5. Apply principles of dimensional analysis on real life problems
6. Interpret the boundary layer aspects of laminar and turbulent flows

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
THEORY	TUTORIAL	PRACTICAL	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	**INTRODUCTION TO FLUID STATICS:** Definition of fluid, Fluid properties, Classification of fluids, Pascal's Law and Hydrostatic Law, Pressure and its variation in a static Fluid, Measurement of static fluid pressure: Manometers	**04**
2	**HYDROSTATIC FORCES AND BOUYANCY:** Hydrostatic forces on Plane –Inclined and Curved surfaces, Buoyancy, Condition of Equilibrium for Submerged and Floating Bodies, Centre of	**06**

	Buoyancy, Metacentre– Determination of Metacentric Height	
3	**FLUID KINEMATICS AND DYNAMICS:** Fluid kinematics: Description of fluid motion – Lagrangian and Eulerian approach, Types of flows, Control volume, Material derivative and acceleration, Streamlines, Pathlines and Streaklines, Circulation and Vorticity, Stream function and velocity potential function, Vortex flow Fluid dynamics: Continuity equation, Euler's equation of motion, Bernoulli's equation, Practical applications of Bernoulli's equation in flow measurement devices like venturi meter, orifice meter and pitot tube, elementary Theory of notches	**10**
4	**VISCOUS FLOW AND TURBULANT FLOW:** Reynolds number, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, movement of piston in dash pot, methods of measurement of viscosity, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes	**08**
5	**FLOW THROUGH PIPES:** Darcy-Weisbach equation, major and minor losses in pipes, pipe friction, parallel, series and branched pipes	**03**
6	**DIMENSIONAL ANALYSIS:** Dimensional homogeneity, Rayleigh's method, Buckingham π theorem, Non-dimensional numbers, Model laws and distorted models, Modelling and similitude	**04**
7	**BOUNDARY LAYER FLOW:** Boundary layers, Laminar flow and turbulent flow, Boundary layer thickness, Momentum integral equation, Drag and lift, Separation of boundary layer, Methods of preventing the boundary layer separation	**06**
8	**COMPRESSIBLE FLOW:** Basic equations for one dimensional, compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties	**05**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
20	**30**	**25**	**15**	**10**	**--**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of Experiments :

1. To determine the different types of flow Patterns by Reynolds's experiment
2. Verification of Bernoulli's theorem
3. To determine the friction factor for different pipes

4. To determine the loss coefficients for different pipe fittings (for sudden enlargement and sudden contraction)
5. To determine the loss coefficients for different pipe fittings (for bend and elbow)
6. To determine the coefficient of discharge through an orifice meter
7. To determine the coefficient of discharge through venturi meter
8. To measure the velocity of flow using pitot tube
9. To determine the coefficient of discharge through open channel flow over a rectangular notch
10. To determine the coefficient of discharge through open channel flow over a V-shaped notch
11. To determine metacentric height of floating body
12. Free and forced vortex flow

Reference books :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons, 9th Edition, 2015.
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications, 10th Edition, 2019.
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S. Chand & Co, 6th Edition, 2015.
4. Fluid Mechanics by Frank M. White, McGraw Hill Publishing Company Ltd, 8th Edition, 2016.
5. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd, 8th Edition, 2020.
6. Yunus A. Çengel, John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill, 4th Edition, 2018.

List of Open Base Software / learning website :

1. http://nptel.iitm.ac.in
2. http://media.efluids.com/galleries/all
3. https://swayam.gov.in/