

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE104	FLUID MECHANICS	2	2	0	3

**Course Category:**

Programme core

**a. Preamble :**

The course aims at providing the students with a broad understanding of fluid statics and dynamics. It deals with the dimensional analysis of models and introduces analysis of flow through pipes. It outlines the elementary concepts of boundary layer theory.

**b. Prerequisite Courses:**

- Engineering Mathematics II

**c. Related Courses:**

- Incompressible flow aerodynamics
- Boundary layer theory
- Turbomachinery

**d. Course Educational Objectives:**

- To develop a strong foundation in the fundamentals of fluid mechanics.
- To provide understanding of dimensional analysis and its importance in the experimental study of fluid mechanics
- To have a basic understanding of flow through pipes and boundary layer theory.

**e. Course Outcomes:**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Discuss the basic properties of fluids and solve typical fluid statics problems	K3
CO2	Develop the governing fluid dynamic equations and solve typical fluid dynamic problems	K3
CO3	Use dimensional analysis to design physical and numerical experiments and to apply dynamic similarity.	K3
CO4	Explain the flow through pipes and solve typical numerical problems	K3
CO5	Describe the boundary layer concepts and solve typical numerical problems	K3

**f. Correlation of COs with POs:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		H		L	H	H	L	H		
CO2	H	M		H		L	H	H	L	H		
CO3	H			H		L	H	H	L	H		
CO4	H	M		H		L	H	H	L	H		
CO5	H			H		L	H	H	L	H		

H- High; M-Medium; L-Low

**g. Course Content:**

**UNIT-I BASIC CONCEPTS AND FLUID STATICS**

**L-6 T-6**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges

**UNIT-II FLUID KINEMATICS AND FLUID DYNAMICS**

**L-6 T-6**

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube

**UNIT-III DIMENSIONAL AND MODEL ANALYSIS**

**L-6 T-6**

Need for dimensional analysis – Dimensional homogeneity -Methods of dimensional analysis – Similitude –types of similitude -Dimensionless parameters- application of dimensionless parameters – Model Analysis-Model laws- classification of models

**UNIT-IV FLOW THROUGH PIPES**

**L-6 T-6**

Laminar and turbulent flow- Boundary layer flow – Boundary layer thickness - Reynolds number and its Significance-Laminar fully developed pipe Flow-Hagen-Poiseuille Flow-Coefficient of Friction-Head loss – Darcy-Wiesbach Equation-Hydraulic gradient- Total Energy Lines-Moody's Diagram-Turbulent flow through pipes

**UNIT-V BOUNDARY LAYER THEORY**

**L-6 T-6**

Introduction, laminar boundary Layer-Turbulent Boundary Layer-Laminar sublayer- boundary layer thickness- displacement thickness- momentum thickness- energy thickness-shape factor - Drag force on a flat plate due to boundary Layer-Separation of boundary layer, Drag and Lift on immersed bodies, Numerical problems.

**Total Periods: 30 + 30 = 60 Periods**

## **h. Learning Resources**

### **i. Text Books:**

1. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 1995.
2. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995

### **ii. References:**

1. Philip J. Pritchard, "Fox and McDonald's Introduction to Fluid Mechanics", John Wiley & Sons Inc, 8<sup>th</sup> edition, 2011
2. YunusCengel, John Cimbala, "Fluid Mechanics in SI Units", McGraw Hill Education (India) Private Limited, 3<sup>rd</sup> edition, 2014
3. Frank White, "Fluid Mechanics", McGraw-Hill Education, 8<sup>th</sup> edition, 2015
4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
5. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
6. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", DhanpatRai and Sons, Delhi, 1998.
7. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004.