B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – IV

FLUID MECHANICS

Course Code	**18ME43**	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have a working knowledge of the basic properties of fluids and understand the continuum approximation.
- To calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy.
- To understand the flow characteristic and dynamics of flow field for various engineering applications.
- To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
- To discuss laminar and turbulent flow and appreciate their differences and the concept of boundary layer theory.
- To understand the concept of dynamic similarity and how to apply it to experimental modelling.
- To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows.

Module-1

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Concept of continuum, types of fluids etc., pressure at a point in the static mass of fluid, variation of pressure. Pascal's law, absolute, gauge, atmospheric and vacuum pressures; pressure measurement by simple, differential manometers and mechanical gauges.

Fluid Statics: Total pressure and centre of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid.

Module-2

Buoyancy, center of buoyancy, meta center and meta centric height its application.

Fluid Kinematics: Velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate free form, acceleration of fluid particle, rotational & irrotational flow, Laplace's equation in velocity potential and Poisson's equation in stream function, flow net.

Module-3

Fluid Dynamics; Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline. Integration of Euler's equation to obtain Bernoulli's equation, Assumptions and limitations of Bernoulli's equation. Introduction to Navier-Stokes equation. Application of Bernoulli's theorem such as venturi-meter, orifice meter, rectangular and triangular notch, pitot tube.

Laminar and turbulent flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, Poiseuille equation – velocity profile loss of head due to friction in viscous flow. Reynolds's experiment, frictional loss in pipe flow. Introduction to turbulence, characteristics of turbulent flow, laminar-turbulent transition major and minor losses.

Module-4

Flow over bodies: Development of boundary layer, Prandtl"s boundary layer equations, Blasius solution, integral momentum equation, drag on a flat plate, boundary layer separation and its control, streamlined and bluff bodies -flow around circular bodies and aero foils, calculation of lift and drag.

Dimensional analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitude.

Course Outcomes: At the end of the course the student will be able to:

CO1: Identify and calculate the key fluid properties used in the analysis of fluid behavior.

CO2: Explain the principles of pressure, buoyancy and floatation

CO3: Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.

CO4: Describe the principles of fluid kinematics and dynamics.

CO5: Explain the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.

CO6: Illustrate and explain the basic concept of compressible flow and CFD

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	A Text Book of Fluid Mechanis And Hydraulic Machines	Dr R.K Bansal	Laxmi Publishers	
2	Fluid Mechanics	F M White	McGraw Hill Publications	Eighth edition. 2016
3	Fluid Mechanics (SI Units)	Yunus A. Cengel John M.Cimbala	TataMcGraw Hill	3rd Ed.,2014.
Reference Books				
1	Fluid Mechanics	F M White	McGraw Hill Publications	Eighth edition. 2016
2	Fundamentals of Fluid Mechanics	Munson, Young, Okiishi&Huebsch,	John Wiley Publications	7th edition
3	Fluid Mechanics	Pijush.K.Kundu, IRAM COCHEN	ELSEVIER	3rd Ed. 2005
4	Fluid Mechanics	John F.Douglas, Janul and M.Gasiosek and John A.Swaffield	Pearson Education Asia	5th ed., 2006
5	Introduction to Fluid Mechanics	Fox, McDonald	John Wiley Publications	8th edition.

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