INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

FLUID MECHANICS								
IV Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMED14	**Core**	3	0	0	3	30	70	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		
Prerequisite: Thermodynamics								

I. COURSE OVERVIEW:
Fluid mechanics is that branch of science which deals with the behavior of the fluids (liquids or gases) at rest as well as in motion. Thus, this branch of science deals with the static, kinematics and dynamic aspects of fluids. The proper understanding of mechanics of fluids is critical in various branches of engineering. The primary motive of this course is to examine, through the laws of fluid mechanics and thermodynamics, the means by which the energy transfer is carried out in the turbo-machinery, together with the differing behavior of individual types in operation. A modern discipline, called computational fluid dynamics (CFD), is devoted to this approach to solving fluid mechanics problems.

II. COURSES OBJECTIVES:
The students will try to learn

I. The fundamental knowledge of fluids, their properties and behavior under various conditions of closed conduit and external flow systems.
II. The development of various static and dynamic fluid flow governing equations from the fundamental conservation laws of motion studied under basic physics and classical mechanics.
III. The concepts and principles related to fluid mechanics, which are used in the applications of hydraulics and hydraulic machines.
IV. The real-world engineering problems and examples towards gaining the experience for how fluid mechanics is applied in engineering practice.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO 1 Relate the basic properties, various types and patterns of fluid flow configurations that are encountered in fluid flows
CO 2 Apply the basic laws of conservation for various phenomena of fluid flow systems by understanding appropriate parametric assumptions and limitations
CO 3 Outline the regimes and separation of boundary layer during external fluid flow systems
CO 4 Compare the total and hydraulic gradient lines for distinct cases of losses during a closed conduit fluid flow system
CO 5 Analyse a variety of practical fluid-flow devices and utilize fluid mechanics principles in design

CO 6 Make use of the dimensionless parameters, model analysis to analyse prototypes of hydraulic pumps

IV. COURSE CONTENT:
MODULE-I: FLUID STATICS (10)

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, measurement of pressure. Manometers-Piezometer, U-tube, inverted and differential manometers.

MODULE –II: FLUID KINEMATICS AND DYNAMICS (09)

Fluid Kinematics: Kinematics of fluid flow- Eularian and Lagrangian descriptions, Stream line, path line, streak line and stream tube, classification and description of flows for one and three dimensions. Fluid Dynamics: Euler's equation of motion, Bernoulli equation for flow along a stream line and applications, Measurement of flow and momentum equation.

MODULE –III: BOUNDARY LAYER CONCEPTS AND CLOSED CONDUIT FLOW (10)
Concept of boundary layer – Definition, characteristics along thin plate, laminar, transition and turbulent boundary layers, separation of boundary layer, measures of boundary layer thickness.

Closed conduit flow: – Darcy Weisbach equation, friction factor, Head loss in pipe flow, Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

MODULE –IV: FLUID MACHINES (09)
Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines, working principles–draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines

MODULE –V: PUMPS (10)
Theory of rotodynamic machines, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles, Centrifugal pumps, working principle, work done by the impeller, performance curves– Cavitation in pumps- Reciprocating pump–working principle-indicator diagrams.

V. TEXT BOOKS:

1. P. N. Modi & S. M. Seth, "Fluid Mechanics, Hydraulic and Hydraulic Machines", 4th edition in SI units, Standard book house, New Delhi, 2017.
2. R. K. Bansal, "A text of Fluid mechanics and hydraulic machines", Revised 9th edition, Laxmi Publications (P) ltd., New Delhi, 2014.

VI. REFERENCE BOOKS:

1. R. K. Rajput, "Fluid mechanics and Fluid Machines", S. Chand & Co., Delhi, 2018
2. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons, 2018.

VII. ELECTRONIC RESOURCES:

1. https://nptel.ac.in/courses/112106286.
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=33.
3. https://akanksha.iare.ac.in/index?route=course/details&course_id=31.
4. https://akanksha.iare.ac.in/index?route=course/details&course_id=1293.

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech-talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)