FLUID MECHANICS AND HYDRAULIC MACHINES

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC12	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Engineering Mechanics and Thermodynamics

I. COURSEOVERVIEW:

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 turbomachinery, together with the differing behavior of individual types in operation.

II. COURSEOBJECTIVES:

The students will try to learn:

1. The fundamental knowledge of fluids, their properties and behavior under various conditions of closed conduit and external flow systems.
2. 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.
3. The concepts and principles related to fluid mechanics, which are used in the applications of hydraulics and hydraulic machines.
4. The real world engineering problems and examples towards gaining the experience for how fluid mechanics is applied in engineering practice.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** the basic properties, various types and patterns of fluid flowconfigurations that are encountered in fluid flows.	Remember
CO 2	**Apply** the basic laws of conservation for various phenomena of fluid flow systems by understanding appropriate parametric assumptions and limitations.	Apply
CO 3	**Outline** the regimes and separation of boundary layer during external fluid flow systems.	Understand
CO 4	**Compare** the total and hydraulic gradient lines for distinct cases oflosses during a closed conduit fluid flow systems.	Understand
CO 5	**Demonstrate** the theories, phenomena and working principles ofhydraulic machines.	Understand
CO 6	**Make use of** the dimensionless parameters, model analysis to analyze prototypes of hydraulic pumps.	Apply

IV. SYLLABUS:

MODULE-I: FLUID STATICS (12)

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, application of continuity equation.

MODULE –II: FLUID KINEMATICS AND DYNAMICS (12)

Fluid Kinematics: Kinematics of fluid flow- Eulerian 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 (12)

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, Moody's diagram and introduction to dimensional analysis.

MODULE –IV: FLUID MACHINES (12)

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 (12)

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. TEXTBOOKS

1. Rajput, "Fluid Mechanics and Hydraulic Machines", S.Chand & Co, 6th Edition, 1998.
2. H Modi, Seth, "Hydraulics, Fluid Mechanics and Hydraulic Machinery", Rajsons Publications, 20th Edition, 2013.
3. M. White, Fluid Mechanics, 8th Edition, Tata McGraw Hill, 2016.

VI. REFERENCEBOOKS:

1. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", Kotaria & Sons, 9th Edition 2013.
2. Dr. R K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th Edition, 2015.
3. R. L. Panton, Incompressible Flow, Wiley-India, 3rd Edition, 2005.

VII. WEBREFERENCES:

1. https://nptel.ac.in/courses/112105171/
2. https://www.oreilly.com/library/view/fluid-mechanics-and/9788177583649/
3. https://books.google.co.in/books/about/A_Textbook_of_Fluid_Mechanics_and_Hydrau.html?id=nTMVnwEACAAJ&redir_esc=y

VIII. E-TEXT BOOKS:

1. https://vscht.cz/uchi/ped/hydroteplo/materialy/introduction.fluid.mech.pdf
2. https://idoc.pub/documents/drrkbansal-fluid-mechanics-and-hydraulic-machines-pdf-6nq99jo6gqlw
3. https://www.pdfdrive.com/a-textbook-of-fluid-mechanics-hydraulic-machines-by-r-k-rajput-e184521268.html