FLUID MECHANICS AND MACHINES

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB08	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

The aim of this course is to introduce basic principles of fluid mechanics and it is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery. Nowadays the principles of fluid mechanics find wide applications in many situations. The course deals with the fluid machinery, like turbines, pumps in general and in power stations. This course also deals with the large variety of fluids such as air, water, steam, etc; however, the major emphasis is given for the study of water.

II. OBJECTIVES:

The course should enable the students to:

I. Learn about the application of mass and momentum conservation laws for fluid flows.
II. Understand the importance of dimensional analysis.
III. Obtain the velocity and pressure variations in various types of simple flows.
IV. Analyse the flow in water pumps and turbines.

III. COURSE OUTCOMES (COs):

COs	Course Outcome
CO1	Discuss the basic concepts and methodologies of fluid statics
CO2	Understand various laws for fluid kinematics and dynamics
CO3	Understand the concepts of boundary layer theory and closed conduit flow
CO4	Explore the design, working and performance of turbines
CO5	Analyse the design, working, performance of pumps and dimensionality laws

IV. SYLLABUS:

MODULE-I	FLUID STATICS	Classes: 09

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, Control volume-application of continuity equation and momentum equation, Incompressible flow.

MODULE-II	FLUID KINEMATICS AND DYNAMICS	Classes: 09

Fluid Kinematics: Kinematics of fluid flow- Eulerian and Lagrange 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.

MODULE-III	BOUNDARY LAYER CONCEPTS AND CLOSED CONDUIT FLOW	Classes: 09
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. Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli.		
MODULE-IV	**FLUID MACHINES**	**Classes: 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	**DIMENSIONAL ANALYSIS AND PUMPS**	**Classes: 09**
Dimensional Analysis: Need for dimensional analysis–methods of dimension analysis, Similitude, types of similitude Dimensionless parameters–application of dimensionless parameters, Model analysis. Pumps: Theory of Roto dynamic 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.		

V. Text Books:

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.
4. V. Gupta and S. K. Gupta, Fundamentals of Fluid Mechanics, 4th Edition, New Age International 2011.
5. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill International Edition 2005.
6. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall of India, 2005.
7. R. W. Fox, P. J. Pritchard and A. T. McDonald, Introduction to Fluid Mechanics, 7th Edition, Wiley-India 2010.
8. R. Welty, C. E. Wicks, R. E. Wilson, G. Rorrer, Fundamentals of Momentum, Heat and Mass Transfer, 4th Edition, 2007.

VI. Reference Books:

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. B. R. Munson, D. F. Young, T. H. Okiishi and W. W. Huebsch, Wiley-India, 6th Edition, 2010.
4. R. L. Panton, Incompressible Flow, , Wiley-India, 3rd Edition, 2005.
5. R. B. Bird, W. E. Stewart and E. N. Lightfoot, Transport Phenomena, 2nd Edition, Wiley- India

VII. Web Reference:

1. https://nptel.ac.in/courses/112105171/

VIII. E-Book:

1. https://vscht.cz/uchi/ped/hydroteplo/materialy/introduction.fluid.mech.pdf