FLUID DYNAMICS

III Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEC03	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes:60		

Prerequisites: Linear Algebra and Calculus

I. COURSE OVERVIEW:

This course will provide with the terminology associated with fluid mechanics and the use of fluid properties in solving problems. It also emphasizes on mathematical description of fluid flows. The basic conservation equations of a fluid flow are derived for different fluid flows. It introduces the concept of a boundary layer, boundary layer thickness and basic aspects of bluff body aerodynamics. Compare and contrast various fluid machinery based on flow properties and its applications. The course discusses the concept of dimensional analysis and its importance, and open-channel flows which are widely applicable in engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamental knowledge of types of fluids, properties and behavior under static and dynamic conditions of closed conduit and external flow systems.

II. The analysis of prototype models based on geometric, kinematic, and dynamic similarities for the evaluation of performance of designed hydraulic machines.

III. The importance of formation of boundary layer when fluid flows over the solid bodies and effect in reduction of displacement, momentum, energy and pressure gradient.

IV. The operating principle of various turbo machinery and analyze their characteristics for their suitability in engineering application using governing equations.

III. SYLLABUS:

MODULE – I: FLUID PROPERTIES AND FLUID STATICS(10)

Density, specific weight, specific gravity, surface tension and capillarity, Newton's law of viscosity, incompressible and compressible fluid, numerical problems; Hydrostatic forces on submerged bodies - Pressure at a point, Pascal's law, pressure variation with temperature and height, center of pressure plane, vertical and inclined surfaces; Manometers - simple and differential Manometers, inverted manometers, micro manometers, pressure gauges and numerical problems. Buoyancy - Archimedes principle, metacenter, Meta centric height calculations; Stability.

MODULE – II: DIMENSIONAL ANALYSIS(10)

Fundamental and secondary quantities, Dimensional homogeneity, Methods of dimensional Analysis- Rayleigh's method, Buckingham's π- theorem, method of selecting repeating variables, similarity parameters - Reynolds number, Froude number, Euler's number, Weber's number, Mach number concepts of geometric, kinematic and dynamic similarity.

MODULE – III: KINEMATICS AND DYNAMICS OF FLUIDS(10)

Methods of describing fluid motion, types of fluid flows, differential form of continuity equation- Cartesian, cylindrical and polar coordinate system, Numerical problems

Euler's equation of Motion; Bernoulli's equation, Application of Bernoulli's equation in flow measurements: velocity and mass flow rate, pitot-static tube, venturi meter, orifice meter and V-Notch

MODULE - IV BOUNDARY LAYER THEORY (09)

Introduction and classification of boundary layer, boundary layer properties- Displacement, momentum and energy thickness, idea of boundary layer separation, streamlined and bluff bodies, drag force on flat due to boundary layer.

MODULE - V TURBO MACHINERY(09)

Introduction and classification of fluid machines: Turbo machinery analysis; The angular momentum principle; Euler turbo machine equation; Application to fluid systems, working principle overview of turbines, fans, pumps and compressors.

IV. TEXT BOOKS:

1. D.J Tritton, "Physical Fluid Dynamics", Oxford university press, 2nd Edition 2016.
2. R. K Bansal, "Fluid mechanics and hydraulic machines", Laxmi publications ltd, 9th Edition, 2011.
3. Robert W Fox, Alan T McDonald, "Introduction to fluid Mechanics", John Wiley and Sons, 6th Edition, 1995.
4. Streeter V. L, Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 9th Edition, 1983.

V. REFERENCE BOOKS:

1. Yuan S W, "Foundations of fluid Mechanics", Prentice-Hall, 2nd Edition, 1987.
2. Milne Thompson L M, "Theoretical Hydrodynamics", MacMillan, 5th Edition, 1968.
3. Rathakrishnan. E, "Fundamentals of Fluid Mechanics", Prentice-Hall, 5th Edition, 2007.
4. Som S. K, Biswas. G, "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd Edition, 2004.

VI. WEB REFERENCES:

1. https://nptel.ac.in/courses/112105171/1
2. https://textofvideo.nptel.iitm.ac.in/112105171/lec1.pdf
3. https://www.fkm.utm.my/~syahruls/3-teaching/2-fluid-II/fluid-II-enote/32-pump-2.pdf
4. https://www.scribd.com/doc/16605891/Fluid-Mechanics