FLUID DYNAMICS

III Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB03	Foundation	3	1	-	4	30	70	100
Contact Classes: 33	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 48		

OBJECTIVES:

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

COURSE OUTCOMES:

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

CO 1 **Recall**the basic properties, various types and patterns of fluid flow configurations that encounter in practicefor describing various fluid flows.

CO 2 **Explain** various effects of viscosity, static pressure, surface tension, Newton's law of viscosity, pressure difference and capillary risefor the bodies immersed in fluids.

CO 3 **Summarize** the concept of pressure measuring devices applications and effect of buoyancy on submerged bodiesfor real world applications

CO 4 **Utilize**the concept of dimensional analysis and similarity parameters for predicting physical parameters that govern fluid systemsfor the fluid flow analysis used in designing proto types devices.

CO 5 **Apply**the basic laws of conservation for various phenomena of fluid flow systems by understanding appropriate parametric assumptions and limitations for obtaining numerical solutions for complex engineering problems.

CO 6 **Demonstrate** Euler's Equation of motion, Bernoulli's equation and principle of flow measuring equipmentsfor analysis and parameters measurements of ideal fluid motion.

CO 7 **Interpret** the regimes and separation of boundary layer during external fluid flow systemsfor identifying its effect in reduction of displacement, momentum and energy thickness gradients.

CO 8 **Outline**the specific and unit indicators, and performance of hydraulic machines such as speed, discharge and power numbers etc., for designingthe new equipments as per the requirements.

CO 9 **Classify** the types of hydraulic machines based on working principle and performance characteristicsfor the selection in real world applications.

CO 10 **Choose**the designing procedure of hydraulic machinesfor real world applications along with enhanced performance and minimized losses.

MODULE-I	FLUID PROPERTIES AND FLUID STATICS	Classes: 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	**FLUID KINEMATICS AND BASIC EQUATIONS OF FLUID FLOW ANALYSIS**	**Classes: 09**
Statement of Buckingham‟s π- theorem, similarity parameters - Reynolds number, Froude number, concepts of geometric, kinematic and dynamic similarity, Reynolds number as a very approximate measure of ratio of inertia force and viscous force. Types of fluid flows, differential equations of mass and momentum for incompressible flows, inviscid eulers equation and viscous flows- navier stokes equations, concept of fluid rotation, vorticity and stream function, exact solutions of navier stokes equations for coquette flow and poiseuille flow, numericals.		
MODULE-III	**FLUID DYNAMICS**	**Classes: 10**
Fluid forces and Motion of a fluid particle; Fluid deformation; Euler's and Bernoulli's equation, phenomenological basis of Naviers- stokes equation, flow measurements : pressure, velocity and mass flowrate, viscosity, pitot-static tube, venturi meter, orifice meter and V-Notch, numericals.		
MODULE-IV	**BOUNDARY LAYER THEORY**	**Classes: 08**
Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Displacement, momentum and energy thickness, numericals.		
MODULE-V	**TURBO MACHINERY**	**Classes: 08**
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.		

Text Books:

1. D.J Tritton, “Physical Fluid Dynamics”, Oxford university press, 2nd edition2016.
2. R. K Bansal, “Fluid mechanics and hydraulic machines”, Laxmi publications ltd, 9thEdition,2011.
3. Robert W Fox, Alan T McDonald, “Introduction to fluid Mechanics”, John Wiley and Sons, 6thEdition,1995.
4. Streeter V. L, Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 9th Edition,1983.

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.
   Som S. K, Biswas. G, “Introduction to fluid mechanics and fluid machines”, Tata McGraw-Hill, 2nd Edition, 2004.

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

E-Text Books:
1. https://bookboon.com/en/engineering-fluid-mechanics-ebook 2. https://www.slideshare.net/asifzhcet/fluid-mechanics-and-hydraulic-machines-dr-r-k-bansal 3. https://eprints.staffs.ac.uk/222/1/engineering-fluid-mechanics%5B1%5D.pdf 4. https://www.engr.uky.edu/~acfd/me330-lctrs.pdf