FLUID MECHANICS

IV Semester: CE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
ACE005	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	-	4	30	70	100
Contact Classes:45	**Tutorial Classes:15**	**Practical Classes: Nil**				**Total Classes: 60**	

OBJECTIVES:

The course should enable the students to:

I. Understand and study the effect of fluid properties on a flow system.
II. Apply the concept of fluid pressure, its measurements and applications.
III. Explore the static, kinematic and dynamic behavior of fluids.
IV. Assess the fluid flow and flow parameters using measuring devices.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

1. Define fluid and its properties. Describe surface tension and relations in different conditions.
2. Explain Newton‟s law of viscosity. Classify fluids based on Newton‟s law of viscosity and solve problems on Viscosity.
3. Employ capillary principle to calculate capillary rise/fall in a given tube.
4. Interpret different forms of pressure measurement.
5. Employ principle of manometry to measure gauge and differential pressure.
6. Calculate Hydrostatic Force and its Location for a given geometry and orientation of plane surface.
7. Examine the possibility of a flow using continuity equation.
8. Employ Archimedes principle to solve numerical examples on Buoyancy.
9. Identify and interpret different flows with relevant equations.
10. Distinguish velocity potential function and stream function and solve for velocity and acceleration of a fluid at a given location in a fluid flow.
11. Examine stability of a floating body by determining its metacentric height.
12. Establish Euler‟s theorem and deduce Bernoulli‟s equation for a ideal fluid and comment on validation assumption made.
13. Examine Bernoulli‟s equation for ideal and real fluids and evaluate the direction of flow.
14. Flow and velocity measuring instruments.
15. Employ Darcy-Weichbach and Chezy‟s equation to calculate friction losses.
16. Describe flow through pipes, and Distinguish between major loss and minor loss in pipes.
17. Sketch HGL and TEL for a given pipe setting.
18. Distinguish between Drag force and lift force and Examine drag and lift force for a given set of dimension and variables.
19. Write the boundary layer concept.
20. Distinguish displacement, momentum, and energy thickness.
21. Explain the concept of prandtl contribution.
22. Evaluate the Vonkarmen momentum integral equation.
23. Analyze the closed conduit flows using Renold‟s experiment. Sketch laminar and turbulent flow.
24. Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations.

UNIT-I	INTRODUCTION	Classes: 09

Dimensions and units , physical properties of fluids, ideal and real fluids, newtonian and non-newtonian fluids, measurement of surface tension, specific gravity, viscosity, vapor pressure and their influences on fluid motion pressure at a point, Pascal's law, hydrostatic law ,atmospheric, gauge and vacuum pressure, pressure measurement, piezometers and manometers, pressure gauges, manometers: differential and micro manometers.

UNIT-II	FLUID KINEMATICS	Classes: 09

Description of fluid flow, stream line, path line and streak lines and stream tube. Classification of flows : Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows, equation of continuity for one, two , three dimensional flows , velocity field, one & two-dimensional flow analysis, circulation and vorticity, stream function, potential flow, standard flow patterns, combination of flow patterns, flownet, flownet analysis.

UNIT-III	FLUID STATICS AND FLUID DYNAMICS	Classes: 09

Hydrostatic Forces: Hydrostatic forces on submerged plane, horizontal, vertical, inclined and curved surfaces, centre of pressure, derivations and problems. Pressure-density-height relationship,   manometers, center of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to uniform accelerations, measurement of pressure.

Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, (Navier, stokes equations (Explanationary)) momentum equation and its application, forces on pipe bend. Pitot tube, venturimeter and orifice meter, classification of orifices, flow over rectangular,
triangular and trapezoidal and stepped notches, broad crested weirs.

UNIT-IV	BOUNDARY LAYER THEORY	Classes: 09

Approximate Solutions of Navier stoke's equations , boundary layer , concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarmen momentum integral equation, laminar and turbulent boundary layers (no deviation), BL in transition, separation of BL, control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

UNIT-V	CLOSED CONDUIT FLOW	Classes: 09

Reynolds's experiment, Laminar and turbulent flow through pipes and velocity distributions. Elements of Boundary layer theory drag and lift elements of aero-foil theory. Characteristics of laminar & turbulent flows. Flow between parallel plates, flow through long tubes, flow through inclined tubes. Laws of fluid friction, Darcy's equation, branching pipes, pipe networks minor losses, total energy line and hydraulic gradient line, pipe network problems, variation of friction factor with Reynolds's number, Moody's Chart.

Text Books:

1. Modi and Seth, "Fluid Mechanics", Standard book house, 2011.
2. S.K.Som & G.Biswas, "Introduction to Fluid Machines", Tata Mc Grawhill publishers Pvt. Ltd, 2010.
3. Potter, "Mechanics of Fluids", Cengage Learning Pvt. Ltd., 2001.
4. V.L. Streeter and E.B. Wylie, "Fluid Mechanics", McGraw Hill Book Co., 1979.

Reference Books:

1. Shiv Kumar, "Fluid Mechanics Basic Concepts & Principles", Ane Books Pvt Ltd., 2010.
2. Frank.M. White, "Fluid Mechanics", Tata Mc Grawhill Pvt. Ltd., 8th Edition, 2015.
3. R.K. Bansal ,"A text of Fluid mechanics and hydraulic machines" - Laxmi Publications (P) ltd., New Delhi, 2011.
4. D. Ramdurgaia, " Fluid Mechanics and Machinery", New Age Publications, 2007.
5. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, "Introduction to Fluid Mechanics", Student Edition Seventh, Wiley India Edition, 2011.

Web References:

1. http://nptel.ac.in/courses/112105171/1
2. http://nptel.ac.in/courses/105101082/
3. http://nptel.ac.in/courses/112104118/ui/TOC.htm

E-Text Books:

1. http://engineeringstudymaterial.net/tag/fluid-mechanics-books/
2. http://www.allexamresults.net/2015/10/Download-Pdf-Fluid-Mechanics-and-Hydraulic-Machines-by- rk-Bansal.html
3. http://varunkamboj.typepad.com/files/engineering-fluid-mechanics-1.pdf

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