INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

FLUID MECHANICS								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACED03	Core	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Engineering Mechanics								

I. COURSE OVERVIEW:

Fluid Mechanics is a branch of physics concerned with the mechanics of fluids, the forces acting on them and basic understanding on fluid properties, fluid dynamics and fluid flow in closed and open conduits. The flow of incompressible fluids in pressure systems constitute as the major portion of this course. This course enables to work and formulate the models necessary to study and analyze fluid systems through the application of control volume. Further, the principles used in Fluid Mechanics help to study the concepts in Hydraulic Machinery and Water Resources Engineering.

II. COURSE OBJECTIVES:

The student will try to learn:

I. Primary principles of fluid properties at rest, in transit for various conditions in both closed and open channels.
II. Concepts of buoyancy, stability of floating bodies and the forces acting on immersed bodies by employing the concept of pressure.
III. The basic laws of continuity, energy and momentum and their governing equations.
IV. Fundamentals of equivalent pipe flow system and branching Pipe analysis using Hardy Cross method.

III. COURSE OUTCOMES:

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

CO1 Utilize basic principles and concepts of Fluid Mechanics for understanding fluid flow problems.
CO2 Execute the principles of manometry and Archimedes Principle for locating the point of application of force on various types of floating and immersed bodies.
CO3 Utilize the conservation laws in differential forms for determining velocities, pressures and acceleration in a moving liquid.
CO4 Analyze fluid flow with the mass and energy equations for determining analytical solutions of fluid flow problems.
CO5 Interpret the law of conservation of energy, Bernoulli's theorem for estimating total energy of various geometrical cross sections and discharge through it.
CO6 Examine the basic ideas of pipe flow, laws of fluid friction for determining fluid pressure and head at different nodes in pipe network.

IV. COURSE CONTENT:

MODULE - I: FLUID PROPERTIES (10)

Definition of fluid, distinction between a fluid and a solid; basic concepts of a fluid, the fundamentals and its applications properties of fluids, intrinsic and extrinsic, ideal, and real fluid, newton law of viscosity with classification, cavitation, surface tension, capillarity, bulk modulus (including ideal gas law), and compressibility

MODULE - II: FLUID STATICS (10)

Fluid Pressure: Pressure at a point, Pascal's law, Hydrostatic pressure and pressure variation in fluids at rest; Absolute pressure and gauge pressure (measurement of pressure); piezometer, Manometers, different types of manometers and pressure gauges; Hydrostatic forces on plane and curved surfaces for submerged bodies. Buoyancy and stability of floating bodies, metacenter.

MODULE - III: FLUID KINEMATICS (10)
Lagrangian and Eulerian descriptions; Streamlines, streaklines and pathlines; Types of fluid flows: compressible, incompressible, viscid, inviscid, rotational, irrotational, laminar, turbulent, internal and external; Reynolds number, Froude number, combinations of fluid flows.

Flow patterns, Laplace equations and flow net, Derivation of Equation of continuity; Velocity field and acceleration field (including temporal and convective components of acceleration); Stream function and velocity potential; equations of streamlines.

MODULE - IV: FLUID DYNAMICS (09)
Forces acting on a fluid in motion; Euler's equations of motion; Bernoulli's equation and its derivation; Applications of Bernoulli's equation (Venturi meter, Pitot tube, free liquid jet, etc.); Impulse-momentum equation and its applications: force exerted by a flowing fluid on a pipe bend, force exerted by a jet on a plate, applications.

MODULE - V: FLOW THROUGH PIPES (09)
Major losses (Derivation of Darcy's Weischbach – Equation) and minor losses thorough pipes, Pipes in series, equivalent pipes, pipes in parallel. TEL and HGL of pipes, Analysis of pipe networks - Hardy Cross method.

V. TEXT BOOKS:

1. Modi, P.N. and Seth, S.M., *Hydraulics and Fluid Mechanics including Hydraulic machines*, 22st edition, Standard Book House, 2017.
2. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, "*Fluid Mechanics and Machinery*", Oxford University Press, 2010.
3. P M Modi and S M Seth, "*Hydraulics and Fluid Mechanics*", Standard Book House, 2014.

VI. REFERENCE BOOKS:

1. K. Subramanya, "*Theory and Applications of Fluid Mechanics*", Tata Mc Graw Hill, 2012.
2. Modi, P. N., and S. M. Seth. *Hydraulics and fluid mechanics*, Standard Book House, 1980.

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105107120/1
2. http://www.nptel.ac.in/courses/105105105/
3. http://www.nptel.ac.in/courses/105105104
4. https://onlinecourses.nptel.ac.in/noc23_ce84/preview

VIII. MATERIAL ONLINE:

1. Course template
2. Tech-talk topics
3. Assignments
4. Definition and terminology
5. Tutorial question bank
6. Model question paper – I
7. Model question paper – II
8. Lecture notes
9. Early lecture readiness videos (ELRV)
10. Power point presentations