20BSM304T					Fluid Mechanics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To lay a foundation of fundamentals of fluid mechanics
- To be able to derive various conservation laws.
- To formulate and solve the basic problems in fluid mechanics
- To use this subject as a foundation for research in this field in higher studies.

UNIT 1 BASIC CONCEPTS **08 Hrs.**

Fluids, Types of Fluids, Fluid Properties: Density, Viscosity, Pressure, Temperature, Thermal conductivity, Specific heat, Specific weight, Specific volume, Specific gravity, Surface tension, Vapor pressure.

UNIT 2 KINEMATICS OF THE FLOW FIELD **11Hrs.**

Lagrangian method, Eulerian method, Relationship between Lagrangian and Eulerian method. Definitions: Steady and unsteady flows, Uniform and non-uniform flows, One, two and three dimensional flows, axisymmetric flow, Line of flow, Streamline, Path line, Stream surface, Stream tube, Streak tube. Velocity of the fluid particle at a point. Local, convective and material derivatives. Equation of continuity, Equation of continuity in Cartesian and Cylindrical coordinates. Equation of continuity (Lagrangian method), equivalence of the two forms of equation of continuity. Velocity potential, irrotational flow, rotational flow. Vorticity, Vorticity vector, Vortex lines, Vortex tubes. Boundary surfaces

UNIT 3 CONSERVATION OF MOMENTUM **10 Hrs.**

Euler's equation of motion along a streamline, Equation of motion of an inviscid fluid, Equation of motion of an inviscid fluid (Cartesian coordinates), Cauchy's integral. Bernoulli's equation. Conservative field of force, Integration of Euler's equation. Helmholtz equation. Impulsive motion of a fluid. Energy equation.

UNIT 4 VISCOUS FLUID FLOWS **11 Hrs.**

Stress analysis at a point, State of stress at a point, Symmetry of stress tensor. Stress in a fluid at rest. Stress in a fluid in motion. Transformation of stress components, Tensor character of stress matrix. Orthogonal principle directions. Strain analysis. Rate of strain quadratic. Transformation of rates of strain. Relation between stress and rate of strain. Navier-Stokes equation of motion of a viscous fluid. Limitations of the Navier-Stokes equation. Equation of energy. Dissipation of energy. Dimensional analysis

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Define the basic terminologies in fluid mechanics.

CO2 – Understand the Lagrangian and Eulerian descriptions of motion.

CO3 – Explain various conservation laws and their importance in Fluid Mechanics.

CO4 – Differentiate local, convective and material derivative and understand its applications.

CO5 – Appraise then notion of stresses and strains in fluid.

CO6 – Formulate the Navier-Stokes equations of motion along with energy equation.

TEXT/REFERENCE BOOKS

1. M. D. Raisinghaniya, Fluid Dynamics, S. Chand, 2003.
2. P. Kundu, I. M. Cohen, Fluid Mechanics, 4th ed., Academic Press, 2010.
3. M. C. Potter, D. C. Wiggert, Schaums Ouline of Fluid Mechanics, McGraw-Hill, 2007.
4. S. Swarup, Fluid Dynamics, 13th ed., Krishna Prakashan, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A: 6 questions of 4 marks each	24 Marks
Part B: 6 questions of 8 marks each	48 Marks
Part C: 2 questions of 14 marks each	28 Marks