FLUID MECHANICS

Paper code: ETCE-205   **L**   **T/P**   **C**
Paper: Fluid Mechanics   **3**   **1**   **4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: To develop knowledge of properties, movement and behavior of fluid (water) under various flowing conditions. At the end of the course, students will have in-depth knowledge of fluid mechanics, measurement of fluid flow.

UNIT I

Introduction: Fluid properties, Ideal and real fluids, Concept of viscosity, surface tension and compressibility; thermodynamic (isothermal, isobaric and adiabatic) properties.

Fluid Statics: Fluid pressure and its measurement, types of manometers, Total pressure and centre of pressure, Evaluation of pressure force on dams, lock gates, curved surfaces, pressure distribution in liquid subjected to constant horizontal/vertical acceleration, principles of equilibrium, buoyancy, centre of buoyancy, meta centre, stability conditions of floating and submerged bodies, Experimental and analytical method of determination of meta-centric height.

[T1,T2][No. of Hrs. 12]

UNIT II

Fluid Kinematics: Variation of flow parameters in space and time, Lagrangian and Eularian concepts in fluid motion, Types of fluid flow: steady and unsteady, uniform and non uniform, rotational and irrotational, Laminar and turbulent, one, two and three dimensional flow, streamline, pathline and streakline, Continuity equation in Cartesian and polar co-ordinates and its applications, Velocity potential and stream function, Cauchy-Riemann equation, flownet.

Types of motion: Linear translation, linear deformation, Angular deformation, Rotation, Vorticity, Free and forced vortex flow.

[T1,T2][No. of Hrs. 12]

UNIT III

Fluid Dynamics : Reynolds's, Navier-Stokes and Euler's equations of motion, Derivation of Bernoulli's equation from Euler's equation and its limitations, Applications of Bernoulli's equations-Orifice, Venturimeter, Mouth piece, Weir and notch, Pitot's tube, Siphon, etc; hydraulic gradient and total energy lines and their Engineering significance. Momentum equation, Moment of momentum equation- Assumptions and limitations, applications, impact of jets and forces in bends.

[T1,T2][No. of Hrs. 11]

UNIT IV

Dimensional and Model Analysis: Dimensional homogeneity, methods of dimensional analysis, Buckingham's π theorem, selection of Repeating variables, Forces acting on moving fluid, Dimensionless numbers and their Engineering significance, Model analysis, Geometric, Kinematic and Dynamic similarity, Model testing of partially submerged bodies, scale ratios for distorted models.

[T1,T2][No. of Hrs. 10]

Text Books:
[T1]   R.J. Garde, "Fluid Mechanics through Problems", New Age Publications
[T2]   A.K. Jain, "Fluid Mechanics and Fluid Machines", Khanna Publishers, New Delhi

References:
[R1]   Victor Streeter, "Fluid Mechanics", International Edition, Tata McGraw Hill Publications
[R2]   Hughes and Brighton, "Fluid Mechanics", Tata McGraw Hill
[R3]   Shames, "Mechanics of Fluids", Tata McGraw Hill
[R4]   Neville, "Fluid Mechanics", Pearson Education
[R5]   A. James, Fay, "Introduction to Fluid Mechanics", PHI Publications