M.Sc.-II (Mathematics) (New CBCS Pattern) Semester - IV

PSCMTH19A - (Optional) : Fluid Dynamics-II

P. Pages : 2 **GUG/S/23/13770**

Time : Three Hours * 1 5 5 1 * Max. Marks : 100

Notes : 1. Solve all the **five** questions.
2. Each question carry equal marks.

UNIT – I

1. a) Discuss the translational motion of fluid element. **10**

b) Obtain the relations between stress & rate of strain. **10**

OR

c) Derive the relation $\xi = \frac{k}{8\pi\nu t}\exp\left(\frac{-R^2}{4\nu t}\right)$ for the diffusion of vorticity. **10**

d) Explain the energy dissipation due to viscosity. **10**

UNIT – II

2. a) Discuss the Maxwell's electromagnetic field equation when the medium at rest. **10**

b) Explain the rate of flow of charge by considering the two cases fluid at rest & fluid in motion. **10**

OR

c) State & prove the Alfven's theorem. **10**

d) Explain the Ferraro's law of isorotation. **10**

UNIT – III

3. a) Obtain the dimensionless equation in the dimensional analysis. **10**

b) Derive the Karman's integral equation. **10**

OR

c) Explain in detail the Reynolds number & its applications. **10**

d) Derive the equation $\frac{\partial \bar{u}}{\partial \bar{x}} + \frac{\partial \bar{v}}{\partial \bar{y}} = o$ for the laminar flow of a fluid at high Raynolds number over a smooth solid boundary. **10**

UNIT – IV

4. a) Explain the two cases of the equations of motion for turbulent flow, Raynolds stresses. **10**

b) Discuss the change in double velocity correlations with time. **10**

OR

c) Obtain the relation **10**

$$\int_{-b}^{+b} dx_2 u'(x_2) g(x_2) = 0$$ for the macro or integral scale of turbulence.

d) Discuss the double correlations between turbulence-velocity components. **10**

5. a) Define : **5**

i) Components of stress.

ii) Normal stresses.

b) State the two laws of electromagnetism. **5**

c) Explain the three dimensionless quantities. **5**

d) Define : **5**

i) Turbulence

ii) Turbulent fluid motion.

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