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BT-4 / M–14

FLUID MECHANICS

Paper–ME-208-E

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in all selecting at least one question from each unit.*

Unit–I

1. (a) Explain :
   (i) Thermodynamic properties of fluid
   (ii) Compressibility
   (iii) Surface tension and capillarity. 6
   (b) Draw an expression for centre of pressure in case of inclined plane surface submerged in Liquid. 10
   (c) A rectangular sluice gate is situated on the vertical wall of a lock. The vertical side of sluice is 'd' meter in length and depth of centroid of the area is 'p' m below the water surface. Prove that the depth of pressure is equal to $(P + d^2/12p)$. 4

2. (a) How fluid can be classified ? 4
   (b) Describe continuity equation for cylindrical polar coordinates. 10
   (c) Describe relation between stream function and potential function. The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point P(2,3). Find velocity potential function ϕ. 6

Unit–II

3. Describe Bernoulli's equation and clearly mention the assumptions made in derivation of Bernoulli's equation. The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 lt/s. The section 1 is 6m above datum line and section 2 is 4m above datum line. If the pressure at section 1 is 39.24N/cm^2. Find intensity of pressure at section 2. 20

4. (a) Explain forced and free vortex flow and draw equation for them. 10
   (b) Explain source-sink pair and doublet. 10

Unit–III

5. (a) Describe I lagen Poiseville formula and state the assumptions made. 12
   (b) Find out power observed in viscous flow in case of (i) journal Bearing (ii) foot step bearing. 8

6. (a) Describe power transmission through pipes, condition for maximum transmission of power, maximum efficiency of transmission of power. 10
   (b) The difference in water surface levels in two tanks, which are connected by the three pipes in series of length 300 m, 170m and 210m and of diameters 300mm, 200mm and 400mm respectively is 12m. Determine the rate of flow of water if co-efficient of frictions are 0.005, 0.0052 and 0.0048 respectively considering (i) minor losses also (ii) neglecting minor losses. 10

Unit–IV

7. (a) Define Boundary layer, laminar boundary layer, Turbulent Boundary layer, boundary layer thickness, Displacement thickness momentum thickness and energy thickness. 8

   (b) Obtain Von-Karman momentum integral equation for boundary layer flows. 12

8. (a) For the velocity profile for laminar boundary layer flows given as $\frac{u}{U} = 2(y/\delta) - (y/\delta)^2$ find an expression for boundary layer thickness (δ), share stress (τ_0) and co-efficient of drag (C_D) in terms of Reynold number. 8

   (b) Explain velocity distribution in turbulent flow in pipe :

   (i) Hydrodynamically Smooth and Rough boundaries (pipes).

   (ii) In terms of average velocity for smooth and rough pipes. 12