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Question Paper Code : 90314

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Civil Engineering

CE 8302 – FLUID MECHANICS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Specific volume of fluid and write its unit.

2. Temperature rise, decreases viscosity in Liquids, but increases in gases, why?

3. Define "Vortex flow".

4. Distinguish between stream line and streak line.

5. Define the term dimensional homogeneity.

6. State the Buckingham's π - theorem.

7. What do you mean by hydraulic gradient line?

8. Define

   (a) Pipes in series (1)

   (b) Pipes in parallel (1)

9. Define boundary layer thickness.

10. Define the terms: Drag and Lift.

PART B — (5 × 13 = 65 marks)

11. (a) If the Velocity distribution of a fluid over a plate is given by $u = ay^2 + by + c$ with a vertex 0.2 m from the plate, where the velocity is 1.5 m/s. Calculate the velocity gradient and shear stress at a distance of 0 m, 0.1 m and 0.2 m from the plate. If the viscosity of the fluid is 0.85 Ns/m^2,

Or

(b) (i) The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.5 m and rotates at 200 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.45 mm. (8)

(ii) Derive the expression for pressure head when fluid at a rest. (5)

12. (a) State Bernoulli's theorem for steady flow of a incompressible. Derive an expression for Bernoulli's equation from first principle and state the assumptions made in the derivation.

Or

(b) The velocity components for a two dimensional incompressible flow are given by $u = 3x - 2y$ and $v = -3y - 2x$. Show that the velocity potential exists. Determine the velocity potential function and stream function.

13. (a) The resisting force (R) of a supersonic flight can be considered as dependent upon length of aircraft (I), velocity (V), air viscosity (μ), air density (ρ). and bulk modulus of air (K). State the functional relationship between these variables and the resisting force.

Or

(b) Define Similitude and discuss its type of similarities in detail.

14. (a) The rate of flow of water through a horizontal pipe is 0.3 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller is 0.12 N/mm^2. Determine the (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe, (iii) power lost due to enlargement. (4+4+5)

Or

(b) Derive an expression for Hagen Poisuille's equation.

15. (a) Define the terms (i) Displacement thickness and (ii) Momentum thickness and also derive an expression for the displacement thickness and momentum thickness in boundary layer with necessary assumptions. (2+2+9)

Or

(b) A plate of 650 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity $\gamma = 10^{-4}$ m²/s The fluid is moving with the velocity of 7 m/s.

Determine (i) Boundary layer thickness (ii) Shear stress at the end of the plate (iii) Drag force on one of the sides of the plate. (4+4+5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Derive an expression for the pressure inside a droplet, hollow bubble and a free jet. (10)

(ii) Explain the rheological classification of fluids and define each type of fluid by giving an example. (5)

Or

(b) A horizontal pipe line 40 m long is connected to a water tank at one end discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur. Determine the rate of flow (discharge). Take Darcy's co-efficient of friction as 0.01 for both sections of the pipe.