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Question Paper Code : 70056

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

Third Semester

Civil Engineering

CE 3301 – FLUID MECHANICS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

(Codes/Tables/Charts to be permitted if any may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Mass Density.
2. Define Viscosity.
3. What are the assumptions made in deriving Bernoulli's equation.
4. Define rotational flow.
5. Define dimensional analysis.
6. State Buckingham's π theorem.
7. What is the expression for head loss due to friction?
8. List the types of similarities used in model analysis.
9. Define kinetic energy correction factor.
10. What is mean by boundary layer growth?

PART B — (5 × 13 = 65 marks)

11. (a) Calculate the capillary effect in millimeters a glass tube of 4mm diameter when immersed in (i) water (ii) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 and 0.51 N/m respectively. The angle of contact for water is zero that for mercury 130°. Take specific weight of water as 9790 N/m³.

Or

- (b) (i) Discuss the types of U - Tube Manometer (5)
- (ii) Two pipes on the same elevation convey water, and oil of specific gravity 0.88 respectively. They are connected by a U-tube manometer with the manometric liquid having a specific gravity of 1.25. If the manometric liquid in the limb connecting the water pipe is 2 m higher than the other, then find the pressure difference in two pipes. (8)

12. (a) (i) Two pipes are in series and the diameter of a pipe at the section 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5m/s. determine also the velocity at section 2. (5)
- (ii) Water is flowing through an inclined pipeline of diameter 20 cm & 40 cm at section A & B respectively. Section A & B are located at height of 2 m & 2.5 m respectively from ground level. The discharge through pipe is 30 l/s. If the pressure at A is 20 kPa, find the pressure at point B. (8)

Or

- (b) Discuss the classification of flow.

13. (a) (i) Write down the Steps for Dimensional Analysis. (5)
- (ii) Explain Kinematic similarity with derivation. (8)

Or

- (b) Solve: The relationship of the effect on pressure drop (ΔP) of the variables d , L , ρ , μ and v

14. (a) Discuss moody diagram with neat sketch.

Or

- (b) (i) A pipe of 1 m diameter and 15 km long transmits water of velocity of 1 m/s. The friction coefficient of pipe is 0.005. Calculate the head loss due to friction? (5)
- (ii) A pipe, 40 m long, is connected to a water tank at one end and flows freely in atmosphere at the other end. The diameter of pipe is 15 cm for first 25 m from the tank, and then the diameter is suddenly enlarged to 30 cm having length of 15 m. Height of water in the tank is 8 m above the centre of pipe. Darcy's coefficient is 0.01. Determine the discharge neglecting minor losses. (8)

15. (a) What is separation of boundary layer? Explain how to control it.

Or

- (b) (i) Explain how the drag forces are formed. (7)
- (ii) Calculate the drag force on each side of a thin smooth plate 2 m long and 1 m wide with the length parallel to a flow of fluid moving at 30 m/s. The density of the fluid is 800 kg/m^3 and the dynamic viscosity is 8 cP. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Derive Euler's and Bernoulli' equation and mention its Assumptions, Limitation.

Or

- (b) A stream function is given by

$$\psi = 3x^2 - y^3$$

Determine the magnitude of velocity components at the point (3, 1).