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Question Paper Code : 21245

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Civil Engineering

CE 2202/ 080100015/ 10111 CE 305/ CE 1203/ CE 35 — MECHANICS OF FLUIDS

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Any missing data can be suitably assumed with proper justification.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define weight density of a liquid.

2. What is control volume of fluid?

3. 'For an inclined immersed surface, the distance of centre of pressure is always greater than the distance of centre of gravity'. Justify the above statement.

4. List any two applications of flow net.

5. Obtain Bernoulli's equation from Euler's equation.

6. Sketch the velocity distribution across a section of parallel plates, when the liquid flows between them.

7. Define momentum thickness.

8. List any four minor losses that are encountered in pipe flow.

9. How are repeating variables selected in Buckingham's π –method?

10. State the reasons for constructing distorted models for rivers.

PART B — (5 × 16 = 80 marks)

11. (a) A square plate of 1 m side weighs 70 N. It slides down an inclined plane which makes 40° to the horizontal. The velocity of plate is 0.6 m/s and the thickness of oil film between the plate and the plane is 1.2 mm. Find the dynamic viscosity and the kinematic viscosity of oil. Take the specific gravity of oil as 0.85. (16)

Or

(b) Explain the following (Four lines for each subdivision)

(i) Compressibility of liquid. (4)

(ii) Continuum concept of system. (4)

(iii) Fluid mass under relative equilibrium. (4)

(iv) One-dimensional continuity equation. (4)

12. (a) (i) An equilateral triangular plate of 3 m side is immersed vertically in water. If one side of the plate coincides with free water surface, determine the total pressure acting on the plate and the position of centre of pressure. (8)

(ii) Explain the applications of U-tube differential manometers. (8)

Or

(b) (i) The velocity potential function for a two-dimensional flow is given by $\phi = x(2y-1)$. Obtain the stream function ψ at origin. (8)

(ii) List various devices used for velocity measurement of fluid. Explain the working of any one device briefly. (8)

13. (a) (i) Explain the working of venturimeter for discharge measurement of a liquid flowing through a pipe. (8)

(ii) Water is flowing through a pipe having diameters 600 mm and 400 mm at the bottom and upper end respectively. The pressure intensity at bottom is 350 kN/m^2 and the same at top is 150 kN/m^2. Determine the difference in datum head if the discharge through the pipe is 50 litres per second. (8)

Or

(b) Derive Darcy-Weisbach equation and obtain Hagen-Poiseuille equation from Darcy's equation by substituting suitable value of co-efficient of friction interms of Reynold's number. (16)

14. (a) (i) Define boundary layer and why does it increase with distance from the upstream edge? (8)

(ii) Explain the physical significance of displacement thickness of boundary layer. (8)

Or

(b) Two reservoirs are connected by three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 300 m, 170 m and 210 m respectively. The three pipes are connected in series. The difference in water surface levels of two reservoirs is 12 m. Determine the discharge of water, if friction factor for all the three pipes is 0.02. Neglect the minor losses. (16)

15. (a) The efficiency η of a fan depends on density ρ, the dynamic viscosity μ, the angular velocity w, diameter D of rotor and the discharge Q. Show that $\eta = \phi\left[\left(\frac{\mu}{\rho w D^2}\right), \left(\frac{Q}{wD^3}\right)\right]$ using any one method of dimensional analysis. (16)

Or

(b) (i) Explain scale effect in model testing. How is it found? (8)

(ii) Explain briefly the significance of Reynold's number and Froude's number in fluid flow problems. (8)
