Reg. No. : E N G G T R E E . C O M

Question Paper Code : 30092

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Civil Engineering

CE 3301 – FLUID MECHANICS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Total Pressure and Centre of Pressure

2. What is the effect of temperature on the viscosity of gases?

3. What is a flow net?

4. Why the coefficient of discharge for an orifice meter is much smaller than that of a venturi meter?

5. Write the dimensions for discharge per unit width and modulus of elasticity.

6. List any two limitations of distorted models.

7. Sketch the velocity and shear stress distribution diagram for viscous flow between parallel plates.

8. Define Equivalent pipe.

9. List any four methods to prevent the separation of the boundary layer.

10. How a drag force is different from a lift force?

PART B — (5 × 13 = 65 marks)

11. (a) The vertical side of a reservoir has a rectangular opening 2.75 m long and 1.2 m high. It is closed by a plate using 4 bolts placed at the corners of the opening. What would be the tension in the bolts if water stands to a height of 1.8 m above the top edge of the opening which is horizontal? (13)

Or

(b) For a compound manometer shown in Fig 1, what is the gauge pressure at C if the manometric fluid is mercury and if the fluid in the pipe and in the tubing which connects the two U-tubes is water? (13)

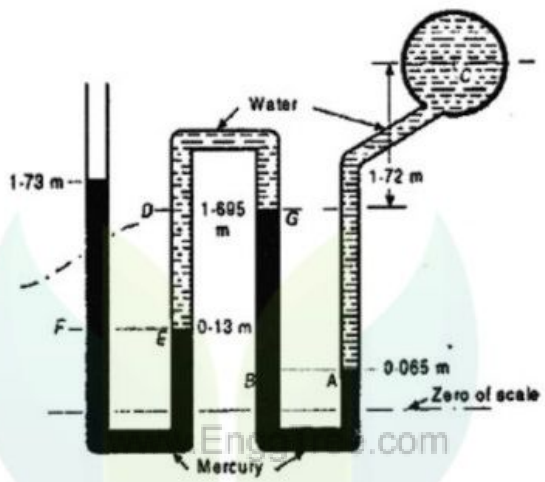

Fig. 1

12. (a) For a two-dimensional flow $\phi = 3xy$ and $\psi = \frac{3}{2}\left(y^2 - x^2\right)$. Determine the velocity components at points (1,3) and (3,3). Also, find the discharge passing between the streamlines passing through the points given above. (13)

Or

(b) 215 litres of gasoline (specific gravity 0.82) flow per second upwards in an inclined venturi meter fitted to a 300 mm diameter pipe. The venturi meter is inclined at 60° to the vertical and it's 150 mm diameter throat is 1.2 m from the entrance along its length. Pressure gages inserted at the entrance and throat show pressures of 0.141 N/mm² and 0.077 N/mm² respectively. Calculate the discharge coefficient of the venturi meter. If instead of pressure gages the entrance and the throat of the venturi meter are connected to the two limbs of a U-tube mercury manometer, determine its reading in mm of differential mercury column. (13)

13. (a) State Buckingham Pi theorem. Outline the procedure for dimensional analysis using the Buckingham Pi method. (13)

Or

(b) A spillway performance has to be studied through a model constructed to a scale of 1 : 9. Negelecting the viscous and surface tension effect, find the discharge in the model if the discharge in the prototype is 1000 m^3/s. Also find the dissipation of energy in the prototype hydraulic jump, if the jump in the model studies dissipates 300 watts. (13)

14. (a) Derive an expression for the drop of pressure head for a given length in a flow of viscous fluid between two parallel plates. (13)

Or

(b) Derive an expression for loss of head due to friction using

(i) Darcy-Weisbach formula (8)

(ii) Chezy's Formula (5)

15. (a) For the velocity profile for laminar boundary layer flows given as $u/U = 2(y/\delta) - (y/\delta)^2$ find an expression for boundary layer thickness, shear stress and coefficient of drag in terms of Reynolds Number. (13)

Or

(b) Derive the Von Karman momentum integral equation for boundary layer flows. (13)

PART C — (1 × 15 = 15 marks)

16. (a) The difference in water surface levels in the two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm 100 mm and 400 mm respectively is 12 m. Determine the rate of flow of water if the coefficient of friction is 0.005, 0.0052 and 0.0048 respectively, considering (i) minor losses also (ii) Neglecting minor losses.

Or

(b) A 45-degree reducing bend is connected in a pipeline, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at the inlet to bend is 8.829 N/cm^2 and the rate of flow of water is 600 lps.
