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Question Paper Code : 80064

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third Semester

Civil Engineering

CE 8302 – FLUID MECHANICS

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate solid and fluid.
2. Define buoyancy.
3. Describe stream function.
4. Recall the application of Orifice-meter.
5. Describe dimensional homogeneity.
6. Describe distorted models
7. Recall the types of pipe flow based on viscosity.
8. Define major and minor losses.
9. Describe Boundary layer.
10. Define drag force.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe the following properties of the fluid with the values of water at standard temperature and pressure: (1) Mass density, (2) Specific weight, (3) Specific gravity and (4) Viscosity. (7)

(ii) Explain surface tension and capillarity and derive an expression for capillarity. (6)

Or

(b) (i) Compute the pressure of water in the pipe, if U tube mercury manometer is connected to a pipe line conveying water at 0.7m below the centre of pipe and the other leg (right leg) is open to atmosphere. The level of mercury in the right leg is 0.2m below the centre of pipe and the space above mercury in the right leg contains oil of specific gravity 0.9 to a height of 0.3m. (6)

(ii) Explain centre of pressure and total pressure, also derive an expression for it. (7)

12. (a) Compute the form of velocity potential if exists with proof and also find stream function in a two dimensional incompressible flow if the fluid velocity components are given by $u=x-4y$ and $v=-y-4x$.

Or

(b) Calculate the discharge of the oil and the pressure difference between the entrance section and throat section of a venturi-meter of size 30 cm × 15 cm fixed in a vertical pipe line carrying oil of specific gravity 0.9 flowing upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U tube mercury manometer shows a deflection of 25 cm. Take the co-efficient of meter as 0.98.

13. (a) Explain the procedure for dimensional analysis by Buckingham's law method.

Or

(b) Compute the velocity and rate of flow in the model, if a pipe of diameter 1.2 m is required to transport an oil of specific gravity 0.9 and viscosity of 0.03 poise flowing at the rate of 3000 l/s. Tests were conducted on a 15cm diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. Take Viscosity of water at 20°C=0.01 poise.

14. (a) Derive Hagen — Poiseuille's equation for viscous flow through a circular pipe.

Or

(b) Determine (i) Reynolds number of flow, (ii) Centre line velocity, (iii) Wall shear stress and (iv) Power required to maintain the flow, for an oil of viscosity 1 poise and specific gravity 0.8 is flowing through 50 mm diameter pipe of length 500 m at the rate of 1.9 litres/sec.

15. (a) Calculate (i) The displacement thickness, (ii) The momentum thickness and (iii) The energy thickness in a boundary layer over the face of a high spillway for which the velocity distribution is $u/U=(y/\delta)$.

Or

(b) Describe boundary layer and the methods of preventing the separation of boundary layer.

PART C — (1 × 15 = 15 marks)

16. (a) Calculate the increase in discharge by neglecting minor losses, if a pipe line of 50 cm diameter of 1.5 km long is laid parallel to the second half of the existing line of 60 cm diameter. Take frictional coefficient of the pipe as 0.01 and head at inlet is 0.3 m.

Or

(b) Compute the forces required to drag a thin plate of surface area 0.75m² length 1 m, between the plane surfaces with a velocity of 0.3m/s, having 4 cm wide gap and the gap is filled with an oil of specific gravity 0.80 and dynamic viscosity 8.5 poise, if

(i) the thin plate is in the middle of the two plane surfaces

(ii) the thin plate is at a distance of 2.5 cm from one of the surfaces

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