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Reg. No. :

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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Reg. No. :

Question Paper Code : 90104

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
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. Write the unit and dimension for dynamic viscosity.
2. Write the unit and dimension for surface tension.
3. What are the advantages of orifice meter ?
4. A pitot tube was inserted in a river to measure the velocity of water in it. If the water rises in the tube above free surface of water is 300 mm, find the velocity of water (Cv = 0.98).
5. Illustrate the principle of dimensional homogeneity.
6. Write the fundamental dimensions and base units.
7. Illustrate the Moody's diagram.
8. What are major and minor losses of flow in pipes ?
9. Define the term boundary layer.
10. How do you classify boundary layer ?

PART – B (5×13=65 Marks)

11. a) i) Explain the difference between the solid and fluid. (7)

ii) A liquid has a mass density of 1550 kg/m^3. Calculate its specific weight, specific gravity and specific volume. (6)

(OR)

b) i) Explain briefly about the Newtonian Fluids and Non Newtonian Fluids with neat sketch. (6)

ii) Derive an expression for centre of pressure and hydrostatic pressure force for a plane submerged vertically in static liquid. (7)

12. a) i) Explain in detail about the various types of fluid flow. (6)

ii) Derive three dimensional continuity equation in Cartesian co-ordinate system. (7)

(OR)

b) i) A pitot static tube placed in the centre of a 250 mm pipe line has one leg pointing up stream and other perpendicular to that. The mean velocity in the pipe is 75% of the central velocity. Find the discharge through the pipe if the pressure difference between the two legs in 80 mm of water and take $C_v = 0.99$. (5)

ii) A venturimeter is used for measurement of discharge water in horizontal pipeline. If the ratio of upstream pipe diameter to that of throat in 2:1, upstream diameter is 300 mm the difference in pressure between the throat and upstream is equal to 3 m head of water and loss of head through meter is one-eight of the throat velocity head, calculate the discharge in the pipe. (8)

13. a) Drag force (F) of an partially submerged body is a function of relative velocity (v), linear dimension (L), surface roughness (k), fluid density (ρ), viscosity (μ), and acceleration due to gravity (g). Using Buckingham pi theorem method of dimensional analysis obtain an expressions for the drag in terms of dimensionless number. (13)

(OR)

b) The lift force 'F' on a missile is a function of its length L, velocity V, Diameter D, Angle of attack α, density ρ, viscosity μ and speed of sound 'C' of the air. Find the functional relationship in dimensionless form. (13)

14. a) Discuss in detail about the test procedure, apparatus and observation of Reynold's experiment with neat sketch. (13)

(OR)

b) Derive the Hagen-Poiseuille's equation for laminar flow of fluid in straight and circular pipe with proper assumptions and neat sketch. (13)

15. a) Describe briefly about the general characteristics of boundary layer on a flat plate and illustrate the definition for boundary layer thickness, displacement thickness and momentum thickness with neat sketch. (13)

(OR)

b) Explain in detail about the boundary layer separation phenomena and methods of controlling boundary layer separation with neat sketch. (13)

PART – C (1×15=15 Marks)

16. a) Explain in detail about the construction details and working principle of venturimeter with neat sketch and also derive the equation to determine volumetric flow rate. (15)

(OR)

b) Using Buckingham's π Theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H is the head causing flow, D is the diameter of the orifice, μ is the coefficient of viscosity, ρ is mass density and g is the acceleration due to gravity. (15)