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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 ($C_v = 0.98$).
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 ?

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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-eighth 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 $V = \sqrt{2gH} \phi \left[\frac{D}{H}, \frac{\mu}{\rho V H} \right]$ 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)