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Question Paper Code: 43105

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Third Semester

Civil Engineering

14UCE305-FLUID MECHANICS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. Capillarity and depression phenomena
 - (a) depend upon the size of the tube
 - (b) depend solely upon the surface tension
 - (c) depend upon the surface tension and material of the tube
 - (d) depend upon the pressure difference between the liquid and the environment
2. Select the correct statement:
 - (a) Viscosity of gas increases with temperature
 - (b) Density of gas increases with temperature
 - (c) Surface tension of the liquid increases with temperature
 - (d) Bulk modulus of elasticity is independent of temperature
3. The centre of gravity of the volume of the liquid displaced is called
 - (a) Centre of pressure
 - (b) Centre of buoyancy
 - (c) Metacentre
 - (d) None of these
4. Bernoulli's theorem deals with the law of conservation of
 - (a) Mass
 - (b) Momentum
 - (c) Energy
 - (d) None of these

5. A flow is said to be steady when
 - (a) conditions change steadily with time
 - (b) conditions do not change with time at any point
 - (c) conditions do not change steadily with time at any point
 - (d) the velocity does not change at all with time at any point

6. The equation of continuity in fluid mechanics
 - (a) is a condition of equilibrium in the flow pattern
 - (b) is an embodiment of the law of thermodynamics
 - (c) express the relation between work and energy
 - (d) is an embodiment of laws of conservation of mass

7. Bernoulli's theorem deals with law of conservation of

(a) mass	(b) momentum	(c) energy	(d) none of these
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8. A U tube manometer reading for the horizontal and inclined pipe for the constant rate of flow

(a) will remain the same	(b) will increase
(c) will decrease	(d) may fluctuate with the time

9. Model analysis of free surface flows are based on

(a) Reynolds number	(b) Froude number
(c) Mach number	(d) Euler number

10. Geometric similarity between model and prototype means

(a) Similarity of discharge	(b) Similarity of linear dimensions
(c) Similarity of motion	(d) Similarity of forces

PART - B (5 x 2 = 10 Marks)

11. Estimate the pressure inside a water droplet of 0.5mm diameter. Assume $\sigma = 0.073\text{N/m}$.
12. Define centre of buoyancy and metacenter.
13. Define stream function.
14. State momentum principle.
15. What are the similarities between model and prototype?

PART - C (5 x 16 = 80 Marks)

16. (a) A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5mm and the dynamic viscosity of the oil is $0.7Ns/m^2$. Determine torque required to overcome friction in bearing and power utilized in overcoming viscous resistance. Assume a linear velocity profile. (16)

Or

- (b) Explain in detail about Types of Fluid & discuss about Surface tension. (16)
17. (a) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid, (16)

Or

- (b) Prove that the pressure at a point in a static fluid is equal in all direction. (16)
18. (a) Given that $u = 4ax(x^2 - 3y^2)$, $v = 4ay(3x^2 - y^2)$. Examine whether these velocity components represent a physically possible two-dimensional flow; if so whether the flow is rotational or irrotational? (16)

Or

- (b) If for a two-dimensional potential flow, the velocity potential function is given by $\phi = x(2y-1)$, determine the velocity at the point $P(2, 3)$. Also determine also the value of stream function at the point P . (16)
19. (a) State Bernoulli's theorem for study flow of an incompressible fluid. Derive an expression for Bernoulli's equation and state the assumptions. (16)

Or

- (b) The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is $13.734 N/cm^2$ while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of C_d for the venturimeter. (16)

20. (a) An oil of specific gravity 0.91 and viscosity of 0.03 *poise* is to be transported at the rate of $3\text{m}^3/\text{s}$ through a 1.3m diameter pipe. Model tests were conducted on a 130mm diameter using water having viscosity of 0.01*poise*. Find the velocity of flow and discharge in the model. (16)

Or

- (b) The pressure difference Δp in a pipe of diameter D and length L due to viscous flow depends on the velocity V , Viscosity μ and density ρ . Using Buckingham's theorem, obtain an expression for Δp . (16)