Reg. No. :

Question Paper Code: 41315

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

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. Pascal's law states that pressure at a point is equal in all directions

   (a) In a liquid at rest   (b) In a fluid at rest
   (c) In a laminar flow   (d) In a turbulent flow

2. Surface tension has the units of

   (a) Force per unit area   (b) Force per unit length
   (c) Force per unit volume   (d) None of these

3. The resultant hydro static force acts through a point known as

   (a) Centre of gravity   (b) Centre of buoyancy
   (c) Centre of pressure   (d) Metacentre

4. Bernoulli's theorem deals with the law of conservation of

   (a) Mass   (b) Momentum   (c) Energy   (d) None of these

5. The flow rate through a circular pipe is measured by

   (a) Pitot tube   (b) Venture meter   (c) Rota meter   (d) Mano meter

6. Reynolds number is defined as the
   (a) Ratio of inertia force to gravity force
   (b) Ratio of viscous force to gravity force
   (c) Ratio of viscous force to elastic force
   (d) Ratio of inertia force to viscous force

7. The point through which the buoyant force acting is called
   (a) Centre of pressure   (b) Centre of gravity
   (c) Centre of buoyancy   (d) None of these

8. If the density of the fluid is constant from point to point in a flow region, it is called
   (a) Steady flow   (b) Incompressible flow
   (c) Uniform flow   (d) Laminar flow

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. Define capillarity.

12. Write the continuity equation.

13. Define velocity.

14. Define the term "Momentum thickness".

15. What is similitude?

PART - C (5 x 16 = 80 Marks)

16. (a) The space between two square flat parallel plate is filled with oil. Each side of the plate is 60 *cm*. The thickness of the oil film is 12.5 *mm*. The upper plate which moves at 2.5 *m/s* requires a force of 98.1 *N* to maintain the speed. Determine the (i) Dynamic viscosity of the oil in poise (ii) Kinematic viscosity of the oil in stokes of the specific gravity of the oil is 0.95.   (16)

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Or

(b) (i) Define Capillary and derive the expression for capillary fall. (8)

(ii) A oil of viscosity 5 *poise* is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5*m* and it rotates at 200 *rpm*. Calculate the power lost in oil for a sleeve length of 100*mm*. The thickness of oil film is 1.00*mm*. (8)

17. (a) The right limb of a simple U–tube manometer containing mercury is open to the atmosphere where the left limb is connected to a pipe in which a fluid of specific gravity of 0.9 is flowing; the centre of pipe is 12*cm* below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limb is 20*cm*. (16)

Or

(b) A rectangular plane surface 3*m* wide and 4*m* deep lies in water in such a way that its plane makes an angle of 30° with free surface of water. Determine the total pressure force and position of centre of pressure, when upper edge is 2*m* below the free surface. (16)

18. (a) Find the head lost due to friction in a pipe of diameter 300 *mm* and length 50 *m*, through which water is flowing at a velocity of 3*m/s* using (i) Darcy formula (ii) Chezy's formula for which $C = 60$. (16)

Or

(b) The velocity components in a two-dimensional flow field for an incompressible fluid are as follows:

$$u = \frac{y^3}{3} + 2x - x^2 y \text{ and } v = xy^2 - 2y - \frac{x^3}{3}$$

Obtain an expression for the stream function. (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.

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Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of *Cd* for the venturimeter. (16)

20. (a) The efficiency of a fan depends on duty density *e*, viscosity *μ*, angular velocity *ω*, diameter *D* and discharge *Q*. Express efficiency in terms of dimension less parameters. (16)

Or

(b) Explain the Buckingham's π theorem method of dimensional analysis. (16)

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