Reg. No. : | | | | | | | | | | |

Question Paper Code: 41135

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. One litre of water occupies a volume of

   (a) 100 cm^3 (b) 250 cm^3 (c)500 cm^3 (d)1000 cm^3

2. Newtonian fluid is defined as the fluid which

   (a) obeys Hook's law (b) is compressible

   (c) obeys Newton's law of viscosity (d) is incompressible

3. A manometer is used to measure

   (a) low pressure (b) moderate pressure

   (c) high pressure (d) atmospheric pressure

4. 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

5. Streamline and equipotential lines in a flow field

   (a) are parallel to each other (b) are identical to each other

   (c) are perpendicular to each other (d) intersect at acute angles

6. The continuity equation is the result of application of the following law to the flow field

(a) First law of thermodynamics (b) Conservation of energy

(c) Newton's second law of motion (d) Conservation of mass

7. Bernoulli's equation cannot be applied when the flow is

(a) rotational (b) turbulent (c) unsteady (d) all the above

8. In pipe flow the critical Reynolds number is about

(a) 640 (b) 5×10^5 (c) 2000 (d) 64000

9. What are the dimensions of force?

(a) $[M\ L\ T^{-2}]$ (b) $[M\ L\ T^{-1}]$ (c) $[M\ L^2\ T^{-2}]$ (d) $[M\ L^2\ T^2]$

10. Which of the following is a dimensionless equation?

(a) Reynold's equation (b) Euler's equation

(c) Weber's equation (d) all the above

PART - B (5 x 2 = 10 Marks)

11. Why does the viscosity of a liquid decreases with increase in temperature?

12. State the Pascal's law for a static fluid.

13. What is flownet?

14. What are the limitations of the Bernoulli's equation?

15. What are distorted models?

PART - C (5 x 16 = 80 Marks)

16. (a) The velocity distribution of flow over a plate is parabolic with vertex 30 cm from the plate, where the velocity is 180 cm/s. If the viscosity of the fluid is 0.9 Ns /m^2 find the Properties of fluids velocity gradients and shear stresses at distance of 0.15 cm and 30 cm from the plate. (16)

Or

(b) Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in (i) water and (ii) mercury. Take surface tensions $\sigma = 0.0725$ N/m for water and $\sigma = 0.52$ N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact = 130º. (16)

17. (a) An open tank contains water up to a depth of 2 m and above it an oil of sp. gr. 0.9 for a depth of 1 m. Find the pressure intensity (i) at the interface of the two liquids, and (ii) at the bottom of the tank. (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) For an incompressible fluid the velocity components are:

$$u = x^3 - y^3 - z^2\,x,\ v = y^3 - z^3,\quad w = -3x^2z - 3y^2z + \frac{z^3}{3}.$$

Determine whether the continuity equation is satisfied. (16)

19. (a) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if rate of flow through pipe is 40 lit/s. (16)

Or

(b) Derive an expression for Bernoulli's equation from first principle. (16)

20. (a) The resistance R experienced by a partially submerged body depends upon the velocity V, length of the body L, viscosity of the fluid μ, density of the fluid ρ and gravitational acceleration g. Obtain a dimensionless expression for R. (16)

Or

(b) A 7.2 m high and 15 m long spillway discharges 94m^3/s discharge under a head of 2.0 m. If 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experiences a force of 7500 N, determine force on the prototype. (16)

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