KUMARAGURU
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Register Number: ……..

B.E DEGREE EXAMINATIONS: DEC 2014

(Regulation 2009)

Third Semester

CIVIL EVGINEERING

CEE104: Mechanics of Fluids

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The resultant hydro static force acts through a point known as
   a) Centre of pressure b) Metacentre
   c) Centre of gravity d) Centre of buoyancy
2. The flow rate through a circular pipe is measured by
   a) Venture meter b) Pitot tube
   c) Rota meter d) Mano meter
3. Model analysis of free surface flows are based on
   a) Froude number b) Mach number
   c) Reynold number d) Euler number
4. Pascal's law states that pressure at a point is equal in all directions
   a) In a laminar flow b) In a liquid at rest
   c) In a fluid at rest d) In a turbulent flow
5. 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 the above
6. Geometric similarity between model and prototype means
   a) Similarity of linear dimensions b) Similarity of motion
   c) Similarity of discharge d) Similarity of forces
7. Surface tension has the unit of
   a) Force/unit area b) Force/unit length
   c) Force/unit volume d) None of the above

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

a) Energy b) Momentum

c) Mass d) None of the above

9. If the density of the fluid is constant from point to point in a flow region, it is called

a) Laminar flow b) Uniform flow

c) Incompressible flow d) Steady flow

10. 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

PART B (10 x 2 = 20 Marks)

11. Define the term Dimensional Homogeneity with an example
12. What is pitot's tube? Where it is used?
13. What are the limitations of Bernoulli's theorem?
14. Give any two properties of fluids.
15. What is similitude?
16. Write the continuity equation.
17. What do you mean by 'Laminar Boundary layer'?
18. Give the Darcy's Weisbach formula.
19. Explain the term 'surface tension'.
20. Write the dimensions for Area and Shear stress in MLT form.

PART C (5 x 14 = 70 Marks)

21. a) 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 Cd for the venturimeter.

(OR)

b) A laminar flow is taking place in a pipe of diameter of 200 mm. The maximum velocity is 1.5 m/sec. Find the mean velocity and the radius at which this occurs.

22. a) State Bernoulli's theorem for study flow of an incompressible fluid. Derive an expression for Bernoulli's equation and state the assumptions.

(OR)

b) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100mm and length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds.

23. a) 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 co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity.

(OR)

b) A ship 300 m long moves in seawater, whose density is 1030 kg/m^3, A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30m/sec and the resistance of the model is 60 N. Determine the velocity of ship in seawater and also the resistance of the ship in seawater. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of seawater and air as 0.012 stokes and 0.018 stokes respectively.

24. 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 3m/s using (i) Darcy formula, (ii) Chezy's formula for which C = 60.

(OR)

b) A pipe line, 300 mm in diameter and 3200 m long is used to pump up 50 kg/s of oil whose density is 950 kg/m3 and whose kinematic viscosity is 2.1 stokes. The centre of the pipe line at the upper end is 40 m above than that at the lower end. The discharge at the upper end is atmospheric. Find the pressure at the lower end and draw the hydraulic gradient and total energy line.

25. a) Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when

immersed in (i) water and (ii) mercury. The temperature of the liquid is 20^oC and the values of the surface tension of water and mercury at 20^oC in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero that for mercury 130^o. Take density of water at 20^o as equal to 998 kg /m^3.

OR

b) Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5 m^2 between the two large plan surfaces at a speed of 0.6 m/sec, if the thin plate is at a distance of 0.8 cm from one of the plane surfaces? Take the dynamic viscosity of glycerine = 8.10×10^{-1} Ns/m^2.

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