CBCS SCHEME

USN

15CV33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following properties of fluid. State their SI units.
(i) Density
(ii) Specific volume
(iii) Specific gravity
(iv) Kinematic viscosity **(08 Marks)**

b. Find the kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second. **(08 Marks)**

OR

2 a. State and prove Pascal's law. **(06 Marks)**

b. Find out the minimum size of glass tube than can be used to measure water level of the capillary rise in the tube is to be restricted to 2 mm. Take surface tension of water in contact with air as 0.073575 N/m. **(04 Marks)**

c. The right column of a simple U-tube manometer containing mercury is open to atmosphere and left column is connected to a pipe in which fluid of specific gravity 0.8 is flowing. The difference of mercury levels in two column's is 23 cm and the centre of pipe is 15 cm below the mercury level in the right column. Calculate the pressure of fluid in the pipe. **(06 Marks)**

Module-2

3 a. Obtain the expressions for total pressure and the depth of centre of pressure on an inclined plane surface immersed in a fluid. **(08 Marks)**

b. A circular plate 3.0 meter diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. **(08 Marks)**

OR

4 a. Derive continuity equation in Cartesian coordinates. **(08 Marks)**

b. Velocity potential function for a two dimensional fluid flow is given by $\phi = x(2y - 1)$. Check the existence of flow, determine the velocity of flow at a point P(2, 3) and corresponding stream function. **(08 Marks)**

Module-3

5 a. Derive Euler's equation of motion along a stream line and hence deduce Bernoulli's equation. **(08 Marks)**

b. Water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end at the rate of 50 lits/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. **(08 Marks)**

OR

6 a. Derive an expression for discharge through a venturimeter. **(08 Marks)**

b. A venturimeter of size 200 × 100 mm is used to measure the flow of liquid of specific gravity 0.85. If the mercury differential manometer head is 250 mm find the discharge through the venturimeter. Also find the absolute pressure at the throat if the pressure of the inlet is 49 kPa. Assume $C_d = 0.98$. **(08 Marks)**

Module-4

7 a. Define Vena-Contracta related to orifice. **(04 Marks)**

b. Define hydraulic coefficients and derive an expression $C_d = C_V \times C_C$. **(04 Marks)**

c. The head of water over the centre of an orifice of diameter 20 mm is 1m. The actual discharge through the orifice is 0.85 lits/sec. Find the coefficient of discharge. **(08 Marks)**

OR

8 a. Derive an expression for discharge through a triangular notch. **(08 Marks)**

b. Water flows over a rectangular weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right angled weir. Take C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir. **(08 Marks)**

Module-5

9 a. Derive the Darcy-Weisbach equation for loss of head due to friction in pipe. **(08 Marks)**

b. Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m. When one end of pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the centre of pipe. Calculate all minor losses and take f = 0.009 in the formula $h_f = \frac{4flV^2}{2gd}$. **(08 Marks)**

OR

10 a. Explain Hydraulic Gradient line and Total Energy line. **(04 Marks)**

b. Describe pipes in parallel and pipes in series. **(04 Marks)**

c. A 5 cm diameter pipe takes off abruptly. From a large tank and runs 8m then expands abruptly to 10 cm diameter and runs 45 m and next discharges directly into open air with a velocity of 1.5 m/sec. Compute the necessary height of water surface above the point of discharge. Take coefficient of friction f = 0.0065 in Darcy's equation. **(08 Marks)**

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