CBCS SCHEME

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18CV33

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and prove Pascal's law. **(10 Marks)**

b. Calculate the specific weight, density and specific gravity of one litre of liquid which weighs 7 N. **(06 Marks)**

c. Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure. **(04 Marks)**

OR

2 a. Define the following and write their SI units:
(i) Density (ii) Specific weight (iii) Specific gravity (iv) Surface tension
(v) Capillarity **(10 Marks)**

b. A differential manometer is connected at the two points A and B of two pipes as shown in Fig.Q2 (b). The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the manometer. **(10 Marks)**

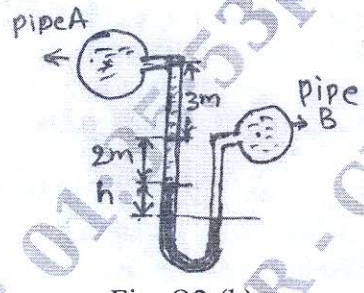

Fig. Q2 (b)

Module-2

3 a. Derive the expression for 3 dimensional continuity equation in Cartesian coordinates in general form. **(10 Marks)**

b. Find the total pressure and position of centre of pressure on a triangular plate of base 2 m and height 3 m which is immersed in a water in such a way that the plan of the plate makes an angle of 60° with the free surface of the water. The base of the plate is parallel to water surface and at a depth of 2.5 m from water surface. **(10 Marks)**

OR

4 a. Derive the expression for total pressure and centre of pressure for a vertical plane surface submerged in liquid. **(10 Marks)**

b. Define velocity potential function and stream function. Also write down their relationship with velocity components in x, y and z directions. **(06 Marks)**

c. The velocity potential function is given by an expression, $\phi = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$ find the velocity components in x and y directions. **(04 Marks)**

Module-3

5 a. Derive the expression for Euler's equation of motion and obtain the Bernoulli's equation from it. **(10 Marks)**

b. A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. **(10 Marks)**

OR

6 a. Derive the expression for discharge through the orificemeter. **(10 Marks)**

b. A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 diameter at position A to 500 mm diameter at a position B which is 4 m at a higher level. If the pressure at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 litres/s. Determine the loss of head and direction of flow. **(10 Marks)**

Module-4

7 a. Explain the theory, concept and classification of orifices and mouthpieces. **(10 Marks)**

b. Derive the expression for discharge over a triangular notch. State its advantages over a rectangular notch. **(10 Marks)**

OR

8 a. Write short notes on the following :

(i) Cippoletti notch.

(ii) Ventilation of weirs

(iii) Hydraulic coefficients of orifice. **(10 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. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir. **(10 Marks)**

Module-5

9 a. Derive the Darcy Weisbach equation for loss of head due to friction in a pipe. **(10 Marks)**

b. Explain the different types of minor losses occur in flow through pipe. **(10 Marks)**

OR

10 a. Write the short notes on the following :

(i) Pipes in series and Pipes in parallel.

(ii) Water hammer. **(10 Marks)**

b. An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/s. Find the Reynold's number of flow, head lost due to friction for a 500 m length of pipe. Also find the power required to maintain this flow. **(10 Marks)**

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