CBCS SCHEME

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17CV33

Third Semester B.E. Degree Examination, Jan./Feb. 2021
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. Define the following fluid properties. Also mention their units.
i) Specific Gravity ii) Viscosity iii) Mass Density iv) Specific Volume. **(06 Marks)**

b. Define capillarity and derive expressions for capillary rise and capillary fall. **(06 Marks)**

c. A differential manometer is connected at the two points A and B of two pipes as shown in Fig.Q.1(c). The pipe A contains a liquid of specific gravity of 1.5, while pipe B contains a liquid of specific gravity of 0.9. The pressures at A and B are 1kgf/cm^2 and 1.8kgf/cm^2 respectively. Find the difference is mercury level in the differential manometer. **(08 Marks)**

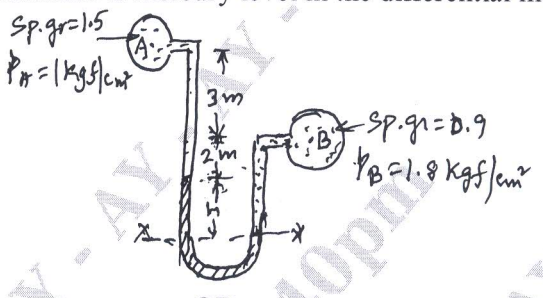

Fig.Q.1(c)

OR

2 a. With neat sketch, explain Bourdon tube pressure gauge. **(06 Marks)**

b. State and prove hydrostatic law of pressure. **(06 Marks)**

c. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 0.6N.sec/m^2. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5mm. **(08 Marks)**

Module-2

3 a. Define total pressure and centre of pressure. Also derive expressions for total pressure and centre of pressure for a plane surface submerged vertically in a liquid. **(08 Marks)**

b. Distinguish between:
i) Laminar Flow and turbulent flow
ii) Uniform flow and non uniform flow
iii) Steady flow and unsteady flow. **(06 Marks)**

c. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4m when it is immersed vertically in an oil of specific gravity 0.9. The base of the plate coincides with the free surface of oil. **(06 Marks)**

OR

4 a. Derive the three dimensional continuity equation in the Cartesian coordinates. **(06 Marks)**

b. The velocity vector n a fluid flow is given as $V = 4x^3i - 10x^2yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t =1. **(08 Marks)**

c. Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water in such a way that the centre of the plate is 3m below the free surface of water. Find the position of centre of pressure also. **(06 Marks)**

Module-3

5 a. Define free vortex flow and forced vortex flow. Also mention two examples for each. **(04 Marks)**

b. Derive Euler's equation of motion along a stream line and obtain Bernoulli's equation from Euler's equation. Also mention the assumptions made in derivation. **(10 Marks)**

c. A 30cm × 15cm venturimeter is inserted on a vertical pipe carrying water, flowing in upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20cm. Find the discharge. Take $C_d = 0.98$. **(06 Marks)**

OR

6 a. Derive an expression for discharge through a venturimeter. **(06 Marks)**

b. List the various instruments that works on the Bernoullie's principle. Also explain how pilot tube is used to measure velocity of flow. **(06 Marks)**

c. A 300mm diameter pipe carries water under a head of 20m with a velocity of 3.5m/s. If the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force on the bend. **(08 Marks)**

Module-4

7 a. Give a detailed note on classification of orifices mouth pieces. **(06 Marks)**

b. Derive an expression for discharge through a Borda's mouth piece running free. **(06 Marks)**

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

OR

8 a. Give a detailed note on classification of weirs. Derive an expression for discharge through a triangular notch. **(10 Marks)**

b. Define hydraulic coefficients. Also mention the general values of hydraulic coefficients. **(06 Marks)**

c. A jet of water, issuing from a sharp edged vertical orifice under a constant head of 10cm at a certain point, has the horizontal and vertical coordinates measured from the vena-contracta as 20cm and 10.5cm respectively. Find the value of C_v and also value of C_c if $C_d = 0.6$. **(04 Marks)**

Module-5

9 a. Give a brief note on loss of energy in pipes. Also derive Darcy's Weisbach equation for loss of energy due to friction. **(10 Marks)**

b. Give a brief note on water harmer in pipes. **(04 Marks)**

c. Three pipes of lengths 800m, 500m and 400m and diameters 500mm, 400mm and 300mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700m. Find the diameter of the single pipe. **(06 Marks)**

OR

10 a. Derive an expression for the loss of head due to sudden enlargement of pipe section. **(08 Marks)**

b. The water is flowing with a velocity of 1.5m/s in a pipe of length 2500m and of diameter 500mm. At the end of the pipe, a valve is provided. Find the rise in pressure if the valve is closed in 25 seconds. Take the value of C = 1460m/s. **(06 Marks)**

c. An oil of specific gravity 0.7 is flowing through a pipe of diameter 300mm at the rate of 500*l*/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000m. Take $\gamma = 0.29$ stokes. **(06 Marks)**

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