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Third Semester B.E. Degree Examination, July/August 2022 Fluid Mechanics

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART – A

- 1 a. How are fluids classified based on property of viscosity? Explain with examples for each types. (10 Marks)
- b. A liquid has a specific gravity of 0.72. Find its density and specific weight. Find also the weight per liter of liquid. (05 Marks)
- c. The left and right limbs of capillary U-tube are 1.25 mm and 2.50 mm in diameter. The tube contains a liquid of surface tension 0.05 N/m. Assuming the contact angle to be zero, find the specific weight and density of the liquid if the difference in the liquid levels in the two limbs is 10 mm. (05 Marks)
- 2 a. Explain the working principles of electronic pressure gauge. List the types of electronic pressure gauge. Explain any one type. (08 Marks)
- b. With a neat sketch, of “U” tube manometer, explain the principle of writing manometric equation. (04 Marks)
- c. The right and left limb of a “U” tube is of diameter 20 mm and 5 mm respectively. The left limb contains liquid of sp.gravity 0.9 while left limb consists of liquid of sp.gravity 1.35. The positions of the liquid level in the two limbs are shown in Fig, Q2 (c). What pressure should be applied on surface of the heavier liquid in order to rise the level in the limb containing lighter liquid by 10 mm. (08 Marks)

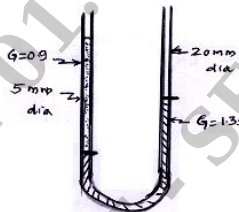


Fig. Q2 (c)

- 3 a. What is total pressure and centre of pressure? Explain. (04 Marks)
- b. Derive an expression for force exerted on submerged inclined plane surface by static liquid and locate the position of centre of pressure. (06 Marks)
- c. An inclined rectangular gate of width 5m and depth 1.5m is installed to control the discharge of water as show in Fig Q3(c). The end A is hinged. Determine the force normal to the gate applied at B to open it.

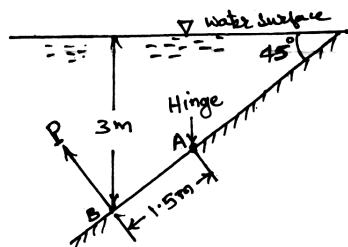


Fig Q3(c)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.



- 4 a. Differentiate between :
- (i) Streamline and Streak line
 - (ii) Stream function velocity potential function
 - (iii) Uniform and Non Uniform flow
 - (iv) Rotational and Irrotational flow. (08 Marks)
- b. What are equipotential line and line of constant stream function? Show that they are orthogonal to each other? (04 Marks)
- c. The stream function in a two dimensional flow field is $\Psi = 6x - 4y + 7xy$. Verify whether the flow is irrotational. Determine the direction of stream line at point (1, -1). Determine also expression for velocity potential. (08 Marks)

PART – B

- 5 a. Write Euler's equation of motion along a streamline and integrate it to obtain Bernoulli's equation. State also assumption made. (10 Marks)
- b. At a point in the pipe line where the diameter is 20cm, the velocity of water is 4 m/s and pressure is 343 kN/m². At a point 15m downstream the diameter reduces to 10cm. Calculate the pressure at this point if pipe is (i) horizontal (ii) vertical with flow downwards (iii) vertical with flow upwards. (10 Marks)
- 6 a. Obtain an expression for loss of head due to sudden expansion of flow in pipe. (08 Marks)
- b. Obtain an expression for pressure rise due to sudden closure of valve when the pipe is elastic. (08 Marks)
- c. Water is flowing with an velocity of 1.5m/s in a pipe of length 2500m and diameter 0.5. At the end of the pipe a valve is provided. Find the rise in pressure if the valve is closed in 25 seconds. Take $C = 1460$ m/s. (04 Marks)
- 7 a. Write a note on the following:
- i) Point gauge
 - ii) Hook gauge
 - iii) Staff gauge
 - iv) Weight gauge
 - v) Float gauge. (10 Marks)
- b. Obtain an expression for finding velocity at a point using pitot tube. (06 Marks)
- c. Find the velocity of flow of an oil through a pipe when the difference of mercury level in a differential u tube manometer connected to the two tappings of the pitot tube is 100mm. Take coefficient of pitot tube 0.98 and specific gravity of oil is 0.8. (04 Marks)
- 8 a. Prove that discharge equation over Cipolletti notch is same as the equation of discharge over a suppressed rectangular notch. (08 Marks)
- b. What are the advantages of triangular notch over rectangular notch? (04 Marks)
- c. Find the Venturi head for a venturimeter which has its axis vertical. The inlet and throat diameters are 150 mm and 75 mm respectively. The throat is 225 mm above the inlet and petrol of sp. gravity 0.78 flows up through the meter at a rate of 0.029 m³/s. Take $K = 0.96$. Also find the pressure difference between inlet and the throat. (08 Marks)

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