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06CV35

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the following fluid properties:Relative density, surface tension and vapour pressure. Give their dimensions. **(09 Marks)**

b. State and prove Newton's law of viscosity. **(06 Marks)**

c. Determine the minimum size of a glass tube for the capillary rise in it not to exceed 0.2mm of water. The surface tension of water in contact with air is 0.0725 N/m and contact angle 60°. **(05 Marks)**

2 a. List out the characteristics of manometric liquids. Give examples for manometric liquid. **(06 Marks)**

b. Sketch and explain the use of U-tube differential manometer. Also write the pressure equation representing the pressure difference between two points in a horizontal pipe. **(06 Marks)**

c. Determine the pressure difference between two pipes A and B shown in Fig.2(c), carrying water. The specific gravity of manometric liquid is 0.9. **(08 Marks)**

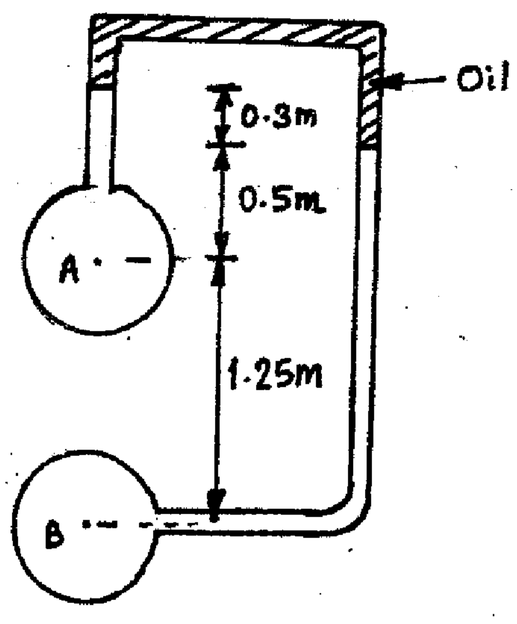

Fig.2(c)

3 a. Sketch the pressure diagrams for plane surfaces immersed in water:
i) horizontally, ii) vertically and iii) inclined.
Also write the expression for total pressure and location of centre of pressure for each of them. **(09 Marks)**

b. A cylindrical gate of 2.5m diameter retains two liquids on either side of it as shown in Fig.3(b). Estimate the resultant pressure force acting on unit length of the gate. **(11 Marks)**

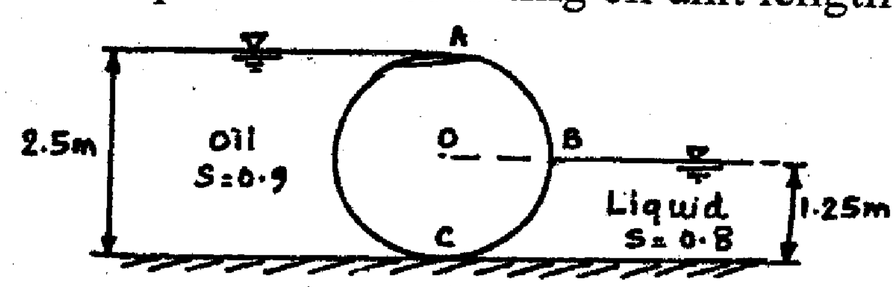

Fig.3(b)

4 a. Distinguish between:
i) Laminar flow and turbulent flow ii) Rotational flow and irrotational flow. **(04 Marks)**

b. Show that stream lines and equipotential lines meet orthogonally. **(06 Marks)**

c. The velocity vector in a fluid flow is, $v = 4x^3i - 10x^2yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) and at time t = 1 **(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.

PART – B

5 a. Derive Euler's equation of motion. **(06 Marks)**

b. A venturimeter 150mm×75mm is installed in a horizontal pipe line of 150mm diameter carrying oil (S = 0.9). The mercury level difference in the U-tube manometer connected to inlet and throat is 175mm. If $C_d = 0.97$, find the rate of flow through the pipe. **(06 Marks)**

c. Water flows up a tapered pipe as shown in Fig.5(c). Find the mercury deflection 'h' in the manometer corresponding to the discharge of 120 lps. Neglect all losses. **(08 Marks)**

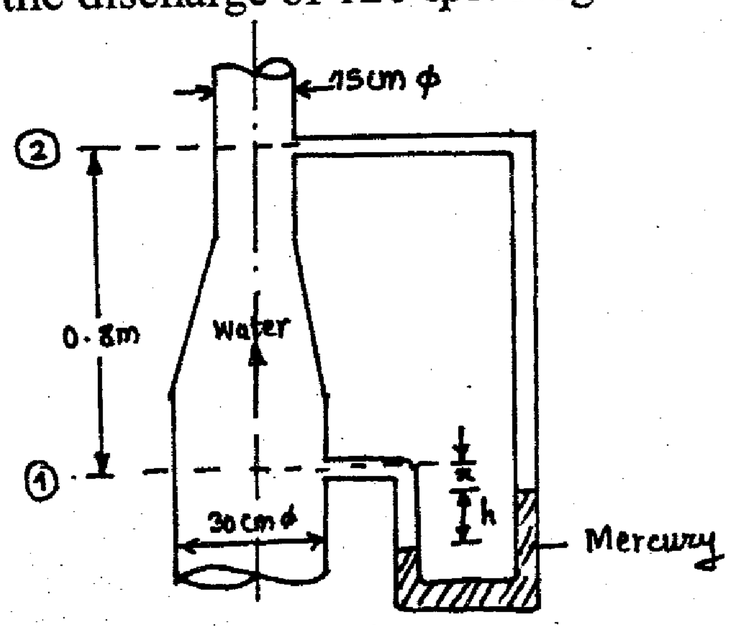

Fig.5(c)

6 a. Define Reynolds number. Give the expression, defining each term. **(04 Marks)**

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

c. Two pipes A and B are connected in parallel as shown in Fig.6(c). Pipe A is 150m long and 15cm in diameter. Pipe B is 100m long and 12cm in diameter. Both the pipes have friction factor f = 0.018 used in $h_f = fLV^2/2gD$. A partially closed valve in pipe A causes the discharge in two pipes to be same. Estimate the value of the valve coefficient 'k'. Neglect other minor losses. **(08 Marks)**

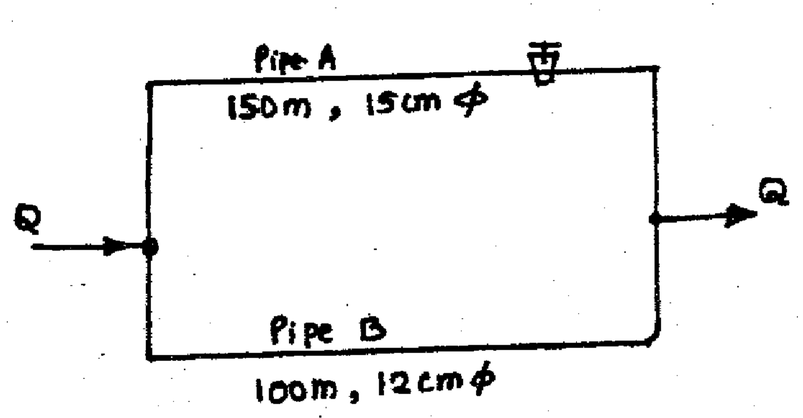

Fig.6(c)

7 a. Derive a relationship to determine the coefficient of velocity for flow through an orifice. **(06 Marks)**

b. Show that the coefficient of velocity for an external cylindrical mouthpiece is 0.855. **(08 Marks)**

c. The head of water over an orifice of 100mm diameter is 10m. The discharge through the orifice is 70 lps. If the coordinates of a point on the jet, measured from vena-contracta are 4.3m horizontal and 0.5m vertical, determine C_d, C_v and C_c. **(06 Marks)**

8 a. What are the advantages of V-notch over a rectangular notch? **(05 Marks)**

b. What is ventilation? Why it is necessary? How it is provided? **(06 Marks)**

c. A discharge of 100 lps is to be measured by a triangular notch of crest angle 60°. What would be the head over the crest? If the accuracy of reading the head is 1 mm, what error in discharge can be expected? Take $C_d = 0.6$. **(09 Marks)**

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