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10CV35

Third Semester B.E. Degree Examination, June/July 2017
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. ***Missing data if any may be suitably assumed.***

PART – A

1 a. Even though the needle is heavier than water, it can float on it, if it is placed lengthwise on the water surface. Why? **(04 Marks)**

b. If the velocity distribution for laminar flow in a pipe is given by $\frac{U}{U_{max}} = \left[1 - \frac{r^2}{R^2}\right]$.

Determine the expression for shear stress τ. V = velocity at a distance r from the centre line U_{max} = Centre line velocity ; R = Radius of pipe. **(06 Marks)**

c. If the relative density of fluid is 1.59, calculate its Mass density, Specific weight and Specific volume. **(06 Marks)**

d. Determine the diameter of a droplet of water in mm. If the pressure inside is to be greater than outside pressure by 130N/mm^2. **(04 Marks)**

2 a. State Pascal's law. **(04 Marks)**

b. Determine the pressure at the bottom of sea 1.0km deep if density of sea water is 1030kg/m^3. **(06 Marks)**

c. What considerations govern the diameter of glass tube to be used in a manometer? **(04 Marks)**

d. What are the common liquids used in manometer? What conditions should it satisfy before you choose a manometric liquid? **(06 Marks)**

3 a. When will the centre of gravity and centre of pressure coincide in case of plane immersed surfaces? **(02 Marks)**

b. A circular plane surface 4m in diameter is immersed in water such that the top and bottom edges are 1.5 and 4m below the water surface. Find the total pressure and the position of centre of pressure with respect to the water surface. **(12 Marks)**

c. Derive the expression for the depth of centre of pressure for an inclined submerged plane lamina. **(06 Marks)**

4 a. Define the terms : Stream line, Streak line , Flow net and Stagnation point. **(04 Marks)**

b. Check whether the velocity components U = 3x , V = 2z + 3x^2 and W = -3z + 2t, satisfy the continuity equation. **(04 Marks)**

c. Complete the following table : **(12 Marks)**

ψ	x	y	u	v
x + y	1.0	1.0	?	?
$2x^2 - y^2$	?	-2.0	?	4

PART – B

5 a. State the differential form of Energy equation. Integrate it. Name the resulting equation. **(06 Marks)**

b. List the assumptions made in the derivation of energy equation. **(02 Marks)**

c. A 50mm tube gradually expands to 100mm diameter tube in a length of 10 mts. If the tube makes an angle of 20^0 in upward direction with the horizontal, determine the pressure P_2 at the exit end, if the tube carries a discharge of 3.925 lts/sec and the inlet pressure P_1 is $60kN/m^2$. Assuming i) No energy loss and ii) A loss of 0.20m. **(12 Marks)**

6 a. Define the term 'Equivalent diameter' of pipe. Obtain the 'Equivalent diameter' for the system of pipes in series. **(06 Marks)**

b. A 300mm diameter pipe gradually tapers to 150mm diameter in a length of 10mts. If the discharge through pipe is $0.15m^3/sec$. Determine the loss of head due to friction, if $f = 0.01$. **(06 Marks)**

c. A discharge of 60.70 lits/sec of water flows through a bend in 100mm diameter pipe and gives 300mm of differential mercury head across the bend. Determine the discharge coefficient of the bend. **(08 Marks)**

7 a. Write short notes on : Weight gauge, Float gauge, Pitot tube and Current meter. **(08 Marks)**

b. A Pitot – Static tube placed in the centre of a 200mm pipe line has one orifice pointing upstream and the other perpendicular to it. If the pressure difference between the two orifices is 40mm of water when the discharge through the pipe is 1365 litres per minute. Calculate the coefficient of the pitot tube. Take the mean velocity in the pipe to be 0.83 of the central velocity. **(12 Marks)**

8 a. Derive the expression for discharge through a 'Venturimeter'. **(10 Marks)**

b. Find the discharge of water flowing over rectangular notch of 3m length when the constant head of water over a notch is 40cm. Take $C_d = 0.6$. **(10 Marks)**

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