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10CV35

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. 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)**

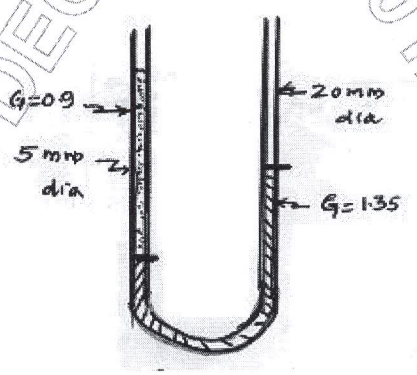

Fig. Q2 (c)

3 a. With Usual notation, derive expression for the force exerted on a submerged inclined plane surface by the static fluid and locate the position of centre of pressure. Also prove that the total pressure exerted by a static liquid on an inclined plane submerged surface is the same as the force exerted on a vertical plane surface as long as the depth of centre of gravity of the surface is unaltered. **(10 Marks)**

b. A square pipe whose two edges parallel to the ground surface is of edge dimension 1.5 m. It carries oil of specific gravity 0.9 under pressure (measured at the centre) 250 kN/m^2. Find the force exerted by the oil on the gate valve at the end of the pipe and also find the position of the centre of pressure. **(10 Marks)**

4 a. With new sketches, define and distinguish between streamline, path line and streak line. **(06 Marks)**

b. Derive with usual notation three dimensional continuity equation in Cartesian co-ordinates. **(08 Marks)**

c. The velocity components of a two dimensional incompressible flow are $u = x - 4y$ and $v = -y - 4x$. The flow is continuous. Find the velocity potential function and stream function. **(06 Marks)**

PART – B

5 a. State the assumptions made in the Bernoulli's equation. Derive the Bernoulli's equation from Euler's equation with usual form. **(08 Marks)**

b. What is kinetic energy correction factor, derive the expression for kinetic energy correction factor. How is it incorporated in Bernoulli's equation. **(06 Marks)**

c. A 400 m long pipe tapers from 1.20 m diameter at high end and 0.60 m diameter at the low end, the slope of the pipe being 1 in 100. The pipe conveys a discharge of 1025 cum/s. If the pressure at high end is 75 KPa, find the pressure at the low end, ignore losses. **(06 Marks)**

6 a. Derive expression for pressure rise due to instantaneous closure of valve for rigid and elastic pipes. **(10 Marks)**

b. A pipe line 2.50 km long 180 mm diameter conveys a discharge of 0.015 m^3/s. From high level tank to a low level tank. If it is planned to increase the discharge to the low level tank by 30% by attaching an additional pipe in parallel to the latter half length of the pipe, find the diameter of this pipe. Take $f = 0.0075$. **(10 Marks)**

7 a. How Floats and Currents meter are used to find the velocity in stream? Explain. **(08 Marks)**

b. A Pitot tube records a reading of 7.85 kPa as the stagnation pressure, when it is held at the centre of a pipe of 250 mm diameter conveying water. The static pressure in the pipe is 40 mm of mercury (vacuum). Calculate the discharge in the pipe assuming that the mean velocity of flow is 0.8 times the velocity at the centre. Take co-efficient of Pitot tube as 0.98. **(06 Marks)**

c. Following velocities are recorded in a stream with a current meter,

Depth above bed (m)	0	1	2	3	4
Velocity (m/s)	0	0.5	0.7	0.8	0.8

Find the discharge per unit width of stream near the point of measurement depth of flow at the point was 5 m. Use both single point and double point of assessment of discharge. **(06 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 ms/s. Take $K = 0.96$. Also find the pressure difference between inlet and the throat. **(08 Marks)**

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