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10CV35

Third Semester B.E. Degree Examination, Aug./Sept.2020
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms with unit:
i) Mass density ii) Weight density iii) Specific gravity. **(06 Marks)**

b. Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet. **(06 Marks)**

c. A plate is having an area of $0.64m^2$ is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.3m/s. There is a cushion of fluid 1.5mm thick between the plane and the plate. Find the viscosity of the fluid, if the weight of the plate is 300N. **(08 Marks)**

2 a. State and prove Pascal's law. **(06 Marks)**

b. Define Absolute pressure, vacuum pressure and Guage pressure with neat sketches showing the relationship between them. **(06 Marks)**

c. A simple U tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 400mm and height of fluid in left from the centre of pipe is 150mm below. **(08 Marks)**

3 a. Define:
i) Total pressure
ii) Centre of pressure. **(04 Marks)**

b. Derive an expression for total hydrostatic force and centre of pressure for a plane, immersed in water and inclined by an angle θ to the free surface of water. **(08 Marks)**

c. Determine total pressure and the position of centre of pressure of 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. **(08 Marks)**

4 a. Derive the continuity equation in Cartesian coordinates for steady, incompressible, three dimensional flows. **(10 Marks)**

b. The potential function for a flow is known as $\phi = 12xy - 16x$. Determine the stream function for the flow. Also calculate the value of ψ at (2, 3). **(10 Marks)**

PART – B

5 a. Derive the Bernoullie's energy equation form the Euler's motion equation, mentioning clearly the assumptions made in the derivation. **(10 Marks)**

b. A pipe line carrying oil of specific gravity 0.87, changes from 200mm diameter at a position A to 500mm diameter at a position B which is 4 meters at a higher level. If the pressure at A and B are $9.81 \times 10^4 N/m^2$ and $5.886 \times 10^4 N/m^2$ respectively and discharge is 200 liters/s determine the loss of head and direction of flow. **(10 Marks)**

6 a. Explain major losses and minor losses in pipes. Derive an expression for the loss of head due to sudden expansion of flow in pipes. **(10 Marks)**

b. Three pipes of 400mm, 200mm and 300mm diameters have lengths of 400m, 200m and 300m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16m. If coefficient of friction for these pipes is same and equal to 0.005 determine the discharge through the compound pipe neglecting the minor losses. **(10 Marks)**

7 a. Explain the following:
i) Point gauge
ii) Hook gauge
iii) Weight gauge
iv) Float gauge
v) Staff gauge. **(10 Marks)**

b. With a neat sketch, explain the function of current meter. **(10 Marks)**

8 a. Prove that discharge through a triangular notch or weir is $Q = \frac{8}{15} C_d \tan \theta/2 \sqrt{2g} H^{5/2}$ **(10 Marks)**

b. Water flows through a triangle right angled weir first and then over a rectangular weir of 1m width. The discharge coefficients of the triangle and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360mm, find the depth of water over the rectangular weir. **(10 Marks)**

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