CBCS Scheme

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15CV33

Third Semester B.E. Degree Examination, June/July 2018
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Assume missing data if any suitably.

Module-1

1 a. Distinguish between
i) Ideal fluid and real fluid
ii) Newtonion and non Newtonion fluid
iii) Cohesion and adhesion **(06 Marks)**

b. State and prove Pascal's law. **(04 Marks)**

c. Calculate the specific weight, density, specific volume and specific gravity of two litres of a liquid which weighs 15 N. **(06 Marks)**

OR

2 a. With the help of neat sketches, explain (i) simple U-tube manometer and (ii) differential U-tube manometer. **(06 Marks)**

b. What is capillarity? Derive an expression for capillary rise and a liquid in a glass tube. **(04 Marks)**

c. A U tube differential manometer connects two pipes A and B. Pipe A contains carbon tetra chloride having specific gravity 1.594 under a pressure of 117.72 kN/m^2 and pipe B contains oil of specific gravity 0.8 under a pressure of 117.72 kN/m^2. The pipe A lies 2.5 m above pipe B. Find the difference in pressure measured by mercury as fluid filling U-tube. Assume mercury in the right limb is 50 cm below centre of pipe B. **(06 Marks)**

Module-2

3 a. Distinguish between:
i) Steady and unsteady flow
ii) Rotational and irrotational flow **(04 Marks)**

b. Derive the expressions for total pressure and centre of pressure for a plane surface submerged vertically in a liquid. **(06 Marks)**

c. A circular opening 3m diameter, in a vertical side of a tank is closed by a disc of 3m diameter which can rotate about a horizontal diameter. Calculate: (i) The force on the disc, and (ii) The torque required to maintain the disc in equilibrium in vertical position when the head of water above the horizontal diameter is 6m. **(06 Marks)**

OR

4 a. Define the terms velocity potential function and stream function. **(04 Marks)**

b. Derive an expression for continuity equation for a three dimensional flow. **(06 Marks)**

c. A stream function in a two dimensional flow is $\psi = 2xy$. Show that the flow is irrotational and determine the corresponding velocity potential ϕ. **(06 Marks)**

Module-3

5 a. What is pitot tube? How will you determine velocity using pitot tube? **(04 Marks)**

b. State and prove Bernoulli's theorem for steady flow of an incompressible fluid. **(06 Marks)**

c. The water is flowing through a tapper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end at the rate of 50 litres/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher end is 196.2 kPa. **(06 Marks)**

OR

6 a. Define the terms: i) forced vertex flow and ii) free vertex flow. **(04 Marks)**

b. What is venturimeter? Derive an expression for discharge through a venturimeter. **(06 Marks)**

c. A pipe of 300 mm diameter conveying 300 litres/s of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of bend are 245.25 kPa and 235.44 kPa. **(06 Marks)**

Module-4

7 a. Explain different hydraulic coefficient and establish the relation between them. **(04 Marks)**

b. Derive an expression for discharge over a triangular notch. **(06 Marks)**

c. The head of water over an orifice of diameter 100 mm is 5m. The water coming out from the orifice is collected in a circular tank of diameter 2 m. The rise of water level in circular tank is 450 mm in 30 seconds. Also the coordinates at a certain point on the jet, measured from vena-contracta are 1000 mm horizontal and 52 mm vertical. Find the hydraulic coefficients C_V, C_d and C_C. **(06 Marks)**

OR

8 a. Explain the terms:
   i) Velocity of approach
   ii) Effect of end contractions in notches **(04 Marks)**

b. What is Cipolletti notch? Derive an expression for discharge over a Cipolletti notch. **(06 Marks)**

c. Water flows over a rectangular weir 1.2m wide at a depth of 15 cm and afterwards passes through a triangular right angled weir. Taking coefficient of discharge for rectangular Weir 0.62 and for triangular Weir 0.59 find the depth over the triangular Weir. **(06 Marks)**

Module-5

9 a. Explain briefly:
   i) Hydraulic gradient line and
   ii) Energy gradient line **(04 Marks)**

b. Derive an expression for head loss due to friction in pipes. **(06 Marks)**

c. A rigid pipe conveying water is 3200 m long. The velocity of flow is 1.2 m/s. Calculate the rise of pressure behind a valve at the lower end if it is closed (i) in 20 seconds (ii) in 3 seconds. Take bulk modulus and water equal to 2000 N/mm^2. **(06 Marks)**

OR

10 a. Explain briefly the phenomenon of water hammer. **(04 Marks)**

b. Derive an expression for head loss due to sudden enlargement in a pipe flow. **(06 Marks)**

c. At a sudden enlargement of a water main from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow. **(06 Marks)**

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