CBCS SCHEME

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15CV33

Third Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the terms:
- i) Mass density
- ii) Specific volume
- iii) Specific gravity
- iv) Compressible fluid
- v) Incompressible fluid. **(05 Marks)**

b. State Newton's law of viscosity. The velocity distribution over a plate is given by $V = \frac{y}{3} - y^2$, in which 'V' is the velocity in m/sec, at a distance 'y' m above the plate. Find the shear stress at y = 0 and y = 0.1m, $\mu = 0.835$ N-s/m^2. **(05 Marks)**

c. Explain the phenomenon of capillarity obtain an expression for capillary rise of a liquid. **(06 Marks)**

OR

2 a. What are the desirable characteristics of a manometric liquid? **(05 Marks)**

b. Differentiate between:
- i) Absolute and gauge pressure
- ii) Simple manometer and differential manometer
- iii) Piezometer and pressure gauges. **(06 Marks)**

c. Using an inverted U-Tube manometer, find the intensity of pressure at B for the given condition shown in Fig.Q.2(c). Carbon tetrachloride of relative density 1.6 is flowing through the pipe A and B. Water is used as monometer fluid. The pressure at A is 294.33 kN/m^2. **(05 Marks)**

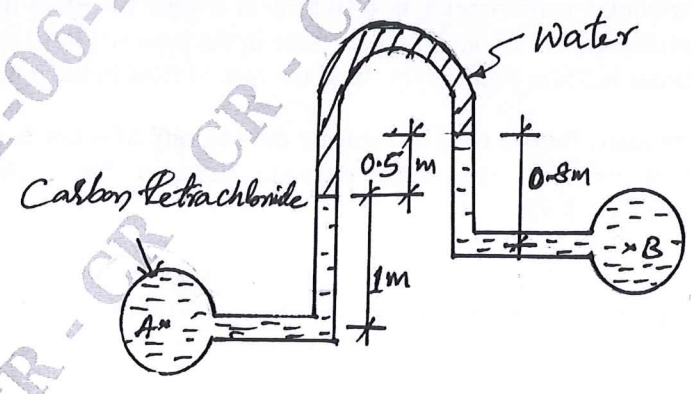

Fig.Q.2(c)

Module-2

3 a. Derive an expression for total pressure on a inclined submerged plane surface. **(04 Marks)**

b. A triangular plate of base width 2m and height 3m is immersed in water with its plane making an angle of 60° with the free surface of water. Determine the hydrostatic pressure force and the position of centre of pressure when the apex of the triangle lies 5m below the free water surface. **(06 Marks)**

c. A concrete dam of trapezoidal section having water on vertical face is 16m high. The base of the dam is 8m wide and top 3m wide. Find the resultant thrust on the base per metre length of the dam water is stored upto top of dam. Take density of masonry = 24 kN/m^3. **(06 Marks)**

OR

4 a. Explain the terms: i) Path line ii) Streak line iii) Stream line and iv) Streams tube. **(04 Marks)**

b. The velocity components in a two-dimensional incompressible flow field are expressed as $u = \frac{y^3}{3} + 2x - x^2y$; $V = xy^2 - 2y - \frac{x^3}{3}$. Determine the velocity and acceleration at point P(x = 1m, y = 3m). **(06 Marks)**

c. The velocity potential function for a two dimensional flow $\phi = x^2 (3y - 2)$. At a point P(2, 3) determine:

i) The velocity at that point.

ii) The value of stream function (ψ) at the point. **(06 Marks)**

Module-3

5 a. What are the different energies of moving fluid? Explain each one of them. **(04 Marks)**

b. Derive the Bernoulli's energy equation from the Euler's motion equation, mentioning clearly the assumption made in the derivation. **(06 Marks)**

c. The water is flowing through a pipe having diameter 20cm and 10cm at section 1-1 and 2-2 respectively. The rate of flow through a pipe is 35 lt/sec. The section 1-1 is 6m above datum and section 2-2 is 4m above datum. If the pressure at section 1-1 is 0.4 N/mm^2. Find the intensity of pressure at section 2-2. **(06 Marks)**

OR

6 a. A pipe of 200mm diameter conveying 0.18m^3/sec of water has a 90° bend in a horizontal plane. The pressure intensities at the inlet and outlet of the bend are 290 kPa and 280 kPa. Find the resultant force exerted by water on the bend. **(08 Marks)**

b. A horizontal venturimeter is provided in a pipe of 30cm diameter conveying water. The throat diameter is 15cm. If the pressure in the pipe is 160 kN/m^2 and the Vaccum pressure of the throat is 35cm of mercury. Find the rate of flow in the pipe. Assume $C_d = 0.98$. **(06 Marks)**

c. A pitot static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6m and the static pressure head is 5m. Calculate the velocity of flow. Assume $C_v = 0.98$. **(02 Marks)**

Module-4

7 a. What is orifice? Discuss the classification of orifices. **(06 Marks)**

b. What is mouth piece? Discuss the classification of mouth piece with sketches. **(06 Marks)**

c. The head of water over an orifice of diameter 10cm is 10m. The water coming out from orifice is collected in a circular tank of diameter 1.5m. The rise of water level in this tank is 1m in 25 sec. The co-ordinates of a point on the jet, measured from Vena-contracta are 4.3m horizontal and 0.5m vertical. Find the coefficient of C_d, C_v, C_c? **(04 Marks)**

OR

8 a. Derive an expression for discharge over a rectangular notch in terms of head of water over the crest of the notch. **(06 Marks)**

b. Water flows over a rectangular weir 1m wide at depth of 15cm and afterwards passes through a triangular right angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively, find the depth over the triangular weir. **(06 Marks)**

c. Describe a cippoletti weir. Water is flowing over a cippotte weir 4m long under a head of 1m. Compute the **(04 Marks)**

Module-5

9 a. What do you understand by the terms:

i) Major energy loss and minor energy loss.

ii) Total energy line and hydraulic gradient line. **(04 Marks)**

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

c. Water has to be supplied to a town of 4,25,000 in habitants. The reservoir is 6km from the town. The head lost in the pipe line due to friction is measured as 12.5m. Find the size of the supply main if each inhabitant consumes 180 lit of water per day and half the daily supply is pumped in 8 hours. Take f = 0.0075. **(06 Marks)**

OR

10 a. Three pipes of diameters 300mm, 200mm and 400mm and lengths 450m, 225m and 315m respectively are connected in series. The difference in water surface levels in two tanks is 18m. Determine the rate of flow of water if co-efficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering minor losses. **(06 Marks)**

b. Derive an expression for pressure rise due to sudden closure of valve when the pipe material is elastic. **(08 Marks)**

c. Water is flowing in a pipe of 150mm diameter with a velocity of 3.5m/sec. When it is suddenly brought to rest by closing the valve find the pressure rise assuming the pipe is elastic. E = 206 GN/m^2, Poisson's ratio 0.25 and K for water = 2.0 GN/m^2, thickness of wall = 10mm. **(02 Marks)**

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