CBCS SCHEME

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17CV33

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following with symbols and units :
i) Weight density
ii) Specific volume
iii) Density. **(06 Marks)**

b. What do you mean by single column manometer? Derive the expression for vertical single column manometer. **(06 Marks)**

c. The right limb of a simple U–tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe which a fluid of sp.gr. 0.9 is flowing. The centre of the pipe is 12cm below the level of the mercury in the right limb. Find the pressure of fluid in the pipe. If difference of mercury level in the two limb is 20cm. **(08 Marks)**

OR

2 a. What is capillarity? Derive an expression for capillarity rise for a liquid in a glass tube. **(06 Marks)**

b. Explain difference between i) absolute and gauge pressure ii) Newtonian and non Newtonian iii) ideal fluid and real fluid iv) simple manometer and differential manometer. **(08 Marks)**

c. Calculate pressure due to a column of 0.4 of i) water ii) an oil of sp.gr 0.9 and iii) mercury of sp.gt 13.6. Take density water $\rho = 1000 kg/m^3$. **(06 Marks)**

Module-2

3 a. Derive an expression for total pressure and centre of pressure of a inclined plane surface immersed in a liquid. **(08 Marks)**

b. Determine eth total pressure and depth of centre of pressure on a plane rectangular surface of 1m wide and 3m deep when its upper edge is horizontal and i) coinsides with water surface ii) 2m below the free water surface. **(06 Marks)**

c. A circular plate 3m diameter is immersed in water in such way that its greatest and least depth below the free surface are 4m and 1.5m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. **(06 Marks)**

OR

4 a. Define :
i) Uniform and non-uniform flow
ii) Rotational and irrotational flow
iii) Stream line and path line
iv) Laminar and turbulent flow. **(08 Marks)**

b. Derive the three dimensional continuity equation in the Cartesian coordinates. **(06 Marks)**

c. A 40cm diameter pipe, conveying water, branches into two pipes of diameter 30cm and 20cm respectively. If the average velocity in the 40cm pipe is 3m/sec. Find the discharge in the pipe. Also determine velocity in 20cm pipe if the average velocity in 30cm diameter pipe is 2m/sec. **(06 Marks)**

Module-3

5 a. Derive an expression for Bernoulli's equation and state the assumption made for such a derivation. **(06 Marks)**

b. What is venturimeter? Derive an expression for the discharge through venturimeter. **(08 Marks)**

c. Water flowing through a pipe having diameter 30cm and 15cm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 29.43N/cm^2 and pressure at the upper end is 14.715N/cm^2. Determine the difference datum head if the rate of flow through the pipe is 50lit/sec. **(06 Marks**

OR

6 a. Define the terms : i) Free vortex ii) Forced vortex **(04 Marks)**

b. State the momentum equation. How will you apply the momentum equation for determining the force exerted by flowing liquid on a bend? **(08 Marks)**

c. 250 lit/sec of water is flowing in a pipe having diameter of 300mm. If the pipe is bent by 135°(i.e changes from initial to final direction is 135°). Find the magnitude and direction on of the resultant force on the bend. The pressure of water flowing is 39.24N/cm^2. **(08 Marks)**

Module-4

7 a. Prove that the discharge over triangular notch is $Q = \frac{8}{15} cd\sqrt{2g} \tan\theta / 2H^{\frac{5}{2}}$. **(08 Marks)**

b. Explain the experimental determination of hydraulic coefficients C_d, C_V and C_C. **(06 Marks)**

c. The head of water over an orifice of diameter 100mm is 5m. The water coming out from the orifice is collected in a circular tank of diameter 2m. The rise of water level in this tank is 0.45min 30Sec. Also coordinates of certain print of jet, measured by venacontracts are 100cm horizontal and 5.2cm vertical. Find the hydraulic coefficients C_d, C_V and C_C. **(06 Marks**

OR

8 a. Distinguish between : i) Notch and Weir ii) Orifice and mouthpiece. **(04 Marks)**

b. What is cipolleti weir? Prove that the discharge through cipolleti Weir is given by $Q = \frac{2}{3} cd\sqrt{2g}\, H^{\frac{3}{2}}$. **(08 Marks)**

c. The water flowing in a rectangular channel of 1.2m wide and 0.8m deep. Find the discharge over the rectangular Weir of the crest length 70cm. If the head of water over the crest of weir is 25cm and water form channel flows over the weir. Take C_d = 0.60 Neglect end contraction but consider velocity of approach. **(08 Marks)**

Module-5

9 a. Explain the term s with neat sketch : i) Pipes in parallel ii) Piopes in series iii) Hydraulic gradient line iv) Total energy line. **(08 Marks)**

b. Three pipes of length 800m, 500m and 400m and of diameter 500mm, 400mm and 300mm respectively are connected by a single pipe of length 1700m. Find the diameter of the single pipe. **(06 Marks)**

c. Find the diameter of the pipe of length 2500m when the rate of flow of water through the pipe is 0.25m^3/sec and head loss due to friction is 5m. Take C = 50 in Chezy's formula. **(06 Marks)**

OR

10 a. What do you mean by equivalent pipe? Obtain an expression for equivalent pipe. **(08 Marks)**

b. Derive expression for the loss of head due to sudden expansion in the pipe. **(08 Marks)**

c. Find the loss of head when pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm. The rate of flow of water through the pipe is 250lit/sec. **(04 Marks)**