CBCS SCHEME

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15CT63

Sixth Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics and Hydraulic Structures

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following as applied to fluids : **(04 Marks)**
Mass density ii) Viscosity iii) Surface tension iv) Capillarity.

b. Explain classification of fluids based on Newton's law of viscosity. **(04 Marks)**

c. A glass tube 0.25mm in diameter contains a mercury column with water above mercury. The surface tension of mercury in contact with water is 0.037 kg(f)/m. What will be the capillary depression of mercury? Take angle of contact of mercury with glass as 130°. **(08 Marks)**

OR

2 a. State and prove Pascal's law. **(05 Marks)**

b. At what depth below the free surface of oil having a density of 700 kg/m^3 will the pressure be equal to one bar? **(05 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 I which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe, if the difference in mercury level in the two limbs is 20cm. **(06 Marks)**

Module-2

3 a. Define total pressure and centre of pressure. **(02 Marks)**

b. Derive an expression for total pressure and centre of pressure of an inclined plane surface submerged in a liquid. **(06 Marks)**

c. A rectangular gate closes a horizontal tunnel of 5m height and 3m width running full with water. The pressure at the bottom of the gate is 196.2kN/m^2. Determine the total pressure on the gate and the centre of pressure. **(08 Marks)**

OR

4 a. State Bernoulli's equation. Starting from Euler's equation derive Bernoulli's equation for motion of fluid along a streamline. **(06 Marks)**

b. Give assumptions and limitations of Bernoulli's equation. **(04 Marks)**

c. A pipe carrying oil of specific gravity 0.877 changes in size from 0.15m at section A to 0.45m at section B. Section A is 3.6m lower then B. And the pressure at A and B are 90.252kN/m^2 and 59.841 kN/m^2 respectively. If the discharge in the pipe is 0.145m^3/s, determine the head loss and the direction of flow. **(06 Marks)**

Module-3

5 a. What is an equivalent pipe? Derive Dupuit's equation for an equivalent pipe. **(08 Marks)**

b. A pipeline 16km long supplies 40 million liters per day water to a city. The first 5km of the pipe is of 1.0m diameter. The remaining length is of 0.80m diameter. If the supply is to be made at a residual head of 15.0m of water, calculate the design head at the inlet. Neglect minor losses. Assume f = 0.03 for the entire length of pipe. **(08 Marks)**

OR

6 a. Derive an expression for discharge over a V-notch. **(06 Marks)**

b. Water discharges at the rate of 98lps through a 0.12m diameter vertical sharp edged orifice placed under a constant head of 18m. A point on the jet measured from the vena contracta of the jet has co-ordinates 4.5m horizontal and 0.54m vertical. Find i) the hydraulic coefficients of orifice C_c, C_v, C_d and C_r and ii) the power lost at the orifice. **(10 Marks)**

Module-4

7 a. Show that the efficiency of a jet striking a series of flat vanes mounted on the periphery of a circular wheel is maximum when the jet velocity is double the velocity of vane and the maximum efficiency is 50%. **(08 Marks)**

b. A jet of water impinges on a curved plate with velocity of 20m/s making an angle of 20° with the direction of motion of vane at inlet and leaves at 130° to the direction of motion oat outlet. The vane is moving with a velocity of 10m/s. compute

i) Vane angles, so that water enters and leaves without shock

ii) Work done per second. **(08 Marks)**

OR

8 a. Derive Chezy's formula for velocity of flow in open channel. Give the assumptions made. **(08 Marks)**

b. A trapezoidal channel has side slopes of 1H : 2V and the slope of the bed is 1 in 1500. The area of section is $40m^2$. Find the dimensions of the section and the discharge if it is most economical. **(08 Marks)**

Module-5

9 a. What are reaction turbines? Give their advantages over impulse turbines. **(08 Marks)**

b. A Francis turbine has inlet wheel diameter of 2.0m and outlet diameter of 1.20m. The runner turns at 250rpm and water flows at 8.0 cumecs. The blades have a costant width of 200mm. if the vanes are radial at inlet and the discharge is radially outwards at the exit; find the angle of guide vane at inlet and blade angle at exit. **(08 Marks)**

OR

10 a. List ad explain different efficiencies of centrifugal pumps. **(08 Marks)**

b. A centrifugal pump runs at 1000rpm and delivers water against a total head of 15m. The impeller diameter and width at outlet are 0.30m and 0.05m respectively. The vanes are curved back at an angle of 30° with the periphery at the outlet. If manometric efficiency is 92% find the discharge through the pump. **(08 Marks)**

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