CBCS SCHEME

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15CT63

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Fluid Mechanics and Hydraulics Structures

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State Newton's law viscosity and derive the expression for coefficient of viscosity. **(04 Marks)**

b. Derive expression for capillarity rise. **(04 Marks)**

c. A cylindrical shaft of 100mm diameter rotates about a vertical axis inside a fixed cylindrical tube of length 1m and 110mm internal diameter. If the space between the tube and the shaft is filled by lubricant of dynamic viscosity poise. Determine the power required to overcome viscouse resistance. When the shaft is rotate @ a speed of 240 rpm. **(08 Marks)**

OR

2 a. Distinguish between :
i) Simple manometer and differential manometer
ii) Newtonian fluids and Non-Newtonian fluids. **(04 Marks)**

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

c. A liquid of specific gravity 0.8 flows up through a vertical pipe, A and B are the two points in the pipe, B being 0.5m higher than A. A and B are connected to a U – tube differential manometer contains mercury. If the pressure difference between A and B is 18KPa, Find the mercury difference in manometer Refer Fig Q2(c). **(06 Marks)**

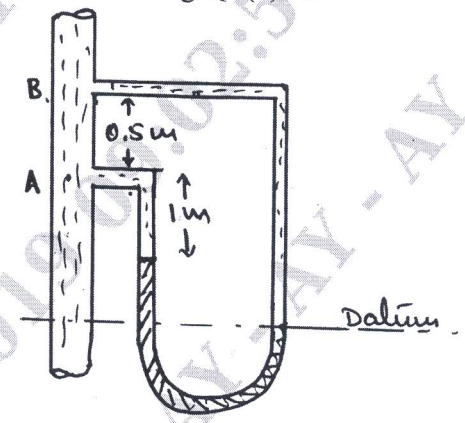

Fig Q2(c)

Module-2

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

b. A rectangular plane surface 3m wide and 4m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure force and position of centre of pressure, when the upper edge is 2m below the free surface. **(04 Marks)**

c. Water is flowing through a pipe of 5cm dia under a pressure of 29.43 N/cm^2 and with mean velocity of 2m/s. Find the total head (or) total energy per unit weight of the water @ a cross section, which is 5m above the datum line. **(04 Marks)**

OR

4 a. State and prove Bernoulli's theorem. **(08 Marks)**

b. Water is flowing through a pipe having diameter 300mm and 200mm at the lower and upper end respectively. The intensity of pressure at the bottom end is $24.525 N/cm^2$ and the pressure at the upper end is $9.81 N/cm^2$. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s. **(08 Marks)**

Module-3

5 a. Derive Darcy – Weicback equation for head loss though a pipe. **(08 Marks)**

b. A pipe line of 20cm diameter and 1500m long carries water from one end to other end. The pressure measured @ inlet and outlet of the pipe 12KPa and 2KPa. Determine the discharge through pipe in LPM. Take f = 0.008 for pipe line. **(08 Marks)**

OR

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

b. An oil of sp.gr 0.7 is flowing through a pipe of diameter 300mm @ the rate of 500 ℓtr/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000m. Take $\mu = 0.02$. **(08 Marks)**

Module-4

7 a. Derive Chezy's formula for discharge through an open channel. Give assumptions. **(08 Marks)**

b. A jet of water of diameter 50mm moving with a velocity of 40m/s, striker a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate. **(04 Marks)**

c. Find the discharge through a trapezoidal channel of width 8m and side slope of 1 horizontal to 3 vertical. The depth of flow of water is 2.4m and value of Chezy's constant C = 50. The slope of the bed is 1 in 4000. **(04 Marks)**

OR

8 a. Derive equation for efficiency and workdone by the jet on series of plates giving the assumptions involved in it. **(08 Marks)**

b. A jet of water diameter 50mm, having a velocity of 20m/s strikers a curved vane which is moving with a velocity of 10m/s in the direction of the jet. The jet leaves the vane @ an angle of 60° to the direction of motion of vane @ outlet. Determine :

i) The force exerted by the jet on the vane in the direction of motion

ii) Work done per second by the jet. **(08 Marks)**

Module-5

9 a. Define the following :

i) Suction Head ii) Delivery Head iii) Static head iv) Monometric Head. **(08 Marks)**

b. A pelton wheel has a mean bucket speed of 10meters per second with a jet of water flowing at the rate of 700 ltr/s under a head of 30 meters. The bucket deflects the jet through an angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. **(08 Marks)**

OR

10 a. Derive equation for minimum speed for starting a centrifugal pump. **(08 Marks)**

b. Explain the following terms

i) Hydraulic efficiency

ii) Mechanical efficiency

iii) Volumetric efficiency

iv) Overall efficiency. **(08 Marks)**