CBCS SCHEME

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18CV33

Third Semester B.E. Degree Examination, Aug./Sept.2020
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. Dynamic Viscosity, kinematic viscosity, surface tension. **(06 Marks)**

b. Derive the expression for pressure intensity inside a soap bubble. **(06 Marks)**

c. If 10,000 liters of certain liquid weigh 1329kN. Calculate:
i) Specific weight ii) Mass density iii) Specific volume and iv) Specific gravity. **(08 Marks)**

OR

2 a. Define gauge pressure, absolute pressure and atmospheric pressure and give the relation between them. **(08 Marks)**

b. What is the difference between U-tube differential manometer and inverted U-tube differential manometer? Where are they used? **(04 Marks)**

c. An U tube differential manometer connects two pressure pipes A and B. Pipe A contains carbon tetra chloride (1.594) under a pressure of 11.772N/cm^2 and pipe B contains oil (0.8) under a pressure of 11.772N/cm^2. The pipe A lies 2.5m above pipe B. Find the difference of pressure measured by mercury (13.6) as manometric fluid. The centre of pipe B coincides with manometer liquid in left limb. **(08 Marks)**

Module-2

3 a. Explain the procedure of finding the resultant pressure on a curved surface immersed in a liquid. **(04 Marks)**

b. A circular plate of diameter 0.75m is immersed in a liquid of relative density 0.80 with its plane making an angle of 30° with the horizontal. The centre of the plate is at a depth of 1.50m below the free surface. Calculate the total pressure force on one side of the plate and the location of the centre of pressure. **(08 Marks)**

c. A fluid flow field is given by
$V = x^2yi + y^2zj - (2xyz + yz^2)K$. Prove that it is a core of possible steady in compressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3). **(08 Marks)**

OR

4 a. Define:
i) Steady and unsteady flow
ii) Compressible and incompressible flow. **(04 Marks)**

b. Define velocity potential function and stream function and give their properties. **(08 Marks)**

c. Check whether the stream function $\psi = 5xy$ is irrotational and if so, determine the corresponding velocity potential function ϕ. **(08 Marks)**

Module-3

5 a. State Impulse-Momentum principle and give its any two applications. (04 Marks)

b. Derive the Euler's equation of motion and then obtain Bernoullis equation. (08 Marks)

c. A reducer bend having an outlet diameter of 15cms discharges freely, the bend, connected to a pipe of 20cms diameter has a deflection of 60° (that is, change from initial to final direction is 60°) and lies in horizontal plane. Determine the magnitude and direction of force on the bend, when a discharge of 0.3m^3/sec passes through the pipe. (08 Marks)

OR

6 a. List the forces present in fluidmotion and give equations of motion. (06 Marks)

b. What is Pitot tube? Explain how it is used to find the velocity of flow in pipes or channel. (06 Marks)

c. Find the discharge of water flowing through a pipe 30cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15cm. The difference of pressure between the main and the throat is measured by a liquid of specific gravity 0.6 in an inverted U-tube which gives a reading of 30cm. The loss of head between the main and the throat is 0.2 times the kinetic head of the pipe. (08 Marks)

Module-4

7 a. Give the classification of orifices. (04 Marks)

b. Derive the expression for discharge through a rectangular notch. (08 Marks)

c. A tank has two identical orifices in one of its vertical sides. The upper orifice is 3.0m below the water surface and lower orifice is 5.0m below the water surface. If the value of coefficient of velocity for each orifice is 0.96, find the point of intersection of the two jets. (08 Marks)

OR

8 a. Explain the different types of Nappe with sketches. (06 Marks)

b. Derive the expression for maximum discharge over a broad created weir. (08 Marks)

c. Water flows over a rectangular weir 1.0m wide at a depth of 150mm and afterwards passes through a triangular right angles weir, taking coefficient of discharge for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth of water over the triangular weir. (06 Marks)

Module-5

9 a. Derive Darcy-Weisbach equation for head loss due to friction in a pipe. (08 Marks)

b. List the different types of loss in pipe flow. (04 Marks)

c. When a sudden contraction from 60cm diameter to 30cm is introduced in a horizontal pipeline, the pressure drops from 100kPa at the upstream of the contraction to 80kPa on the downstream. Assuming a coefficient of contraction of 0.65, i) Estimate the flow rate in the pipe and ii) the loss of head due to sudden contraction. (08 Marks)

OR

10 a. What is water hammer? List the factors upon which it depends. (06 Marks)

b. Obtain Dupit's equation for equivalent pipe. (06 Marks)

c. Derive an expression for pressure rise in a pipe due to sudden closure of valve considering the elasticity of pipe material and compressibility of fluid. (08 Marks)

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