USN ☐☐☐☐☐☐☐☐☐☐   **15AU42**

Fourth Semester B.E. Degree Examination, July/August 2022
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 and explain the terms:
    i)   Weight density
    ii)   Specific volume
    iii)   Specific gravity
    iv)   Viscosity.   **(08 Marks)**

   b. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5m and it rotates at 200rpm. Calculate the power lost in oil for a sleeve length of 100mm. The thickness of oil film is 1mm.   **(08 Marks)**

OR

2 a. Explain vertical single column manometer with neat sketch.   **(08 Marks)**

   b. A differential manometer is connected at the two points A and B of two pipes as shown in Fig.Q.2(b). The pipe A contains a liquid of specific gravity = 1.5 while pipe B contains a liquid of specific gravity = 0.9. The pressures at A and B are 1kgf/cm^2 and 1.80kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer.   **(08 Marks)**
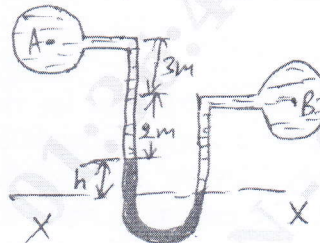

Fig.Q.2(b)

Module-2

3 a. Derive an expression for analytical method for metacentric height.   **(08 Marks)**

   b. A solid cylinder of diameter 4m has a height of 3 meters. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder = 0.6.   **(08 Marks)**

OR

4 a. Obtain an expression for continuity equation for a three dimensional steady incompressible flow.   **(08 Marks)**

   b. Distinguish between:
    i)   Steady flow and unsteady flow
    ii)   Uniform and non-uniform flow
    iii)   Compressible and incompressible flow
    iv)   Laminar and Turbulent flow.   **(08 Marks)**

Module-3

5 a. Derive Euler's equation of motion. How will you obtain Bernoulli's equation from it?

(08 Marks)

b. A non uniform part of a pipe line 5m long is laid at a slope of 2 in 5. Two pressure gauges each fitted at upper and lower ends read 20N/cm^2 and 12.5N/cm^2. If the diameters at the upper and lower ends are 15cm and 10cm respectively. Determine the quantity of water flowing per second.

(08 Marks)

OR

6 a. Derive an expression for discharge through a orifice meter. (08 Marks)

b. Obtain an expression for discharge over a triangular notch. (08 Marks)

Module-4

7 a. The frictional torque T of a disc of diameter 'D' rotating at a speed N in a fluid of viscosity 'μ' and density 'ρ' in a turbulent flow is given by $T = D^5 N^2 \rho \phi \left[\dfrac{\pi}{D^2 N \rho} \right]$. Prove this by the method of dimensions.

(08 Marks)

b. What do you mean by dimensionless numbers? Name any four dimensionless numbers.

(08 Marks)

OR

8 a. Obtain an expression for head loss in a sudden expansion in the pipe. List all assumptions made.

(08 Marks)

b. A 150mm diameter pipe reduces in diameter abruptly to 100mm diameter. If the pipe carries water at 30 litres per seconds, calculate the pressure loss across the contraction. Take the co-efficient of contraction as 0.6.

(08 Marks)

Module-5

9 a. Prove that the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature. (08 Marks)

b. A fluid of viscosity 0.7Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100mm. The maximum shear stress at the pipe wall is given as 196.2N/m^2, find:
i) The pressure gradient   ii) The average velocity   iii) Reynold number of the flow.

(08 Marks)

OR

10 a. Derive an expression for velocity of sound wave in a fluid. (08 Marks)

b. Explain propagation of pressure waves in a compressible fluid. (08 Marks)

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