CBCS SCHEME

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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)**

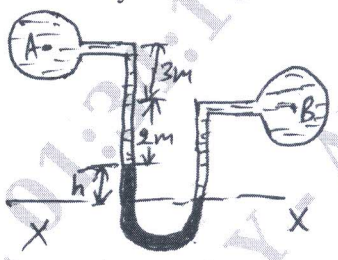

Fig.Q.2(b)

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 $T = D^5N^2\rho\phi\left[\frac{\pi}{D^2N\rho}\right]$. 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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