CBCS SCHEME

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15MA44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Fluid Mechanics & Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Distinguish between:
(i) Mass density and Specific weight
(ii) Newtonian and Non-Newtonian fluid.
(iii) Absolute and kinematic viscosity. **(06 Marks)**

b. The space between two square flat parallel plates is filled with oil. Each side of the plate is 800 mm. Thickness of the oil film is 20 mm. The upper plate moves at a uniform velocity of 3.2 m/s when a force of 50 N applied to upper plate.
Determine
(i) Shear stress.
(ii) Dynamic visocity of oil in poise.
(iii) Power absorbed in moving the plate.
(iv) Kinematic viscosity of oil, if specific gravity of oil is 0.90. **(10 Marks)**

OR

2 a. State and prove Pascal's law. **(08 Marks)**

b. An inverted U-tube differential manometer is connected to two pipes 'A' and 'B', 'A' manometric fluid is oil with specific gravity 0.9. Find the pressure difference between points 'A' and 'B'. **(08 Marks)**

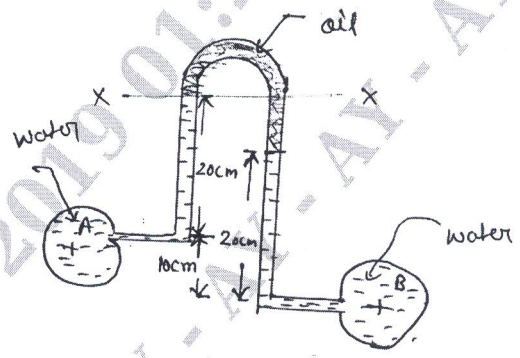

Fig. Q2 (b)

Module-2

3 a. Derive continuity equation for three dimensional fluid flow in Cartesian co-ordinates. **(10 Marks)**

b. The velocity potential is given by $\phi = x(2y-1)$. Calculate the value of stream function at a point (1, 2) **(06 Marks)**

OR

4 a. State and prove Bernoulli's equation for fluid flow. Mention assumptions made in the derivation. **(10 Marks)**

b. A 0.25 m diameter pipe carries an oil of SG 0.8 at the rate of 120 lit/sec and the pressure at a point 'A' is 19.62 kN/m^2, if the point 'A' is 3.5 m above the datum line, calculate the total energy at point A in m of oil. **(06 Marks)**

Module-3

5 a. Derive an expression for actual discharge through an orifice meter. **(08 Marks)**

b. Water flows over a rectangular notch 1 m wide with a head of 15 cm and afterwards passes through a triangular (V-notch) of 90°. Taking C_d for the rectangular and V-notch as 0.62 and 0.59 respectively. Find the head over the triangular notch. **(08 Marks)**

OR

6 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,

$$T = D^5N^2\rho\phi\left(\frac{\mu}{D^2N\rho}\right)$$

Use Buckingham π theorem. **(10 Marks)**

b. What do you mean by,
(i) Geometric similarity (ii) Kinematic similarity
(iii) Dynamic similarity **(06 Marks)**

Module-4

7 a. Derive Darcy-Weisbach equation for loss of head in a pipe due to friction. **(10 Marks)**

b. A horizontal pipe of 50 mm diameter and 750 m long maintain water flow rate of 0.03 m^3/min. Calculate the head loss due to friction and the power required to maintain the flow if, $\mu = 1.14\times10^{-3}$ N-S/m^2 and f = 0.008. **(06 Marks)**

OR

8 a. Derive Hagen-Poiseuille's equation for laminar flow through circular pipe. **(12 Marks)**

b. Define Reynold's number. What is its significance? **(04 Marks)**

Module-5

9 a. With neat sketch, explain the parts and working of centrifugal pump. **(10 Marks)**

b. With neat sketch, explain working principle of centrifugal pumps in series. **(06 Marks)**

OR

10 a. Explain the phenomena of surging in centrifugal compressor. **(06 Marks)**

b. With the help of velocity triangle, obtain an expression for energy transfer through axial flow compressor. **(10 Marks)**

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