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B.E. III - Semester Examination

BE-III/11 (A)

247019

MECHANICAL ENGINEERING

Fluid Mechanics

Course No. : PME - 301

Time Allowed- 3 Hours *Maximum Marks-100*

Note: Attempt five questions in all selecting at least two questions from each section.

Section - A

1. A vertical venturimeter with 30cm diameter at inlet and 15 cm diameter at throat is used in a pipeline carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U-tube mercury manometer shows a gauge deflection of 25 cm. Calculate the discharge of the oil and pressure difference between entrance and throat section. Take coefficient of meter as 0.98 and specific gravity of mercury as 13.6

2. a) If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$ determine the velocity components in x and y direction and check whether the velocity components satisfy the conditions of flow continuity and irrotationality, find velocity at the point $P(4,5)$. Also determine the value of stream function at point p.

b) Derive Bernoulli's equation for a fluid along with its assumptions. Also give equation for the real fluids.

3. a) What is streamline, pathline and streakline? Discuss their important characteristics.

b) The velocity components in a two dimensional flow-field for an incompressible fluid are expressed as $u = y^3 + 2x - x^2y$ and $v = xy^2 - 2y - x^3/3$. Show that these functions represent a possible case of irrotational flow; obtain an expression for the stream function ψ and velocity potential ϕ.

4. Define velocity potential and stream function and discuss their properties.

Section - B

5. Derive continuity equation for compressible and incompressible flow listing all assumptions.

6. A 300 mm diameter pipe carries water under a head of 20 meters with a velocity of 3.5 m/sec. If the axis of pipe turns through 45°, find the magnitude and direction of the resultant force at the bend.

7. Discuss frictional losses in the pipe flow and derive an expression for loss of head due to friction.

8. A crude oil of kinematic viscosity 0.4 cm2/sec is flowing through the pipe of diameter 300 mm at the rate of 300 litres per second. Find the head loss due to friction for a length of 50 m of the pipe.