(DME 214)

B. Tech. DEGREE EXAMINATION, MAY - 2015

(Examination at the end of Second Year)

MECHANICAL ENGINEERING

Paper - IV : Fluid Mechanics

Time : 3 Hours **Maximum Marks : 75**

Answer question No. 1 compulsory ***(15)***

Answer ONE question from each unit ***(4 x 15 = 60)***

1) Define the following terms :

a) Specific gravity.

b) Surface tension.

c) Capillarity.

d) Pascal's law.

e) Centre of pressure.

f) Continuity Equation.

g) Turbulent flow.

h) Rate of flow.

i) Assumptions of Bernoulli's Equation.

j) Conservation of Momentum.

k) Water hammer.

l) Total Energy Line.

m) Impulse – momentum equation.

n) Laminar sub layer.

o) Local co-efficient of drag.

Unit – I

2) a) Define and explain Newton's law of viscosity & how does viscosity of a fluid vary with temp?

b) The velocity distribution for flow over a flat plate is given by $u = \frac{3}{2}y - y^{3/2}$, where *u* is the point velocity in metre per second at a distance *y* metre above the plate. Determine the shear stress at *y* = 9 cm. Assume Dynamic viscosity as 8 poise.

OR

3) a) A U-tube differential monemeter connects two pressure pipes A & B. Pipe A contains carbon tetra chloride having a specific gravity 1.594 under a pressure of 11.772 N/cm^2 and pipe B contains oil of sp.gr. 0.8 under a pressure of 11.772 N/cm^2. The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as fluid filling U-tube.

b) A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30^o with the free surface of water. Determine the total pressure end position of centre of pressure when the upper edge is 1.5 m below the free water surface.

Unit – II

4) a) The velocity potential function is given by $\phi = 5(x^2 - y^2)$. Calculate the velocity at the point (4, 5).

b) Obtain an expression for continuity equation for a three dimensional flow.

OR

5) a) A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water.The reading of differential manometer connected to inlet & throat is 10 cm of mercury. Determine the rate of flow. Take C_d = 0.98.

b) What is a pitot tube? How will you determine the velocity at any point with the help of pitot tube.

Unit – III

6) How will you determine the loss of head due to friction in pipes by using Darcy Formula?

OR

7) a) What is Momentum Equation?

b) A 45^o reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600 mm & 300 mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2 & rate of flow of water is 600 li/s.

Unit – IV

8) For the velocity profile for laminar boundary layer flows given as

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Find an expression for boundary layer thickness (δ), shear stress (τ_0) and co-efficient of drag (C_D) in terms of Reynold number.

OR

9) Water is flowing over a thin smooth plate of length 4 m & width 2 m at a velocity of 1.0 m/s. If the boundary layer flow changes from laminar to turbulent at a Reynold number 5×10^5, find

(i) distance from leading edge up to which boundary layer is laminar.

(ii) the thickness of the boundary layer at the transition point &

(iii) Drag force of one side of the plate. Take viscosity of water $\mu = 9.81 \times 10^{-4}$ Ns/m^2.

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