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B. Tech 3rd Semester Examination

Mechanics of Fluids-I (CBS)

CE-302

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions Each question up to eight has two alternatives, attempt any one of them. Question 9 is compulsory.

1. (a) Define the following terms:

(i) Specific Weight (ii) Specific Volume

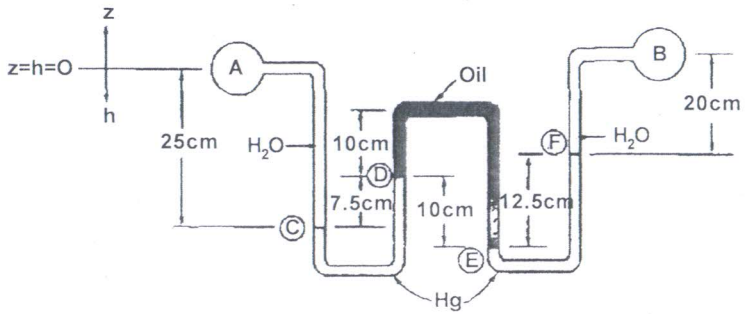
(iii) Viscosity (iv) Surface Tension (2)

(b) An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m × 0.9 m and an inclined plane having an angle of inclination 20° The weight of the square plate is 382.4 N and it slides down the plane with a uniform velocity of 0.25 m/s. Find the dynamic viscosity of the oil. (4)

(c) The surface tension of water in contact with air is given as 0.0725 N/m. The pressure outside the droplet of water is atmospheric (10.32 N/cm^2). Calculate the pressure within the droplet of water. (4)

OR

2. (a) A multiple-liquid manometer is shown below connected to two pipes A and B. Find the pressure difference between A and B. Take specific weights of water, mercury and oil as 9.81 kN/ m^3, 133.7 kN/ m^3 and 7.9 kN/ m^3 respectively. (6)



(b) A rectangular sluice gate is situated on the vertical wall of a lock. The vertical side of the sluice is 6 m in length and depth of the centroid of area is 8 m below the water surface. Prove that the depth of centre of pressure is given by 8.475 m. (4)

3. (a) Differentiate between:

(i) Steady and Unsteady flow.

(ii) Uniform and Non-uniform flow

(iii) Laminar and turbulent flow

(iv) Rotational and Irrotational flow (2)

(b) The velocity potential function for a flow is given by $\varphi = x^2 - y^2$. Verify that the flow is incompressible and determine the stream function for the flow. (4)

(c) Find the acceleration components at a point (1, 2, 3) for the following flow field:

$u = 2x^2+3y$; $v = -2xy+3y^2$; $w = -(3/2)\, z^2+2xz-9y^2z$. (4)

OR

4. (a) A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 50 litre/s, Find the reading of the oil mercury manometer. Take coefficient of discharge of venturimeter $C_d = 0.98$ and specific gravity of mercury=13.6. (5)

(b) A pipe bends through an angle of 45° in the horizontal plane. At the inlet it has a cross section area of 0.002 m^2 and a gauge pressure of 800 kPa. At exit it has an area of 0.0008 m^2 and a gauge pressure of 300 kPa. Calculate the vertical and horizontal forces on the bend. (5)

5. (a) Define (i) Coefficient of velocity (C_v) (ii) Coefficient of contraction (C_c) and (iii) Coefficient of discharge (C_d) and prove that $C_d = C_c \times C_v$. (5)