

29/05/2019

Roll No. ....

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Printed Pages : 3

BT-4/M-19

FLUID MECHANICS

Paper-ME-208 N

Time allowed : 3 hours]

[Maximum marks : 75

Note : Attempt five questions, selecting at least one question from each unit. Assume any missing data suitably.

Unit-I

1. (i) What is capillarity ? Derive an expression for height of capillary rise. 7
- (ii) A solid cone (sp. Gr. 0.7) floats in water with its apex downward. Determine the least apex angle of cone for equilibrium. 8
2. (i) An inverted differential manometer containing an oil of sp. Gravity 0.9 is connected to find the difference of pressures at two points of a pipe containing water. If the manometer reading is 400 mm. find the difference of pressure. 7
- (ii) A circular plate 3 m in diameter is submerged in water in such a way that the greatest and least depths of the surface are 2 m and 1 m respectively, calculate (i) the total pressure on front face of the plate and (ii) the position of centre of pressure. 8

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**Unit-II**

3. Define stream and potential functions. Does the velocity potential exist for two dimensional incompressible flow prescribed by  $u = x - 4y$ ,  $v = -(y + 4x)$ .

If so determine its form as well as that of stream function.

5,10

4. A 300 mm diameter 150 bend discharges  $0.35 \text{ m}^3/\text{s}$  of water in the atmosphere. If the pressure of water entering the bend is  $150 \text{ kN/m}^2$  (gauge), determine the force required to hold the bend in place. Assume the bend to be horizontal in plane. 15

**Unit-III**

5. Derive the Navier-Stokes equation for incompressible fluid. 15

6. (i) Derive an expression for shear stress on the basis of Prandtl Mixing length hypothesis. 5

- (ii) A pipeline of 0.6 m diameter is 1.5 km long. To augment the discharge, another pipeline of the same diameter is introduced parallel to the first in the second half of its length. Find the increase in discharge if the friction factor is 0.04 and head at the inlet is 30 m. 10

**Unit-IV**

7. Define boundary layer and explain the fundamental causes of its existence. 15

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(3)

8. (i) Differentiate between stream lined and bluff bodies. 5
- (ii) A kite weighting 7.85 N has an effective area of  $0.8 \text{ m}^2$ . It is maintained in air at an angle of  $10^\circ$  to the horizontal. The string attached to the kite makes an angle of  $45^\circ$  to the horizontal and at this position the values of coefficients of drag and lift are 0.6 and 0.8 respectively. Determine : (i) the speed of wind, and (ii) the tension in the spring. Take density  $1.25 \text{ kg/m}^3$  for air. 10

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