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OLE-3028

B. Tech. 3rd Semester (Civil Engg.) Examination – April, 2021

FLUID MECHANICS

Paper : PCC-CE-205-G

Time : Three Hours] ***[Maximum Marks : 75***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** question in all, selecting at least ***one*** question from each Unit. Question No. **1** is ***compulsory***.

1. (a) Define fluid and fluid mechanics.

(b) What is the difference between cohesion and adhesion ?

(c) Define total pressure and Centre of pressure.

(d) How are manometers classified ?

(e) Define the following :

(i) Velocity potential

(ii) Stream Function

(f) What is the 'Slip Condition' at the boundary ?

$2.5 \times 6 = 15$

UNIT – I

2. (a) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine : 8

(i) The dynamic viscosity of the oil;

(ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.

(b) A U-tube is made up of two capillaries of bores 1.2 mm and 2.4 mm respectively. The tube is held vertical and partially filled with liquid of surface tension 0.06 N/m and Zero contact angle. If the estimated difference in the two menisci is 15 mm, determine the Mass density of the liquid. 7

3. (a) What is capillarity ? Derive expression for height of capillary rise. 7

(b) Define the term vapour pressure. How does it vary with temperature ? Also explain Compressibility. 8

UNIT – II

4. Explain briefly the following with neat sketches : 15

(i) Piezometer.

(ii) U-tube manometer.

(iii) Differential manometers.

5. (a) A 1.0 m wide and 1.5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75 m below the free water surface. 8

(b) A wooden block of width 1.25 m, depth 0.75 m and length 3.0 m is floating in water. Specific Weight of the wood is 6.4 kN/m^3. Find : 7

(i) Volume of water displaced, and

(ii) Position of centre of buoyancy.

UNIT – III

6. (a) The diameters of a pipe at the section 1-1 and 2-2 are 200 mm and 300 mm respectively. If the Velocity of water flowing through pipe at section 1-1 is 4m/s, find : 10

(i) Discharge through the pipe, and

(ii) Velocity of water at section 2-2

(b) Differentiate between the rotational and irrotational flows. 5

7. A pipe 200 m long slopes down at 1 in 100 and tapers from 600 mm diameter at the higher end to 300 mm diameter at the lower end, and carries 100 litres/sec of oil (sp. Gravity 0.8). If the pressure gauge at the higher end reads 60 kN/m^2, Determine : 15

(i) Velocities at the two ends

(ii) Pressure at the lower end.

Neglect all loses.

UNIT – IV

8. Define the following terms : 15

(i) Laminar boundary layer

(ii) Turbulent boundary layer

(iii) Laminar Sublayer

(iv) Boundary layer thickness

9. The resistance R, to the motion of a completely submerged body depends upon the length of the body L, velocity of flow V, mass density of fluid p and kinematic viscosity of fluid v. By dimensional analysis prove that; $R = \rho v^2 L^2 \varphi(VL/v)$ 15