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Total No. of Questions : 09

B.Tech.(CE) (Sem.–3rd)

FLUID MECHANICS–I

Subject Code : CE-203

Paper ID : [A0602]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. Write briefly :

   a. Explain the phenomenon of capillarity.

   b. What is Hydrostatic Paradox? Discuss with the help of an example.

   c. State the different methods of measuring pressure.

   d. Differentiate between rotational and irrotational flows. Give examples.

   e. What is a flow net and what are its uses?

   f. What is impulse momentum equation and what are its applications?

   g. Explain the term hydraulic similitude.

   h. What do you understand by the terms major energy loss and minor energy losses in pipes?

   i. Deduce an expression of friction factor for laminar flow in a circular pipe.

   j. Write a note on flow over a notch.

SECTION B

2. The space between two horizontal square flat parallel plates of size 600 mm × 600 mm each, is filled with oil of specific gravity 0.95. The thickness of oil film is 12.5 mm. The upper plate which moves at 2.5 m/s requires a force of 98 N to maintain this speed. Determine kinematic and dynamic viscosities of oil. Assume linear velocity distribution in the gap.

3. A wooden log 900 mm diameter and 7.5 m long is floating in water. If specific gravity of log is 0.70, determine the depth of wooden log in water.

4. A two-dimensional flow is described by the velocity components, $u = 5x^3$, $v = -15x^2y$. Determine velocity, acceleration and stream function at point (1,2).

5. A pipe of diameter 300mm and length 800m carries oil of specific gravity 0.85 at the rate of 0.45 m^3/s. Determine head loss and the power required to maintain the flow.

6. A Pitot-tube is inserted in a pipe of 300mm diameter. The static pressure in pipe is 100mm of mercury (vacuum). The stagnation pressure at the center as recorded by Pitot-tube is 9.8 kN/m^2. Calculate the rate of flow of water through pipe if mean velocity of flow is 0.85 times the central velocity. Take $C_v = 0.98$.

SECTION C

7. The velocity of flow V through an orifice depends upon diameter D, head causing flow H, dynamic viscosity μ, mass density ρ, surface tension σ and acceleration due to gravity g. Using Buckingham method of dimensional analysis, derive an expression for velocity.

8. A slab of side 2m supports water. The slab is hinged at the bottom. To support the slab, a prop is provided at the middle of slab. The slab is at 60° to the horizontal and the prop is at 45° with the slab. Determine hydrostatic force, its location and thrust in the prop. The width of slab is 4m.

9. Oil of specific gravity 0.80 flows in 80mm diameter horizontal pipe. The pipe suddenly expands to such a diameter so that the maximum pressure rise is obtained. If the rate of flow is 12.5 litres per sec, determine energy loss per unit weight. Also find the reading of a U-tube mercury-oil differential manometer connected between the two sections of pipe.