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4E4141

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B. Tech. IV Sem. (Main/Back) Exam., June/July-2014

Mechanical Engg.

4ME2A Fluid Mechanics

Common with AE

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

Instructions to Candidates:-

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. _____

2. _____

UNIT-I

Q.1 (a) Define and explain following fluid properties:

(i) Surface Tension

(ii) Viscosity

(iii) Compressibility

(iv) Vapour Pressure

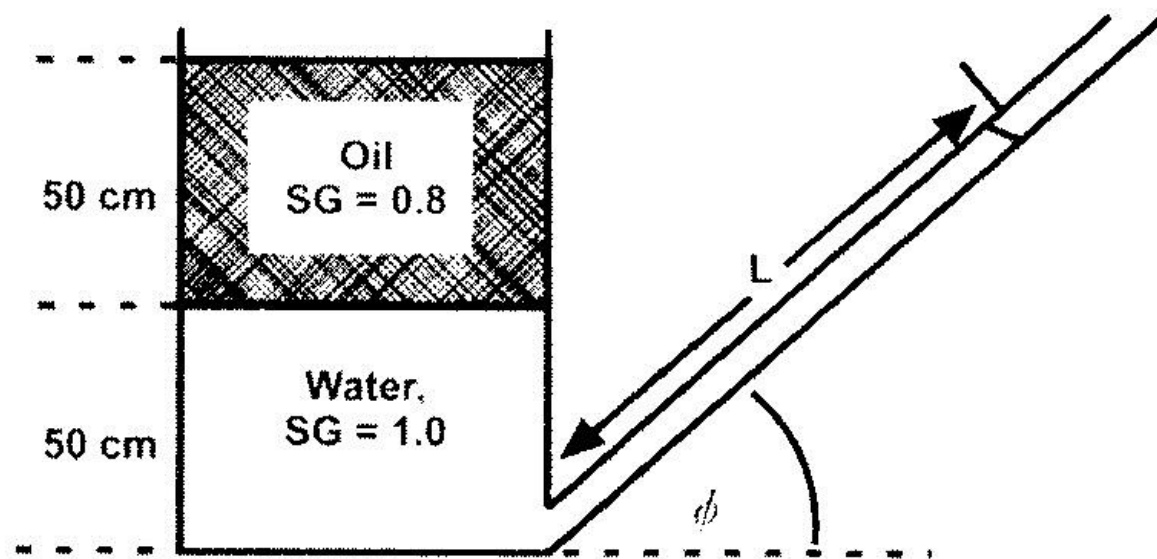
[4×2]

(b) A shaft 6.00 cm in diameter and 40 cm long is pulled steadily at $V = 0.4$ m/s through a sleeve 6.02 cm in diameter. The clearance is filled with oil having

kinematic viscosity = $0.003 \text{ m}^2/\text{s}$ and specific gravity 0.88. Estimate the force required to pull the shaft. [8]

OR

Q.1 (a) As shown in fig. both the tank and the slanted tube are open to the atmosphere. If $L = 2.13 \text{ m}$, what is the angle of tilt (ϕ) of the tube?



[10]

(b) Explain the laws of buoyancy given by the Archimedes. [6]

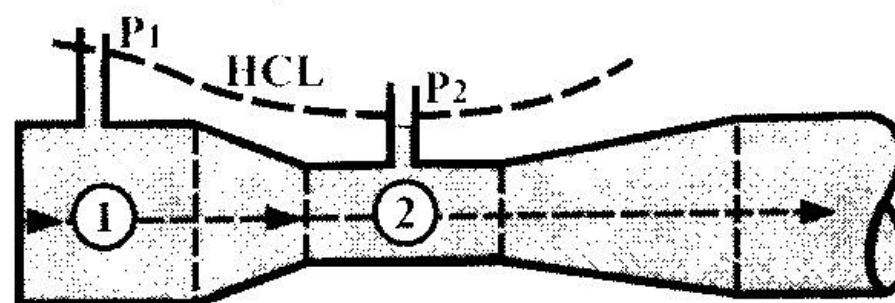
[6]

UNIT- II

Q.2 (a) Explain path line, streak line and streamline. [6]

[6]

(b) A constriction in a pipe will cause the velocity to rise and the pressure to fall at section 2 in the throat. The pressure difference is a measure of the flow rate through the pipe. The smoothly necked-down system is shown in Fig. Find an expression for the mass flux in the tube as a function of the pressure change.



[10]

OR

- Q.2 (a) Explain stream function and velocity potential function. What is their significance? [8]
- (b) Given the eulerian velocity-vector field $V = 3ti + xzj + ty^2k$, find the acceleration of a particle. [8]

UNIT-III

- Q.3/ Define Reynolds, Froude's, Mach, Weber and Euler numbers. Explain the application of these numbers. [16]

OR

- Q.3 (a) What is the difference between distorted and undistorted model? Explain. [6]
- (b) At low velocities (laminar flow), the volume flow Q through a small-bore tube is a function only of the tube radius R , the fluid viscosity μ , and the pressure drop per unit tube length dp/dx . Using the pi theorem, find an appropriate dimensionless relationship. [10]

UNIT-IV

- Q.4 (a) Explain prandtl Mixing Length Theory. [8]
- (b) Kerosene at 20°C is pumped at $0.15 \text{ m}^3/\text{s}$ through 20 km of 16-cm-diameter cast iron horizontal pipe. Compute the input power in kW required if the pumps are 85 percent efficient. [8]

OR

- Q.4 (a) What is water hammer? [4]

- (b) The following data were obtained for flow of 20°C water at 20 m³/hr through a badly corroded 5-cm-diameter pipe which slopes downward at an angle of 8°: $p_1 = 420$ kpa, $z_1 = 12$ m, $p_2 = 250$ kpa, $z_2 = 3$ m. Estimate
- (a) the roughness ratio of the pipe; and
 - (b) the percent change in head loss if the pipe were smooth and the flow rate the same. [12]

UNIT-V

- Q.5 (a) Using Von karman's integral equation, calculate δ/x , δ^*/x and θ/x for the below mentioned sinusoidal profile $\frac{u}{U} \approx \sin\left(\frac{\pi y}{2\delta}\right)$ [16]

OR

- Q.5 (a) What is boundary layer thickness? Explain its significance in analysis of fluid flow problems. [6]
- (b) Write short notes on following:
- (i) Boundary layer separation and control
 - (ii) Coefficient of drag and Coefficient lift [5×2]