4E4141

Roll No. _____ Total No of Pages: 4

4E4141

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

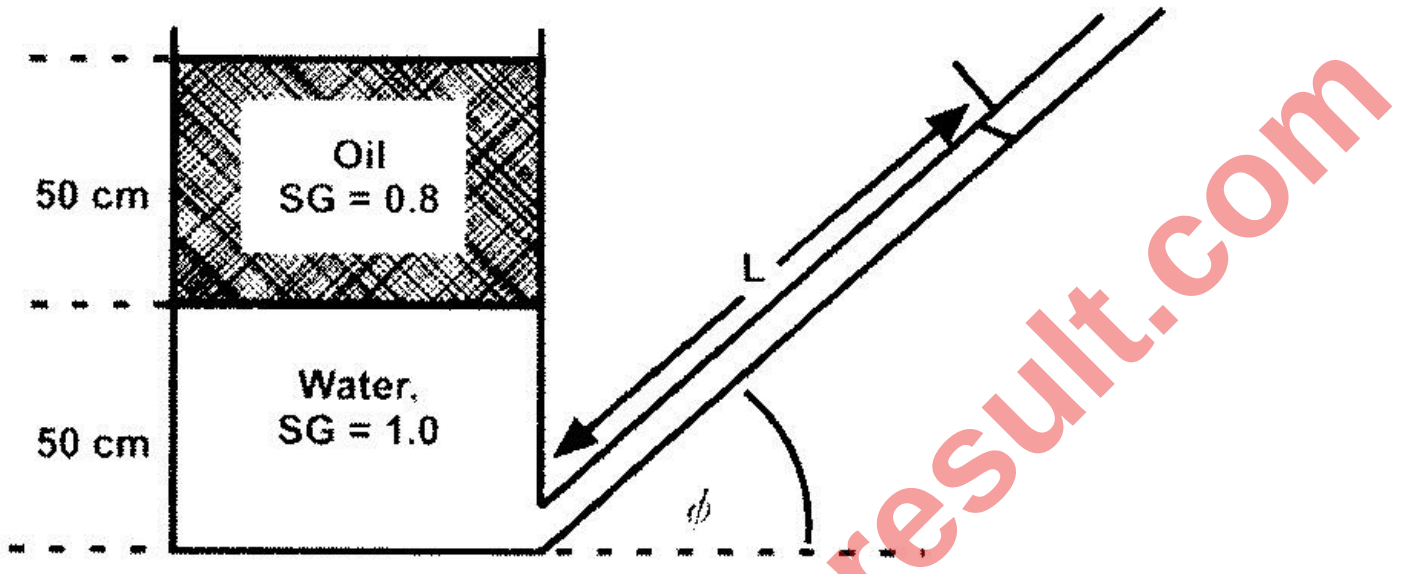
(iv) Vapour Pressure [4×2]

(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 m^2/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 m, what is the angle of tilt (ϕ) of the tube?



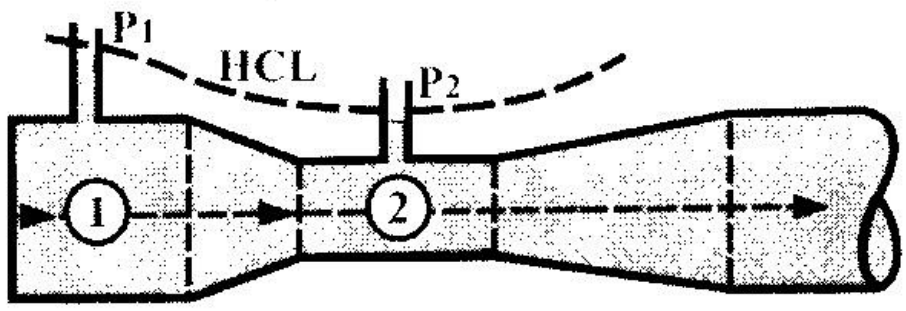
[10]

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

UNIT- II

Q.2 (a) Explain path line, streak line and streamline. [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 m^3/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 m^3/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]
