Roll No. Total No. of Pages : 02

Total No. of Questions : 09

B.Tech (ME) (Sem.–4)

FLUID MECHANICS-I

Subject Code : ME-206

Paper ID : [A0810]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS 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 have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

a. Differentiate between free and forced vortex motions.

b. Write a note on a single column manometer.

c. Explain compressibility of a fluid.

d. What is kinetic energy correction factor and what is its significance?

e. What is the significance of dimensional less numbers?

f. State Pascal's law.

g. Differentiate steady and unsteady flows.

h. Explain the variation of friction factor for laminar and turbulent flows.

i. What is Archimedes' Principle?

j. What are distorted and undistorted models? What is the use of distorted models?

SECTION-B

2. Two reservoirs are connected by a pipe which is 150 mm in diameter for the first 10 m and 250 mm in diameter for the remaining 15 m. The water surface in the upper reservoir is 7.5 m above that in the lower reservoir. Calculate the flow rate through pipe and draw HGL and TEL. Take friction factor as 0.04 for both the pipes

3. What is venturimeter? Derive an expression for the discharge through a venturi meter.

4. Water with a viscosity of 1.12×10^{-3} Ns/m^2 flows slowly along a glass tube of diameter 40.0 mm at a flow velocity of 150 mm/sec. Would the flow be laminar or turbulent?

5. A wooden cylinder of length L and diameter D is to be floated in stable equilibrium on a liquid keeping its axis vertical. What should be the relation between L and D if the specific gravity of liquid and that of the wood are 0.6 and 0.8 respectively?

6. What is the flow whose velocity potential is expressed as $\varphi = \Gamma O / 2\pi$?

SECTION-C

7. Kerosene $\left(\mu = 1.9 \times 10^{-3}\, {NS}/{m^2}, S = 0.81 \right)$ flows in a 2-cm diameter commercial steel pipe (k_s = 0.046 mm). A mercury manometer (S = 13.6) is connected between a 2-m section of pipe as shown, and there is a 5-cm defection in the manometer. The elevation difference between the two taps is 0.5 mm. Find the direction and velocity of the flow in the pipe.

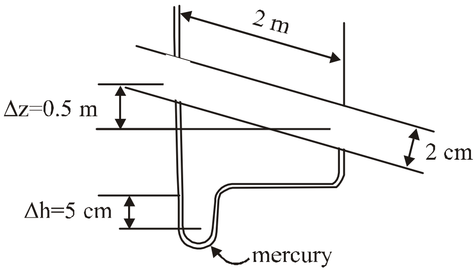

Fig. 1

8. The resisting force R of a supersonic aircraft during flight can be considered to depend upon the length of the aircraft L, velocity V, air viscosity μ , air density ρ and the bulk modulus of air K. Express a functional relationship between the variables and the resisting force.

9. Water at $20^\circ C \left(\mu = 10^{-3}\, {NS}/{m^2}, \rho = 1000\, {kg}/{m^3} \right)$ flows through a 0.5-mm tube connected to the bottom of a reservoir. The length of the tube is 1.0 m, and the depth of water in the reservoir is 20 *cm*. Find the flow rate in the tube. Neglect the entrance loss at the junction of the tube and reservoir.

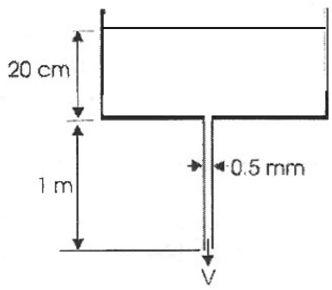

Fig. 2