Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] **Total No. of Pages : 03**

Total No. of Questions : 09

B.Tech. (IE/ME) (Sem.–4) (2008 Batch)

FLUID MECHANICS-I

Subject Code : ME-206

Paper ID : [A0810]

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

l. Answer briefly :

a. Define viscosity and derive the units and dimensions of viscosity.

b. How do you determine the fluid pressure and its location on a submerged horizontal surface?

c. *"The liquid mass in a container subjected to constant horizontal acceleration is equivalent to a liquid mass at rest".* Discuss.

d. What are the various methods of describing fluid flow pattern?

e. What is kinetic energy correction and what is its significance?

f. Explain Reynolds model law.

g. What are the different types of similarities that must exist between model and prototype?

h. What are minor head losses in pipes?

i. Explain vortex motion.

j. Differentiate venturimeter and orificemeter.

SECTION-B

2. Calculate the capillary effects in a glass tube of 4 mm diameter, when immersed in water at 20°C. Given: Surface tension of water at 20°C = 0.0735 N/m. and contact angle = 0°. Also, derive the equation to be used in the calculation.

3. If stream function, $\psi = (x^3 - 3xy^2)$, indicate whether the flow is rotational or irrotational. If flow is irrotational, determine the potential function.

4. The velocity distribution in a pipe is given by the relation: u = $2.5\left(1-\frac{r^2}{R^2}\right)$ m/s, where u is the velocity at any radius r <R, R is the radius of pipe. If diameter of pipe is 250 mm, calculate average velocity and discharge.

5. A pump is used to lift an oil of specific gravity 0.90. The pressures on the suction and discharge sides of the pump as read by the pressure gauges are : -0.25 m of mercury and 140 kN/m^2, respectively. The suction gauge is placed 600 mm below the center line of pump whereas the gauge on the discharge side is placed 170 mm above the centerline. If diameters of pipes on the suction and discharge sides are 150 and 100 mm respectively and the quantity of oil to be lifted is 30 litres per second, calculate power supplied by the pump. Assume efficiency of the pump as 70%.

6. Two small identical orifices are located at the side of a tank filled to a water depth H. One orifice is located at a depth of h below the water surface and the other h above the tank bottom. Show that both the jets issuing from the orifices will strike the ground at the same distance from the orifice. Also, find this distance.

SECTION-C

7. A cylindrical buoy 2 m diameter, 2.5 m high and weighing 21.5 kN, is floating in sea water (specific weight = 10 kN/m^3). Show that the buoy cannot float with its axis vertical. What minimum pull should be applied to a chain attached to the center of base to keep the buoy vertical?

8. Three pipes 300 m length of 300 mm diameter, 150 m length of 200 mm diameter and 200 m length of 250 mm diameter, respectively are fitted between two reservoirs in series. The friction factors for these pipes are 0.019, 0.021 and 0.020, respectively. Determine discharge if difference in water surface elevations between the two reservoirs is 10 m. The value of loss coefficient of contraction may be taken as 0.275. Also, draw HGL and TEL.

9. The pressure drop Δp due to an obstruction in a pipe depends on pipe diameter D, average velocity of flow V, mass density ρ, viscosity μ of the flowing fluid and characteristic dimension of obstruction d. Determine a set of dimensionless parameters using Buckingham method of analysis.