School of Mechanical Engineering
Mechanical Engineering
ETE - Jun 2023

Time : 3 Hours   Marks : 100

Sem IV - G3UB402B / BTME2025
Fluid Mechanics PBL
Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

1. f the velocity profile of a liquid over a plate is a parabolic with the vertex 202 cm from the plate, where the velocity is 120 cm/sec. calculate the velocity gradients and shear stress at a distance of 0, 10 and 20 cm from the plate, if the viscosity of the fluid is 8.5 poise.   K2 CO1 (5)

2. Explain type of fluid.   K2 CO1 (5)

3. Relate shear stress with velocity gradient and state the underlying law and also find the torque and power required to run a 15 cm long and 5 cm diameter shaft running at the rate of 500 rpm in a 5.1 cm diameter concentric bearing flooded with oil of dynamic viscosity 100 centipoise.   K2 CO1 (5)

4. What is a venturimeter. Find discharge through a it.   K3 CO2 (10)

5. A 40 cm diameter pipe, conveying water, branches into two pipes of diameters 30 cm and 20 cm respectively. If the average velocity in the 40 cm diameter pipe is 3 m/s. find the discharge in this pipe. Also determine the velocity in 20 cm pipe if the average velocity in 30 cm diameter pipe is 2 m/s.   K3 CO2 (10)

6.   A pipe line of 0.6 m diameter is 1.5 KM long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if f = 0.01. The head at inlet is 300 mm.   K3 CO5 (10)

OR

Underground water is to be pumped by a 70 percent efficient 3-kW submerged pump to a pool whose free surface is 30 m above the underground water level. The diameter of the pipe is 7 cm on the intake side and 5 cm on the discharge side. Determine (a) the maximum flow rate of water and (b) the pressure difference across the pump. Assume the elevation difference between the pump inlet and the outlet and the effect of the kinetic energy correction factors to be negligible   K3 CO5 (10)

7. Derive the relation for hydrostatic forces on a curved surface, which is immersed in a liquid of specific weight 'W'   K2 CO1 (10)

8. Consider a U-tube filled with mercury except the 18-cm-high portion at the top, as shown in Fig. The diameter of the right arm of the U-tube is D " 2 cm, and the diameter of the left arm is twice that. Oil with a specific gravity of 2.72 is poured into the left arm, forcing some mercury from the left arm into the right one. Determine the maximum amount of oil that can be added into the left arm   K3 CO2 (15)

Oil SG = 2.72
18 cm
2D
D = 2 cm
Mercury SG = 13.6
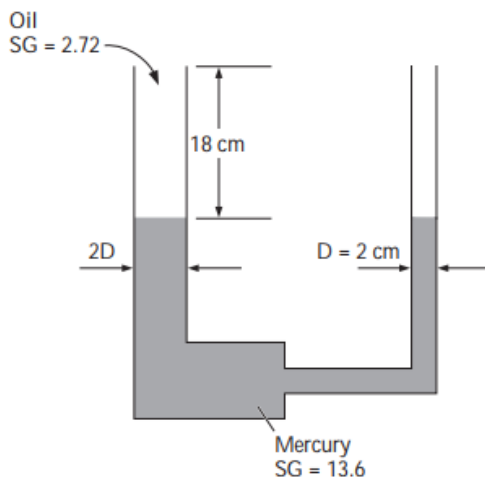
9. Define lift and drag forces. also describe bluff and streamline bodies. impact of boundary layer seperation on drag and lift   K4 CO4 (15)

OR

What do you understand by the terms boundary layer. explain with neat sketch.   K4 CO4 (15)

10. Three pipes of different diameters and different lengths are connected in series to make a compound pipe. The ends of the compound pipes are connected with two tanks whose different of water level is H. If coefficients of frication for these pipes are same, then derive the formula for the total head loss, neglecting first the minor losses and then including them.   K4 CO3 (15)