Assignment- 1

1. Calculate the velocity gradients for y=0, 20,40 and 60 mm if the velocity profile is quarter circle having its Centre 600 mm from the boundary . Also calculate the shear stress at these points if the fluid viscosity is 78.45×10^{-2} Ns/ m^2.
2. A thin plate of large area is placed midway in a gap of height 'h' filled with oil of viscosity μ_o and the plate is pulled at a constant velocity u. If a lighter oil of viscosity μ_1 is then substituted in the gap and the plate is located unsymmetrically in the gap parallel to the wall, it is found that for the same velocity u the drag force will be the same as before.
   Find μ_1 in terms of μ_o and the distance from the nearer wall to the plate.
3. Calculate the approximate viscosity of the oil for the example shown in Fig.1.10.
4. Calculate the capillary rise in a glass tube of 3 mm diameter when immersed in (a) water (b) mercury. The temperature of both liquid in 20 degree Celsius; the angle of contact for water is zero degree and for mercury air at this temperature are 0.0735 N/m and 0.51 N/m.

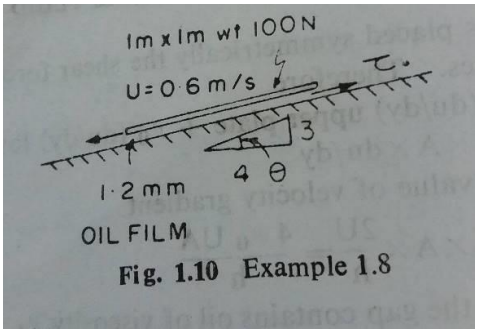

Fig. 1.10 Example 1.8

5. What should be the diameter of droplets of water in mm if the pressure inside is to be 175 N m^2 greater than the outside.
6. The diameter of the limbs of a U tube are 4 mm and 5 mm which is used to measure the pressure readings in the range of 10 mm to 100 mm. Calculate the percentage error at its lowest and highest readings.
7. In measuring the unit surface energy of a mineral oil (specific gravity= 0.85) by the bubble method, a tube having an internal diameter of 1.5 mm is immersed to a depth of 12.5 mm in the oil. Air is forced through the tube forming a bubble at the lower end. What magnitude of unit surface energy will be indicated by a maximum bubble pressure intensity of 150 N/m^2?
8. Determine the capillary rise of water in a clay soil of average diameter 0.06 mm. Assume the average size of the pores to be one fifth of the soil diameter.