UCE 305 FLUID MECHANICS
TUTORIAL NO. 1 (FLUID PROPERTIES)
(Assume data suitably, wherever required)

Q1: If 3.5 m^3 of oil weighs 32.95 kN. Calculate its mass density, specific weight and specific gravity. **(959.6 kg/m^3, 9414 N/m^3, 0.96)**

Q2: Determine the specific gravity of a fluid having viscosity 0.05 Poise and kinematic viscosity 0.035 Stoke. **(1.43)**

Q3: A 90 N rectangular solid block slides down 30^o inclined plane. The plane is lubricated by a 3 mm thick film of oil of relative density 0.90 and viscosity 8 Poise. If the contact area is 0.3 m^2, determine the terminal velocity of block. **(0.56 m/s)**

Q4: A gap of 25 mm between two horizontal large plane surfaces is filled with glycerin of viscosity 0.785 Pa s. What force is required to drag a very thin plate 0.75 m^2 in area between the two surfaces at a velocity of 0.5 m/s for the two positions of plate (i) the plate is in the middle of the gap and (ii) the plate is at a distance of 10 mm from one of the surfaces? **(47.1 N, 49.1 N)**

Q5: Determine the torque and the power required to turn a 2 m long and 100 mm diameter shaft at 100 rpm in a 100.10 mm diameter concentric bearing lubricated with oil of viscosity 4 cP. **(1.315 Nm, 13.8 W)**

Q6: A 50 mm diameter and 100 mm long cylindrical body slides vertically down in a 52 mm diameter cylindrical tube. The space between the cylindrical body and the wall of tube is filled with oil of viscosity 1.9 Ns/m^2. Determine the velocity of fall of the body if its weight is 16 N. **(0.54 m/s)**

Q7: A cylinder of weight 90 N, length 120 mm and diameter 150 mm slides vertically in a lubricated pipe. The clearance between the cylinder and the pipe is 0.025 mm. If cylinder is observed to decelerate at the rate of 0.6 m/s^2 when the velocity is 6 m/s, what is the viscosity of oil? **(0.0662 P)**

Q8: A conical thrust bearing idealized as a cone of vertex angle 60^o, maximum cone diameter 200 mm, rests and revolves over a uniform fluid layer of thickness 1 mm at 600 rpm. If the viscosity of fluid is 1 P, calculate the power lost in overcoming the viscous resistance. **(124 W)**

Q9: Calculate the pressure inside a raindrop, a soap bubble and a liquid jet, all having 40 mm diameter. Given, σ = 0.0736 N/m. **(7.36 N/m^2, 14.72 N/m^2, 3.68 N/m^2)**

Q10: Assuming that sap in trees has the same characteristics as water and that it rises purely due to capillary phenomenon, what will be the average diameter of capillary tubes in a tree if sap is carried to a height of 10 m? **(0.003 mm)**

Q11: What force is required to lift a thin wire ring of diameter 45 mm from a water surface? Neglect the weight of wire. **(0.021 N)**

Q12: Calculate the work done in blowing a soap bubble from a radius of 100 mm diameter to 150 mm diameter if the surface tension of the soap solution in 0.035 N/m. **(0.011 Nm)**