Q1: If 3.5 m$^3$ of oil weighs 32.95 kN. Calculate mass density, specific weight and specific gravity of oil.

Q2: A square plate 600 × 600 mm and weighing 245 N slides down an inclined plane with a uniform velocity of 0.3 m/s. The plane is laid at a slope of 1 vertical to 2.4 horizontal and is provided with 1 mm thick oil film. Find dynamic viscosity of oil.

Q3: A space of 25 mm wide 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 surfaces at a velocity of 0.5 m/s (i) if this plate remains equidistant from the two surfaces and (ii) if it is at a distance of 10 mm from one of the surfaces?

Q4: A vertical gap 22 mm wide and of infinite extent contains oil of specific gravity 0.90 and viscosity 20 P. A metallic plate 1.2 ×1.2 × 0.002 m and weighing 40 N is to be lifted through the gap with a constant velocity of 0.15 m/s. If plate is placed in the middle of gap, calculate the viscous resistance to be overcome by the plate and force required for lifting the plate.

Q5: Determine torque and power required to turn a 200 mm long, 100 mm diameter shaft at 1000 rpm in a 100.10 mm diameter concentric bearing flooded with lubricating oil of viscosity 40 cP.

Q6: 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?

Q7: A circular disc of 100 mm diameter is rotating on a similar stationary disc. The space between the two discs is separated by oil of thickness 1.5 mm and viscosity 80 cP. Compute power dissipated if the disc rotates at 100 rpm.

Q8: Two glass tubes of 1.25 mm and 2.5 mm in diameter are kept vertically in a liquid of surface tension 0.05 N/m and contact angle 30°. Find specific weight and density of the liquid if difference of liquid levels in the two tubes is 10 mm.

Q9: Calculate the pressure inside a rain drop, a soap bubble and a liquid jet, all having 40 mm diameter. Given, \( \sigma = 0.0736 \) N/m and atmospheric pressure = 101.325 kN/m$^2$.

Q10: (a) Calculate the work done in blowing a soap bubble from a radius of 100 mm to 150 mm if surface tension for the soap solution is 0.035 N/m.
(b) What force is required to lift a thin wire ring of diameter 45 mm from a water surface? Neglect weight of wire.