Q 1) calculate specific weight, specific mass, specific volume, specific gravity of liquid having a volume of 6 m^3 and weight of 44 KN.

Q 2) there are 2 parallel plates at a distance of 6 mm and the gap is filled with oil of viscosity 1.5 Ns/m^2. The upper plate is moving at 3 m/s to the right and lower plate is moving at 4 m/s to the left. Find the shear stress on both the plates as the velocity varies linearly.

Q 3) a cubical box of mass 20 Kg and having 20 cm edge is allowed to slide down on an inclined plane making an angle of 20° with horizontal on which there is a thin film of oil having viscosity of 2.2 x 10^{-3} Ns/m^2. What will be the terminal velocity attained by the block if the film thickness is estimated to be 0.025 mm.

Q 4) the velocity distribution for flow over a plate is given by $u = 2y - y^2$ where u is the velocity in m/s at a distance y meters above the plate. Determine the velocity gradient and shear stress at the boundary and 0.15 m from it. Dynamic viscosity $\mu = 0.9$ Ns/m^2

Q 5) the space between 2 square flat parallel plates is filled with oil. Each side of the plate is 720 mm and the thickness of the film is 15 mm. the upper plate moves at 3 m/s and requires a force of 120 N to maintain the speed. Find i) dynamic viscosity of oil, ii) kinematic viscosity of oil if the specific gravity of oil is 0.95.

Q 6) the velocity distribution for flow over a plate is parabolic with vertex 30 cm from the plate where the velocity is 180 cm/s. if the viscosity of oil is 0.9 Ns/m^2 find velocity gradient and shear stress at distance of 0, 15 cm and 30 cm from the plate. Parabolic velocity profile is
$V = ly^2 + my + n$

Q 7) determine the torque and power required to turn 10 cm long, 5 cm diameter shaft at 500 rpm in a 5.1 cm diameter bearing flooded with oil of viscosity of 100 centipoise thus $\mu = 0.1$ Ns/m^2.

Q 8) a shaft of 8 cm in diameter is being pushed through a bearing sleeve of 8.02 cm in diameter and 30 cm long, the uniform clearance assumed is filled with an oil of kinematic viscosity 0.005 m^2/s and specific gravity is 0.9. If the shaft moves axially at 0.5 m/s estimate the resistance force exerted by oil on the shaft.

Q 9) a circular disk of diameter [D] separated by an oil film of viscosity μ of thickness h serves as a thrust bearing. Derive an expression of torque required to maintain angular velocity

Q 10) a thrust bearing consists of 10 cm diameter pad separated by an oil film of 1.55 mm. determine the power dissipated in the bearing if it rotates at 200 rpm and μ of oil is 0.8 poise.

Q 11) a skater of weight 800 N, skates on ice at a speed of 36 Km/hr. the average skating area supporting the skater is 8 cm^2 and the average thickness of the water film separating the skater from ice surface is 10^{-3} mm. assuming viscosity of water at 0° C to be 1.8 x 10^{-3} Kg/m-s. Determine the dynamic co-efficient of friction resisting the motion of the skater.

Q 12) a steel shaft of $\rho = 7850$ Kg/m^3, 3 cm in diameter and 840 cm long falls of its own weight inside a vertical open tube 3.02 cm in diameter. The clearance, assumed uniform is filled with oil and specific gravity of 0.9. How fast will the cylinder fall at terminal conditions where $\mu = 40$ poise consider buoyancy effect.

Q 13) a flywheel weighing 600 N has a radius of gyration of 30 cm. rotating at 600 rpm, its speed reduces by 1 rpm every second due to viscous friction (F_v). If the length of the sleeve bearing is 5 cm, the shaft diameter 200 mm and the radial clearance between the shaft and sleeve is 0.05 mm. determine the fluid viscosity.

Q 14) the velocity distribution of water in a 10 cm radius pipe is given by the expression $u = 20\ (1 - r^2/100)$ where r is in cm. draw the velocity profile over a cross section and calculate drag/Km length of pipe where $\mu = 0.015$ poise for water pipe length of 1000 m.

Q 15) a block of a base area 20 cm^2 and mass 10 Kg moves over a horizontal plane with oil film of 1 mm thick and $\mu = 0.05$ Ns/m^2, if the initial velocity of the block is 2 m/s find the displacement of the block before coming to rest. How much time would it take for the velocity to reduce to 0.2 m/s. assume linear velocity profile when nothing is given. (Problem is a case of non – uniform acceleration)

Q 16) A 2 cm wide gap between two vertical surfaces is filled with an oil of specific gravity of 0.85 and dynamic viscosity 2.5 Ns/m^2. A metal plate 1.25 m x 1.25 m x 0.2 cm thick and weighing 30 N is placed at 0.8 cm from one of the planes. Find the force required if the plate is to be lifted up with a constant velocity of 0.12 m/s.

Q 17) A thin plate of a very large area is placed in a gap of height h with oils of viscosity μ_1 and μ_2 on the two sides of the plate which is pulled at a constant velocity V. calculate the position of the plate so that. i) The shear force on the two sides of the plate is equal. ii) The force required to drag the plate is minimum. Assume viscous flow and neglect all effects.

Q 18) calculate the maximum rise of water to be expected between 2 vertical glass plates spaced 1 mm apart. Take surface tension of water to be 0.0735 N/m and derive the formula to be used.

Q 19) in measuring unit energy of a mineral oil of (specific gravity = 0.85) by bubble method. A tube having internal diameter of 1.5 mm is immersed to depth of 12.5 mm in oil. Air is forced through the tube forming a bubble at lower end. What magnitude of unit surface energy will be indicated by a max bubble pressure intensity of 150 N/m^2?

Q 20) A u-tube is made up of 2 capillaries of bore 1.2 and 2.4 mm respectively. The tube is held vertical and partially filled with liquid of surface tension 0.06 N/m and zero contact angle. If estimated difference in the level of two minuscule is 15 mm. find density of liquid.

Q 21) calculate the capillary effect in a glass tube of 4 mm diameter when immersed in i) water ii) mercury. Also find error in measurement if the tube open to atmosphere is 10 % oversized. The value of surface tension of water and mercury at 20° C in contact with air are 0.0735 N/m and 0.51 N/m respectively. The angle of contact for water is 0° and for mercury is 130°. Specific weight of water at 20° is 9790 N/m^3.