MECHANICS OF FLUIDS

QUESTION BANK

UNIT I FLUID PROPERTIES AND FLUID STATICS

PART - A

1. Define fluid and fluid mechanics.
2. Define real and ideal fluids.
3. Define mass density and specific weight.
4. Distinct b/w statics and kinematics.
5. Define viscosity.
6. Define specific volume.
7. Define specific gravity.
8. Distinct b/w capillarity and surface tension.
9. Calculate the specific weight, density and specific gravity of 1 liter liquid which weighs 7N.
10. State Newton's law of viscosity.
11. Name the types of fluids.
12. Define compressibility.
13. Define kinematic viscosity.
14. Find the kinematic viscosity of oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452N/m^2 and velocity gradient at that point is 0.2/sec.
15. Determine the specific gravity of a fluid having 0.05 poise and kinematic viscosity 0.035 stokes.
16. Find out the minimum size of glass tube that can be used to measure water level if the capillary rise is restricted to 2 mm. Consider surface tension of water in contact with air as 0.073575 N/m.
17. Write down the expression for capillary fall.
18. Explain vapour pressure and cavitation.
19. Two horizontal plates are placed 1.25 cm apart. The space between them is being filled with oil of viscosity 14 poises. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s.
20. State Pascal's law.
21. What is mean by absolute and gauge pressure and vacuum pressure?
22. Define Manometer and list out it's types.
23. Write short notes on 'Differential Manometers'.
24. Define centre of pressure and total pressure.
25. Define buoyancy and centre of buoyancy.

26. Define Meta centre.
27. Define Hydro static Pressure.
28. A differential manometer is connected at the two points A and B. At B pressure is $9.81 N/cm^2$(abs). Find the absolute pressure at A.

PART – B

1. Calculate the capillary effect in millimeters a glass tube of 4mm diameter, when immersed in (a) water (b) mercury. The temperature of the liquid is 20^o C and the values of the surface tension of water and mercury at 20^o C in contact with air are 0.073575 and 0.51 N/m respectively. The angle of contact for water is zero that for mercury 130^o. Take specific weight of water as 9790 N/m^3.
2. If 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.
3. A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 rpm determine the viscosity of the fluid.
4. The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. the thickness of the oil film is 1.5 mm.
5. If the velocity distribution over a plate is given by $u=2/3\ y - y^2$ in which U is the velocity in m/s at a distance y meter above the plate, determine the shear stress at y = 0 and y = 0.15 m.
6. Derive Pascal's law.
7. Derive expression for capillary rise and fall.
8. Two large plane surfaces are 2.4 cm apart. The space between the gap is filled with glycerin. What force is required to drag a thin plate of size 0.5 m between two large plane surfaces at a speed of 0.6 m/sec. if the thin plate is (i) in the middle gap (ii) thin plate is 0.8 cm from one of the plane surfaces? Take dynamic viscosity of fluid is 8.1 poise.
9. Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in (a) water (b) mercury. Take surface tension = 0.0725 N/m for water and = 0.52 N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact of mercury with glass = 130^o.
10. The diameters of a small piston and a large piston of a large piston of a hydraulic jack at 3 cm and 10 cm respectively. A force of 80 N is applied on the small piston. Find the load lifted by the large piston when:
    a. The pistons are at the same level

b. Small piston in 40 cm above the large piston.

The density of the liquid in the jack is given as 1000 kg/m^3.

11. A U - Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs. U tube is 10 cm and the free surface of mercury is in level with over the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, Calculate the new difference in the level of mercury. Sketch the arrangement in both cases.
12. A vertical sluice gate is used to cover an opening in a dam. The opening is 2 m wide and
1.2 m high. On the upstream of the gate, the liquid of sp. Gr 1.45, lies up to a height of
1.5 m above the top of the gate, whereas on the downstream side the water is available up to a height touching the top of the gate. Find the resultant force acting on the gate and position of centre of pressure. Find also the force acting horizontally at the top of the gate which is capable of opening it. Assume the gate is hinged at the bottom.