Test Paper 7

1. Define viscosity?   1

Ans. Viscosity is the property of a fluid by virtue of which an internal frictional force comes into play when the fluid is in motion and opposes the relative motion of its different layers.

2. What is the significance of Reynolds's Number?   1

Ans. If N_R lies b/w o to 2000, the flow of liquid is stream lined if N_R lies above 3000, the flow of liquid is turbulent.

3. Give two areas where Bernoulli's theorem is applied?   1

Ans. Bernoulli's theorem is applied in atomizer and in lift of an aero plane wing.

4. Water flows faster than honey. Why?   1

Ans. Since, $V \propto 1/\eta$

η for water is less than honey, so V for water is greater and hence it flows faster

5. What is Stoke's law and what are the factors on which viscous drag depends?   2

Ans. The viscous drag force F depends on :-

   F = Viscous drag

1) η= co-efficient of viscosity

2) r = radius of spherical body

3) V = Velocity of body

6. Water flows through a horizontal pipe of which the cross – section is not constant. The pressure is 1cm of mercury where the velocity is 0.35m/s. Find the pressure at a point where the velocity is 0.65m/s.   2

Ans. $P_1 = 1cm \, of \, Hg = 0.01 \times 13.6 \times 10^3 \times 9.8 Pa = 1330 Pa$

$v_1 = 0.35 ms^{-1}$

$v_2 = 0.65 ms^{-1}$

$\rho = 10^3 kgm^{-3}$

$P_2 = ?$

Acc. to Bernoullie's theorem (for a horizontal pipe)

$P_1 + \dfrac{1}{2}\rho v_1^2 = P_2 + \dfrac{1}{2}\rho v_2^2$

$P_1 - P_2 = \dfrac{1}{2}\rho\left[v_2^2 - v_1^2\right]$

$1330 - P_2 = \dfrac{1}{2} \times 10^3\left[0.65^2 - 0.35^2\right]$

$\qquad = \dfrac{1}{2} \times 10^3\left[0.4225 - 0.1225\right]$

$\qquad = 150$

$P_2 = 1330 - 150 = 1180 Nm^{-2}$

7. What is terminal velocity and derive an expression for it?   3

Ans. **Terminal velocity** is maximum constant velocity a acquired by the body which is falling freely in a viscous medium.

Derivation

8. What is equation of continuity? Water plows through a horizontal pipe of radius, 1cm at a speed of 2m/s. What should be the diameter of nozzle if water is to come out at a speed of 10m/s?   3

Ans. Derive $a_1v_1=a_2v_2$

$r_1 = 1cm = 10^{-2} m$

$v_1 = 2ms^{-1}$

$v_2 = 10ms^{-1}$

$d_2 = ?$

$a_1 = \pi r_1^2 = 3.14 \times (10^{-2})^2 = 3.14 \times 10^{-4} m^2$

$a_2 = \pi r_2^2 = 3.14 \times r_2^2 \ m^2$

Acc. to equation of continuity

$a_1v_1 = a_2v_2$

$3.14 \times 10^{-4} \times 2 = 3.14 \times r_2^2 \times 10$

$r_2^2 = \dfrac{10^{-4}}{5}$

$r_2 = \dfrac{10^{-2}}{\sqrt{5}}$

$d_2 = 2r_2 = \dfrac{2 \times 10^{-2}}{\sqrt{5}} = 0.894 \times 10^{-2} m$

9. What is Bernoulli's theorem? Show that sum of pressure, potential and kinetic energy in the streamline flow is constant?   3

Ans. Acc. to this theorem, for the streamline flow of an ideal liquid, the total energy that is sum of pressure energy, potential energy and kinetic energy per unit mass remains constant at every cross-section throughout the flow.

Derivation