

7. THE PLANE

1 x 2 = 2 Marks

✍ IMP FORMULAS, KEY CONCEPTS ✍

- 1.1) The general equation of a plane is $ax + by + cz + d = 0$
- 1.2) In the equation $ax + by + cz + d = 0$, the coefficients a, b, c represent the d.r's of the normal to the plane.
- 1.3) The equation of any plane parallel to $ax + by + cz + d = 0$ is of the form $ax + by + cz + k = 0$
- 1.4) The equation of the plane passing through (x_1, y_1, z_1) and perpendicular to the line with d.r's (a, b, c) is $a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$
- 2) The equation of a plane which is at a distance p from the origin and with l, m, n as d.c's of the normal, is $lx + my + nz = p$ (normal form).
- 3) The perpendicular distance from the origin $O(0, 0, 0)$ to the plane $ax + by + cz + d = 0$ is

$$\frac{|d|}{\sqrt{a^2 + b^2 + c^2}}$$

- 4) The perpendicular distance from $A(x_1, y_1, z_1)$ to the plane $ax + by + cz + d = 0$ is

$$\frac{|ax_1 + by_1 + cz_1 + d|}{\sqrt{a^2 + b^2 + c^2}}$$

- 5) The distance between the parallel planes $ax + by + cz + d_1 = 0$ and $ax + by + cz + d_2 = 0$ is

$$\frac{|d_1 - d_2|}{\sqrt{a^2 + b^2 + c^2}}$$

- 6) The equation of the plane with x-intercept a , y-intercept b , z-intercept c is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$

- 7) The intercepts of the plane $ax + by + cz + d = 0$ are $-\frac{d}{a}, -\frac{d}{b}, -\frac{d}{c}$

- 8) The equation of the plane passing through 3 non-collinear points $A(x_1, y_1, z_1), B(x_2, y_2, z_2), C(x_3, y_3, z_3)$ is

$$\begin{vmatrix} x - x_1 & y - y_1 & z - z_1 \\ x_2 - x_1 & y_2 - y_1 & z_2 - z_1 \\ x_3 - x_1 & y_3 - y_1 & z_3 - z_1 \end{vmatrix} = 0$$

- 9) If θ is an angle between the planes $a_1x + b_1y + c_1z + d_1 = 0, a_2x + b_2y + c_2z + d_2 = 0$ then

$$\cos \theta = \frac{a_1a_2 + b_1b_2 + c_1c_2}{\sqrt{(a_1^2 + b_1^2 + c_1^2)(a_2^2 + b_2^2 + c_2^2)}}$$

- 10) The planes $\Pi_1 = a_1x + b_1y + c_1z + d_1 = 0, \Pi_2 = a_2x + b_2y + c_2z + d_2 = 0$ are

(i) parallel $\Leftrightarrow a_1 : b_1 : c_1 = a_2 : b_2 : c_2$ (ii) perpendicular $\Leftrightarrow a_1a_2 + b_1b_2 + c_1c_2 = 0$