Three Dimensional Geometry - Class XII

Past Year JEE Questions

Questions

Quetion: 01

The vector equation of the plane through the line of intersection of the planes x + y + z = 1 and 2x + 3y+ 4z = 5 which is perpendicular to the plane x – y + z = 0 is :

A. $\vec{r} \times \left(\hat{i} - \hat{k}\right) - 2 = 0$

B. $\vec{r}.\left(\hat{i} + \hat{k}\right) + 2 = 0$

C. $\vec{r}.\left(\hat{i} - \hat{k}\right) + 2 = 0$

D. $\vec{r} \times \left(\hat{i} - \hat{k}\right) + 2 = 0$

Solutions

Solution: 01

Explanation

P_1 : x + y + z = 1

P_1 : 2x + 3y + 4z = 5

Equation of the plane passing through the line of intersection of the plane P_1 and P_2 is :

$P_1 + \lambda P_2 = 0$

$\Rightarrow (x + y + z - 1) + \lambda(2x + 3y + 4z - 5) = 0$

$\Rightarrow x(1 + 2\lambda) + y(1 + 3\lambda) + z(1 + 4\lambda) - 5\lambda - 1 = 0$ .....(1)

Direction Ratio (D.R) of this plane = $(1 + 2\lambda, 1 + 3\lambda, 1 + 4\lambda)$

Plane (1) is perpendicular to x - y + z = 0, whose D.R = (1, -1, 1)

As they are perpendicular so dot product of D.R = 0

$\therefore (1)(1 + 2\lambda) + (-1)(1 + 3\lambda) + (1)(1 + 4\lambda) = 0$

$\Rightarrow 1 + 2\lambda - 1 - 3\lambda + 1 + 4\lambda = 0$

$\Rightarrow \lambda = -\frac{1}{3}$

Putting the value of λ in equation (1), we get

$\Rightarrow \frac{x}{3} - \frac{z}{3} + \frac{2}{3} = 0$

$\Rightarrow x - z + 2 = 0$

Vector form of this plane,

$$\vec{r}.\left(\hat{i}-\hat{k}\right)+2=0$$