22. Find the equation of the plane which is perpendicular to the plane 5*x* + 3*y* + 6*z* + 8 = 0 and which contains the line of intersection of the planes *x* + 2*y* + 3*z* – 4 = 0 and 2*x* + *y* – *z* + 5 = 0.

Solution:

The given planes are

P_1: 5x + 3y + 6z + 8 = 0

P_2: x + 2y + 3z – 4 = 0

P_3: 2x + y – z + 5 = 0

Now, the equation of the plane passing through the line of intersection of P_1 and P_3 is

(x + 2y + 3z – 4) + λ(2x + y – z + 5) = 0

(1 + 2λ)x + (2 + λ)y + (3 – λ)z – 4 + 5λ = 0 .... (i)

From the question its understood that plane (i) is perpendicular to P_1, then

5(1 + 2λ) + 3(2 + λ) + 6(3 – λ) = 0

5 + 10λ + 6 + 3λ + 18 – 6λ = 0

7λ + 29 = 0

λ = -29/7

Putting the value of ; in equation (i), we get

$$\left[1+2\left(\frac{-29}{7}\right)\right]x+\left[2-\frac{29}{7}\right]y+\left[3+\frac{29}{7}\right]z-4+5\left(\frac{-29}{7}\right)=0$$

$$\Rightarrow \frac{-15}{7}x-\frac{15}{7}y+\frac{50}{7}z-4-\frac{145}{7}=0$$

-15x – 15y + 50z – 28 – 145 = 0

-15x – 15y + 50z – 173 = 0 ⇒ 51x + 15y – 50z + 173 = 0

Thus, the required equation of plane is 51x + 15y – 50z + 173 = 0.