

# 1.11.3

AI25BTECH11001 - ABHISEK MOHAPATRA

## Question:

If a line makes  $60^\circ$  and  $45^\circ$  angles with the positive directions of the X axis and Z axis respectively, then find the angle that it makes with the positive direction of the Y-axis. Hence, write the direction cosines of the lines.

**Solution:** From the given information, angles made with positive direction of X and Z axis are  $45^\circ$  and  $60^\circ$  respectively.

So, as we know,

$$\cos^2(\alpha) + \cos^2(\beta) + \cos^2(\gamma) = 1 \quad (0.1)$$

Where  $\alpha, \beta, \gamma$  are angles with the positive direction of X, Y, Z axes respectively.

Putting the values,

$$\cos^2(45^\circ) + \cos^2(60^\circ) + \cos^2(\gamma) = 1 \quad (0.2)$$

$$\Rightarrow \left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{2}\right)^2 + \cos^2(\gamma) = 1 \quad (0.3)$$

$$\Rightarrow \left(\frac{1}{2}\right) + \left(\frac{1}{4}\right) + \cos^2(\gamma) = 1 \quad (0.4)$$

$$\Rightarrow \cos^2(\gamma) = \frac{1}{4} \quad (0.5)$$

Rejecting the negative values as we want the smaller angle,

$$\Rightarrow \cos(\gamma) = \frac{1}{2} \quad (0.6)$$

$$\Rightarrow \gamma = 60^\circ \quad (0.7)$$

Therefore the angle with Y axis is  $60^\circ$ .

Graph:

