

2.8.15

EE25BTECH11032 - Kartik Lahoti

Question:

Find the position vector of a point **A** in space such that **OA** is inclined at 60° with **OX** and 45° to **OY** and $|\mathbf{OA}| = 10$ units.

Solution:

Given :

$$\|\mathbf{OA}\| = 10, \text{ Angle with } x\text{-axis} = 60^\circ \text{ and } y\text{-axis} = 45^\circ \quad (0.1)$$

Theory :

If l , m and n are the direction cosines of a given vector then ,

$$l^2 + m^2 + n^2 = 1 \quad (0.2)$$

$$\mathbf{OA} = \|\mathbf{OA}\| \begin{pmatrix} l \\ m \\ n \end{pmatrix} \quad (0.3)$$

$$l = \cos 60^\circ = \frac{1}{2}, m = \cos 45^\circ = \frac{1}{\sqrt{2}} \quad (0.4)$$

$$l^2 + m^2 + n^2 = 1 \quad (0.5)$$

$$\Rightarrow \frac{1}{4} + \frac{1}{2} + n^2 = 1 \quad (0.6)$$

$$\Rightarrow n = \pm \frac{1}{2} \quad (0.7)$$

$$\mathbf{OA} = 10 \begin{pmatrix} \frac{1}{2} \\ \frac{1}{\sqrt{2}} \\ \pm \frac{1}{2} \end{pmatrix} \quad (0.8)$$

$$\mathbf{OA} = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ +5 \end{pmatrix} \text{ or } \mathbf{OA} = \begin{pmatrix} 5 \\ 5\sqrt{2} \\ -5 \end{pmatrix} \quad (0.9)$$

Fig:2.8.15

