# ASSIGNMENT 2
# ICSE 12 2018 PAPER

Pundi Bindusree
CS21BTECH11048

Q.NO:16B SOLUTION:

Given four position vectors A,B,C and D as $4\hat{i} + 5\hat{j} + \hat{k}, -\hat{j} - \hat{k}, 3\hat{i} + 9\hat{j} + 4\hat{k}, 4(-\hat{i} + \hat{j} + \hat{k})$ respectively.

Need to prove given four position vectors are coplanar.

**Position vectors A,B,C and D are coplanar if and only if $\vec{AB}.(\vec{AC} \times \vec{AD}) = 0$ i.e.,scalar triple product of vectors $\vec{AB}, \vec{AC}, \vec{AD}$ is zero.**

$\vec{AB} = \vec{B} - \vec{A}$
$= (-\hat{j} - \hat{k}) - (4\hat{i} + 5\hat{j} + \hat{k})$
$= -\hat{j} - \hat{k} - 4\hat{i} - 5\hat{j} - \hat{k}$

$$\vec{AB} = -4\hat{i} - 6\hat{j} - 2\hat{k} \tag{1}$$

$\vec{AC} = \vec{C} - \vec{A}$
$= (3\hat{i} + 9\hat{j} + 4\hat{k}) - (4\hat{i} + 5\hat{j} + \hat{k})$
$= 3\hat{i} + 9\hat{j} + 4\hat{k} - 4\hat{i} - 5\hat{j} - \hat{k}$

$$\vec{AC} = -1\hat{i} + 4\hat{j} + 3\hat{k} \tag{2}$$

$\vec{AD} = \vec{D} - \vec{A}$
$= (-4\hat{i} + 4\hat{j} + 4\hat{k}) - (4\hat{i} + 5\hat{j} + \hat{k})$
$= -4\hat{i} + 4\hat{j} + 4\hat{k} - 4\hat{i} - 5\hat{j} - \hat{k})$

$$\vec{AD} = -8\hat{i} - 1\hat{j} + 3\hat{k} \tag{3}$$

Scalar triple product of vectors $\vec{AB}, \vec{AC}, \vec{AD} = \vec{AB}.(\vec{AC} \times \vec{AD})$
$= (-4\hat{i} - 6\hat{j} - 2\hat{k}).((-1\hat{i} + 4\hat{j} + 3\hat{k}) \times (-8\hat{i} - 1\hat{j} + 3\hat{k})$
$= (-4\hat{i} - 6\hat{j} - 2\hat{k}).(15\hat{i} + 21\hat{j} + 33\hat{k})$
$= 60 - 126 - 66$
$= 0$

As the scalar triple product value is 0 the condition for coplanar vectors is satisfied therefore the given four positional vectors are coplanar.

Hence it is proved that the given positional vectors are coplanar vectors.