Chapter-20- Vector Algebra and Three Dimensional Geometry

EE24BTECH11051 - Prajwal

I. MCQs and One Correct Answer

1) Let $\mathbf{u},\mathbf{v}$ and $\mathbf{w}$ be vectors such that $\mathbf{u}+\mathbf{v}+\mathbf{w}=0$. If $|\mathbf{u}|=3$,$|\mathbf{v}|=4$ and $|\mathbf{w}|=5$, then $\mathbf{u}.\mathbf{v}+\mathbf{v}.\mathbf{w}+\mathbf{u}.\mathbf{w}$ is (1995S)

    a) 47
    b) -25
    c) 0
    d) 25

2) If $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ are three non-coplanar vectors then $(\mathbf{a}+\mathbf{b}+\mathbf{c}).[(\mathbf{a}+\mathbf{b})\times(\mathbf{a}+\mathbf{c})]$ equals (1995S)

    a) 0
    b) $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]$
    c) $2[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]$
    d) $-[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]$

3) Let $\mathbf{a}=2\mathbf{i}+\mathbf{j}-2\mathbf{k}$ and $\mathbf{b}=\mathbf{i}+\mathbf{j}$. If c is a vector such that $\mathbf{a}.\mathbf{c}=|\mathbf{c}|$,$|\mathbf{c}-\mathbf{a}|=2\sqrt{2}$ and the angle between $(\mathbf{a}\times\mathbf{b})$ and $\mathbf{c}$ is $30°$, then $|(\mathbf{a}\times\mathbf{b})\times\mathbf{c}|=$ (1999 - 2 Marks)

    a) $\frac{2}{3}$
    b) $\frac{3}{2}$
    c) 2
    d) 3

4) Let $\mathbf{a}=2\mathbf{i}+\mathbf{j}+\mathbf{k},\mathbf{b}=\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and a unit vector c be coplanar. If $\mathbf{c}$ is perpendicular ti $\mathbf{a}$, then $\mathbf{c}=$ (1999 - 2 Marks)

    a) $\frac{1}{\sqrt{2}}(-\mathbf{j}+\mathbf{k})$
    b) $\frac{1}{\sqrt{3}}(-\mathbf{i}-\mathbf{j}-\mathbf{k})$
    c) $\frac{1}{\sqrt{5}}(\mathbf{i}-2\mathbf{j})$
    d) $\frac{1}{\sqrt{3}}(\mathbf{i}-\mathbf{j}-\mathbf{k})$

5) If the vectors $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ from the sides BC,CA and AB respectively of a triangle ABC, then (2000S)

    a) $\mathbf{a}.\mathbf{b}+\mathbf{b}.\mathbf{c}+\mathbf{c}.\mathbf{a}=0$
    b) $\mathbf{a}.\mathbf{b}=\mathbf{b}.\mathbf{c}=\mathbf{c}.\mathbf{a}$
    c) $\mathbf{a}\times\mathbf{b}=\mathbf{b}\times\mathbf{c}=\mathbf{c}\times\mathbf{a}$
    d) $\mathbf{a}\times\mathbf{b}+\mathbf{b}\times\mathbf{c}+\mathbf{c}\times\mathbf{a}=0$

6) Let the vectors $\mathbf{a},\mathbf{b},\mathbf{c}$ and $\mathbf{d}$ be such that $(\mathbf{a}\times\mathbf{b})\times(\mathbf{c}\times\mathbf{d})=0$. Let A and B be planes determined by the pairs of vectors $\mathbf{a},\mathbf{b}$ and $\mathbf{c},\mathbf{d}$ respectively. Then the angle between A and B is (2000S)

    a) 0
    b) $\frac{\pi}{4}$
    c) $\frac{\pi}{3}$
    d) $\frac{\pi}{2}$

7) If $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ are unit coplanar vectors, then the scalar triple product $[2\mathbf{a}-\mathbf{b},2\mathbf{b}-\mathbf{c},2\mathbf{c}-\mathbf{a}]=$ (2000S)

    a) 0
    b) 1
    c) $-\sqrt{3}$
    d) $\sqrt{3}$

8) Let $\mathbf{a}=\mathbf{i}-\mathbf{k},\mathbf{b}=x\mathbf{i}+\mathbf{j}+(1-x)\mathbf{k}$ and $\mathbf{c}=y\mathbf{i}+x\mathbf{j}+(1+x-y)\mathbf{k}$. Then $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]$ depends on (2001S)

    a) only x
    b) only y
    c) Neither x Nor y
    d) both x and y

9) If $\mathbf{a},\mathbf{b}$ and $\mathbf{c}$ are unit vectors, then $|\mathbf{a}-\mathbf{b}|^2+|\mathbf{b}-\mathbf{c}|^2+|\mathbf{a}-\mathbf{b}|^2$ does not exceed (2001S)

    a) 4
    b) 9
    c) 8
    d) 6

10) If $\mathbf{a}$ and $\mathbf{b}$ are two unit vectors such that $\mathbf{a}+2\mathbf{b}$ and $5\mathbf{a}-4\mathbf{b}$ are perpendicular to each other then the angle between $\mathbf{a}$ and $\mathbf{b}$ is (2002S)

    a) $45°$
    b) $60°$
    c) $\arccos\frac{1}{3}$
    d) $\arccos\frac{2}{7}$

11) Let $\mathbf{V}=2\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $\mathbf{W}=\mathbf{i}+3\mathbf{k}$. If $\mathbf{U}$ is a unit vector, then the maximum value of the scalar triple product $(U\ V\ W)$ is (2002S)

    a) -1
    b) $\sqrt{10}+\sqrt{6}$
    c) $\sqrt{59}$
    d) $\sqrt{60}$

12) The value of k such that $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies in the plane $2x-4y+z=7$, is (2003S)

    a) 7
    b) -7
    c) no real value
    d) 4

13) The value of $'a'$ so that the volume of parallelopiped formed by $\mathbf{i}+a\mathbf{j}+\mathbf{k},\mathbf{j}+a\mathbf{k}$ and $a\mathbf{i}+\mathbf{k}$ becomes minimum is (2003S)

a) -3 b) 3 c) $\frac{1}{\sqrt{3}}$ d) $\sqrt{3}$

14) If $\mathbf{a} = \mathbf{i}+\mathbf{j}+\mathbf{k}$, $\mathbf{a}.\mathbf{b} = 1$ and $\mathbf{a}\times\mathbf{b} = \mathbf{j}-\mathbf{k}$. Then $\mathbf{b}$ is (2004S)

a) $\mathbf{i}-\mathbf{j}+\mathbf{k}$ c) $\mathbf{i}$
b) $2\mathbf{j}-\mathbf{k}$ d) $2\mathbf{i}$

15) If the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ interest, then the value of k is (2005S)

a) $\frac{3}{2}$ b) $\frac{9}{2}$ c) $\frac{2}{9}$ d) $\frac{-3}{2}$