UNIT – XI

Mathematics

VECTOR ALGEBRA

Group- A

(1 mark each)

1	Find direction cosines of the vector $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$	1
2	Find the scalar components of the vector $a = 7\hat{i} + 2\hat{j} - 3\hat{k}$	1
3	Find the unit vector along $\vec{a} = 3\hat{i} + 4\hat{j} - 5\hat{k}$	1
4	Find the vector joining the points P(2,3,01 and Q (-1,-2,-4) directed from P to Q.	1
5	Find the position vector of the mid point of the line joining the points A (2,3,4) and B (4,1,-2)	1
6	Write the formula for finding the projection of $\vec{a}$ on $\vec{b}$.	1
7	If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ then find $\|\vec{a}\|$.	1
8	If $\vec{a}$ is $\perp\gamma$. to $\vec{b}$ then $\vec{a} \cdot \vec{b} =$ _____	1
9	If $\vec{a}$ is 11ℓ. to $\vec{b}$ then $\vec{a} \times \vec{b} =$ _____	1
10	If θ is the angle between $\vec{a}$ and $\vec{b}$ then write the expression for $\vec{a} \cdot \vec{b}$.	1
11	If θ is the angle between $\vec{a}$ and $\vec{b}$ then write the expression for $\vec{a} \times \vec{b}$.	1
12	Evaluate $\hat{I} \cdot (\hat{J} \times \hat{K}) + \hat{J} \cdot (\hat{I} \times \hat{K}) + \hat{K} \cdot (\hat{I} \times \hat{J})$	1
13	Find $\overrightarrow{AB}$ where A and B are (3,0,5) and (7,1,3) respectively.	1
14	If $\|\vec{a} \cdot \vec{b}\| = \|\vec{a} \times \vec{b}\|$ then find the angle between a and b.	1
15	If $\vec{a} = \hat{i}+\hat{j}+\hat{k}$, $\vec{b} = 2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{c} = \hat{i}-2\hat{j}+\hat{k}$ find $2\vec{a} - \vec{b} + 3\vec{c}$.	1
16	Find the value of x for which x(i+j+k) is a unit vector.	1
17	Write the formula for finding vector area of triangle having $\vec{a}$ and $\vec{b}$ as its two adjacent sides.	1
18	Write the formula for finding scalar area of a parallelogram having $\vec{d_1}$ and $\vec{d_2}$ as its two diagonals.	1

Group- B

(4 mark each)

1	Find a unit vector in the direction of the vector $\vec{a} + \vec{b}$ where $\vec{a} = \hat{i}+2\hat{j}+3\hat{k}$ $\vec{b} = 2\hat{i}+3\hat{j}+\hat{k}$	1+2+1=4
2	Find a vector in the direction of the vector $3\hat{i} - \hat{j}+4\hat{k}$, which has magnitude 6 units.	1+2+1=4
3	Let the points A,B.C with position vectors $\vec{a} = 3\hat{i}-4\hat{j}-4\hat{k}$, $\vec{b} = 2\hat{i}-\hat{j}+\hat{k}$ and $\vec{c} = \hat{i}-3\hat{j}-5\hat{k}$ respectively form the vertices of a triangle then find- (i) $\overrightarrow{AB}$ (ii) $\overrightarrow{BC}$ (iii) $\overrightarrow{AC}$ (iv) Show that A,B,C the vertices of a right angled triangle.	1+2+1=4
4	Find the direction ratio and direction cosines of the vector $\vec{r} = 2\hat{i}+3\hat{j}+\hat{k}$	1+2+1=4

5	Find the position vector of a point R which divides the line joining A (-2,1,3) and B (3,5,-2) in the ratio 2:1 (i) Internally (ii) Externally	2+2=4
6	If $\vec{a} = 2\hat{i}+2\hat{j}+3\hat{k}$, $\vec{b} = 2\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c} = 3i+j$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.	1+2+1=4
7	Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2, respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$	1+2+1=4
8	Using vectors, Find the area of Δ ABC, whose vertices are A (1,2,3), B (2,5-1) and C (-1,1,2)	1+1+1+1=4
9	Find the area of the parallelogram whose diagonals are represented by the vector $\vec{d_1} = 3\hat{i}+\hat{j}-2\hat{k}$ and $\vec{d_2} = \hat{i}-3\hat{j}+4\hat{k}$ $\vec{d_1}$ & $\vec{d_2}$	
10	Prove that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = \vec{o}$	2+2=4
11	Let $\vec{a} = 2\hat{i}+3\hat{j}+2\hat{k}$ and $\vec{b} = \hat{i}+2\hat{j}+\hat{k}$, Find $\vec{a}\ \vec{b}$ and the projection of $\vec{a}$ on $\vec{b}$	2+2=4
12	If A (2,3,4) , B (5,4,=1) , C (3,6,2) and D (1,2,0) be four points, show that $\vec{AB}$ is perpendicular to $\vec{CD}$.	1+1+1+1=4
13	Find the angle between the vectors $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$, if $\vec{a} = 2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b} = 3\hat{i}+\hat{j}+2\hat{k}$	1+1+1+1=4
14	If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$	1+1+1+1=4
15	If $\vec{a}$ makes equal angles with $\hat{i},\hat{j},\hat{k}$ and has magnitude 3 then prove that the angle between $\vec{a}$ & each of $\hat{i},\hat{j},\hat{k}$ is $\cos^{-1}(1/\sqrt{3})$	1+1+1+1=4

Group- C

(6 mark each)

1	Let $\vec{a} = \hat{i}+4\hat{j}+2\hat{k}$, $\vec{b} = 3\hat{i}-2\hat{j}+7\hat{k}$, and $\vec{c} = 2\hat{i}-\hat{j}+\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ such that $\vec{c} \cdot \vec{d} = 15$	6
2	The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of vector $2\hat{i}+4\hat{j}-5\hat{k}$ and $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to one. Find the value of λ	6
3	Given $\vec{\alpha} = 3\hat{i}-\hat{j}+\hat{k}$ and $\vec{\beta} = 2\hat{i}+\hat{j}-3\hat{k}$ then express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta_1} + \vec{\beta_2}$ where $\vec{\beta_1}$ is parallel to $\vec{\alpha}$ and $\vec{\beta_2}$ is perpendicular to $\vec{\alpha}$.	6
4	The two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$. Find the unit vector parallel to its diagonal. Also find its area.	6
5	The dot product of a vector with vectors $\hat{i}+\hat{j}-3\hat{k}$, $\hat{i}+3\hat{j}-2\hat{k}$ and $2\hat{i}+\hat{j}+4\hat{k}$ are 0,5 and 8 respectively. Find the Vector.	6
6	If $\vec{a} = \hat{i}+\hat{j}+\hat{k}$ and $\vec{b} = \hat{j}-\hat{k}$ find a vector $\vec{c}$ such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$	1+2+2+1=6
7	Find the sine of the angle between the vector $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i}+3\hat{j}+2\hat{k}$. Also find projection of $\vec{a}$ on $\vec{b}$.	2+2+2=6

8	If a unit vector $\vec{a}$ makes angles $\pi/3$ with $\hat{i}$, $\pi/4$ with $\hat{j}$ and an acute angle θ with $\hat{k}$ then find θ and hence, the components of $\vec{a}$	1+1+1+ 1+1+1=6
9	The vertices of a Δ ABC are A = (1,-2,-8), B = (5,0,-2) and c = (11,3,7). Find (a) $\vec{AB}$ and $\vec{AC}$ (1.5) (b) a unit vector along $\vec{AB}$ (1.5) (c) $\vec{AB} \times \vec{AC}$ (1.5) (d) Scalar area of Δ ABC (1.5)	6
10	If $\vec{a} = \hat{i}+\hat{j}+2\hat{k}$ and $\vec{b} = 3\hat{i}+2\hat{j}-\hat{k}$ then find (a) $\vec{a} + 3\vec{b}$ (1) (b) $2\vec{a} - \vec{b}$ (1) (c) $(\vec{a} + 3\vec{b}) . (2\vec{a} - \vec{b})$ (1) (d) Projection of $\vec{a}$ on $\vec{b}$ (1) (e) angle between $\vec{a}$ and $\vec{b}$ (1) (f) projection of $\vec{b}$ on $\vec{a}$ (1)	6