VECTOR
LEVEL−I

1. $\vec{OA}$ and $\vec{OB}$ are two vectors such that $|\vec{OA}+\vec{OB}|=|\vec{OA}+2\vec{OB}|$. Then
(A) $\angle BOA = 90°$ (B) $\angle BOA > 90°$
(C) $\angle BOA < 90°$ (D) $60° \le \angle BOA \le 90°$

2. If $\vec{b}$ and $\vec{c}$ are two non-collinear vectors such that $\vec{a}.(\vec{b}+\vec{c})=4$ and $\vec{a}\times(\vec{b}\times\vec{c})=(x^2-2x+6)\vec{b}+(\sin y)\vec{c}$, then the point (x, y) lies on
(A) $x = 1$ (B) $y = 1$
(C) $y = \pi$ (D) $x + y = 0$

3. The scalar $\vec{a}.\{(\vec{b}+\vec{c})\times(\vec{a}+\vec{b}+\vec{c})\}$ equals
(A) 0 (B) $2[\vec{a}\,\vec{b}\,\vec{c}]$ (C) $[\vec{a}\,\vec{b}\,\vec{c}]$ (D) None of these

4. If $\hat{a}, \hat{b}, \hat{c}$ are three unit vectors, such that $\hat{a}+\hat{b}+\hat{c}$ is also a unit vector, and θ_1, θ_2, θ_3 are angle between the vectors, $\hat{a}, \hat{b}$; $\hat{b}, \hat{c}$ and $\hat{c}, \hat{a}$ respectively then $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$ equals
(A) 3 (B) -3 (C) 1 (D) -1

5. If angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$, then angle between $2\vec{a}$ and $-3\vec{b}$ is
(A) $\pi/3$ (B) $-\pi/3$ (C) $2\pi/3$ (D) $-2\pi/3$

6. The vectors $2\hat{i}-m\hat{j}+3m\hat{k}$ and $(1+m)\hat{i}-2m\hat{j}+\hat{k}$ include an acute angle for
(A) all real m (B) $m < -2$ or $m > -1/2$
(C) $m = -1/2$ (D) $m \in [-2, -1/2]$

7. $|\vec{a}|=3$, $|\vec{b}|=4$, $|\vec{c}|=5$ such that each is perpendicular to sum of the other two, then $|\vec{a}+\vec{b}+\vec{c}| =$
(A) $5\sqrt{2}$ (B) $\frac{5}{\sqrt{2}}$ (C) $10\sqrt{2}$ (D) $5\sqrt{3}$

8. If $\vec{x}$ and $\vec{y}$ are two vectors and ϕ is the angle between them, then $\frac{1}{2}|\vec{x}-\vec{y}|$ is equal to
(A) 0 (B) $\frac{\pi}{2}$ (C) $\left|\sin\frac{\phi}{2}\right|$ (D) $\left|\cos\frac{\phi}{2}\right|$

9. If $\vec{u}=\hat{i}\times(\vec{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j})+\hat{k}\times(\vec{a}\times\hat{k})$, then
(A) u is unit vector (B) u = a + i + j + k
(C) u = 2a (D) none of these

10. Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that $\hat{a}+\hat{b}$ is also a unit vector. Then the angle between $\hat{a}$ and $\hat{b}$ is
(A) 30° (B) 60°
(C) 90° (D) 120°

11. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\hat{\vec{b}} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}|$ = $\sqrt{3}$.

(A) α =1, β = -1
(B) α = 1, $\beta \pm 1$
(C) α = -1, $\beta \pm 1$
(D) $\alpha = \pm 1$, β = 1

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

(A) $\frac{2}{3}$
(B) $\frac{3}{2}$
(C) 2
(D) 3

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

(A) only x
(B) only y
(C) NEITHER x NOR y
(D) both x and y

14. If $|\vec{a} + \vec{b}| = |\vec{a}|$, then $\vec{b}.(2\vec{a} + \vec{b})$ equals

(A) 0
(B) 1
(C) 2a.b
(D) none of these

15. If $|\vec{a}|$ = 3, $|\vec{b}|$ = 5, $|\vec{c}|$ = 7 and $\vec{a} + \vec{b} + \vec{c}$ = 0, then angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{3}$
(C) $\frac{\pi}{2}$
(D) none of these

16. Given that angle between the vectors $\vec{a} = \lambda\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = 2\lambda\hat{i} + \lambda\hat{j} - \hat{k}$ is acute, whereas the vector $\vec{b}$ makes with the co-ordinate axes on obtuse angle then λ belongs to

(A) $(-\infty, 0)$
(B) $(0, \infty)$
(C) R
(D) none of these

17. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit coplanar vectors then the scalar triple product $[2\vec{a} - \vec{b},\ 2\vec{b} - \vec{c},\ 2\vec{c} - \vec{a}]$ =

(A) 0
(B) 1
(C) $-\sqrt{3}$
(D) $\sqrt{3}$

18. If $|\vec{a} + \vec{b}| > |\vec{a} - \vec{b}|$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) acute
(B) obtuse
(C) $\pi/2$
(D) none of these

19. If the lines $\vec{r} = x\left(\frac{\vec{b}}{|\vec{b}|} + \frac{\vec{c}}{|\vec{c}|}\right)$ and $\vec{r} = 2\vec{b} + y(\vec{c} - \vec{b})$ intersect at a point with position vector $z\left(\frac{\vec{b}}{|\vec{b}|} + \frac{\vec{c}}{|\vec{c}|}\right)$, then

(A) z is the AM between $|\vec{b}|$ and $|\vec{c}|$
(B) z is the GM between $|\vec{b}|$ & $|\vec{c}|$

(C) z is the HM between $|\vec{b}|$ and $|\vec{c}|$ (D) $z = |\vec{b}| + |\vec{c}|$

20. Let ABCDEF be a regular hexagon and $\overrightarrow{AB} = \vec{a}$, $\overrightarrow{BC} = \vec{b}$, $\overrightarrow{CD} = \vec{c}$ then $\overrightarrow{AE}$ is

(A) $\vec{a} + \vec{b} + \vec{c}$ (B) $\vec{a} + \vec{b}$
(C) $\vec{b} + \vec{c}$ (D) $\vec{c} + \vec{a}$

21. The number of unit vectors perpendicular to vectors $\vec{a} = (1,1,0)$ and $\vec{b} = (0,1,1)$ is

(A) One (B) Two
(C) Three (D) Infinite

22. If $\hat{p}$ and $\hat{d}$ are two unit vectors and θ is the angle between them, then

(A) $\frac{1}{2}\left|\hat{p} - \hat{d}\right|^2 = \sin\frac{\theta}{2}$ (B) $\hat{p} \times \hat{d} = \sin\theta$
(C) $\frac{1}{2}\left(\hat{p} - \hat{d}\right)^2 = 1 - \cos\theta$ (D) $\frac{1}{2}\left(\hat{p} - \hat{d}\right)^2 = 1 - \cos 2\theta$

23. The value of k for which the points A(1, 0, 3) , B(-1, 3,4) ,C(1, 2, 1) and D(k, 2, 5) are coplanar is

(A) 1 (2)2
(C) 0 (D) -1

24. If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$ and the vectors A = (1, a, a^2), B = (1, b, b^2), C = (1,c,c^2) are non - coplanar, then the value of abc will be

(A) –1 (B) 1
(C) 0 (D) None of these

25. Let a, b, c be distinct non-negative numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{k}, c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is

(A) the arithmetic mean of a and b (B) the geometric mean of a and b
(C) the harmonic mean of a and b (D) equal to zero

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26. The unit vector perpendicular to the plane determined by P(1, -1, 2), Q(2, 0, -1), R(0, 2, 1) is

(A) $\frac{i + 2j + k}{\sqrt{6}}$ (B) $\frac{i - j + 2k}{\sqrt{6}}$
(C) $\frac{2i + j + k}{\sqrt{6}}$ (D) None of these

27. If $\vec{A}, \vec{B}, \vec{C}$ are non-coplanar vectors then $\frac{\vec{A}.\vec{B}\times\vec{C}}{\vec{C}\times\vec{A}.\vec{B}} + \frac{\vec{B}.\vec{A}\times\vec{C}}{\vec{C}.\vec{A}\times\vec{B}}$ is equal to

(A) 3 (B) 0
(B) 1 (D) None of there

28. If the vector $a\hat{i}+\hat{j}+\hat{k},\ \hat{i}+b\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+c\hat{k}$ ($a \neq b \neq c \neq 1$) are coplanar, then the value of

$\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is equal to

(A) 1 (B) 0
(C) 2 (D) None of these

29. If $\vec{a},\vec{b},\vec{c}$ are vectors such that $\vec{a}.\vec{b}=0$ and $\vec{a}+\vec{b}=\vec{c}$. Then

(A) $|\vec{a}|^2+|\vec{b}|^2=|\vec{c}|^2$ (B) $|\vec{a}|^2=|\vec{b}|^2+|\vec{c}|^2$

(C) $|\vec{b}|^2=|\vec{a}|^2+|\vec{c}|^2$ (D) None of these

30. The points with position vector 60i + 3j, 40i – 8j and ai –52j are collinear if
(A) a = -40 (B) a = 40 (C) a = 20 (D) none of these .

31. Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that $\hat{a}+\hat{b}$ is also a unit vector. Then the angle between $\hat{a}$ and $\hat{b}$ is
(A) 30° (B) 60° (C) 90° (D) 120°

32. If vectors $ax\hat{i}+3\hat{j}-5\hat{k}$ and $x\hat{i}+2\hat{j}+2ax\hat{k}$ make an acute angle with each other, for all $x \in R$, then a belongs to the interval
(A) $\left(-\frac{1}{4},0\right)$ (B) (0, 1) (C) $\left(0,\frac{6}{25}\right)$ (D) $\left(-\frac{3}{25},0\right)$

33. A vector of unit magnitude that is equally inclined to the vectors $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ is;

(A) $\frac{1}{\sqrt{3}}\left(\hat{i}-\hat{j}-\hat{k}\right)$ (B) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}-\hat{k}\right)$

(C) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (D) none of these

34. Let a, b, c be three distinct positive real numbers. If $\bar{p},\bar{q},\bar{r}$ lie in plane, where $\vec{p}=a\hat{i}-a\hat{j}+b\hat{k}$, $\vec{q}=\hat{i}+\hat{k}$ and $\vec{r}=c\hat{i}+c\hat{j}+b\hat{k}$ then b is
(A) A.M of a, c (B) the G.M of a, c
(C) the H.M of a, c (D) equal to c

85. The scalar $\vec{A}.\left\{\left(\vec{B}+\vec{C}\right)\times\left(\vec{A}+\vec{B}+\vec{C}\right)\right\}$ is equal to ______________________

36. If $\vec{a},\vec{b},\vec{c}$ are unit coplanar vectors, then the scalar triple product $\left[2\vec{a}-\vec{b},\ 2\vec{b}-\vec{c},\ 2\vec{c}-\vec{a}\right]$ is equal to ______________________

37. The area of a parallelogram whose diagonals represent the vectors $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$ is

(A) $10\sqrt{3}$ (B) $5\sqrt{3}$
(C) 8 (D) 4

38. The value of $\left[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}\right]$ is equal to

(A) $2\left[\vec{a}\vec{b}\vec{c}\right]$ (B) $3\left[\vec{a}\vec{b}\vec{c}\right]$

(C) $\left[\vec{a}\vec{b}\vec{c}\right]$ (D) 0

LEVEL−II

1. If $\vec{a}$ is any vector in the plane of unit vectors $\hat{b}$ and $\hat{c}$, with $\hat{b}\cdot\hat{c} = 0$, then the magnitude of the vector $\vec{a}\times\left(\hat{b}\times\hat{c}\right)$ is

(A) $|\vec{a}|$ (B) 2

(C) 0 (D) none of these .

2. If $\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them, then the unit vector along the angular bisector of $\vec{a}$ and $\vec{b}$ will be given by

(A) $\dfrac{\vec{a}-\vec{b}}{2\cos\frac{\theta}{2}}$ (B) $\dfrac{\vec{a}+\vec{b}}{2\cos\frac{\theta}{2}}$

(C) $\dfrac{\vec{a}+\vec{b}}{2\sin\frac{\theta}{2}}$ (D) none of these.

3. If $\bar{a}$ is a unit vector and projection of $\bar{x}$ along $\bar{a}$ is 2 units and $\left(\bar{a}\times\bar{x}\right)+\bar{b}=\bar{x}$, then $\bar{x}$ is given by

(A) $\frac{1}{2}\left[\bar{a}-\bar{b}+\left(\bar{a}\times\bar{b}\right)\right]$ (B) $\frac{1}{2}\left[2\bar{a}+\bar{b}+\left(\bar{a}\times\bar{b}\right)\right]$

(C) $\left[\bar{a}+\left(\bar{a}\times\bar{b}\right)\right]$ (D) none of these.

4. If $4\bar{a}+5\bar{b}+9\bar{c}=0$, then $(\bar{a}\times\bar{b})\times[(\bar{b}\times\bar{c})\times(\bar{c}\times\bar{a})]$ is equal to

(A) A vector perpendicular to plane of $\bar{a}$, $\bar{b}$ and $\bar{c}$ (B) A scalar quantity

(C) $\vec{0}$ (D) None of these

5. The shortest distance of the point (3, 2, 1) from the plane, which passes through a(1, 1, 1) and which is perpendicular to vector $\vec{\alpha}=2\hat{i}+3\hat{k}$, is

(A) $\dfrac{4}{\sqrt{3}}$ (B) 2 (C) 3 (D) $\dfrac{1}{\sqrt{13}}$

6. Let $\vec{a}=2\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-\hat{k}$ and a unit vector $\vec{c}$ be coplanar. If $\vec{c}$ is perpendicular to $\vec{a}$ then $\vec{c}$ =

(A) $\dfrac{1}{\sqrt{2}}\left(-\hat{j}+\hat{k}\right)$ (B) $\dfrac{1}{\sqrt{3}}\left(\hat{i}-\hat{j}-\hat{k}\right)$

(C) $\dfrac{1}{\sqrt{5}}\left(\hat{i}-2\hat{j}\right)$ (D) $\dfrac{1}{\sqrt{2}}\left(\hat{i}-\hat{j}-\hat{k}\right)$

7. Let $\vec{a}$ and $\vec{b}$ be the two non–collinear unit vector. If $\vec{u}=\vec{a}-\left(\vec{a}\cdot\vec{b}\right)\vec{b}$ and $\vec{v}=\vec{a}\times\vec{b}$, then $|\vec{v}|$ is

(A) $|\vec{u}|$ (B) $|\vec{u}|+|\vec{u}\cdot\vec{a}|$

(C) $|\vec{u}|+\vec{u}\cdot\left(\vec{a}+\vec{b}\right)$ (D) none of these

8. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors, then $\left|\vec{a}-\vec{b}\right|^2 + \left|\vec{b}-\vec{c}\right|^2 + \left|\vec{c}-\vec{a}\right|^2$ does NOT exceed

(A) 4 (B) 9
(C) 8 (D) 6

9. If $\vec{a}\times\vec{r} = \vec{b} + t\vec{a}$ and $\vec{a}.\vec{r} = 3$, where $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = -\hat{i} - 2\hat{j} + \hat{k}$ then $\vec{r}$ equals

(A) $\frac{7}{6}\hat{i} + \frac{2}{5}\hat{j}$ (B) $\frac{7}{6}\hat{i} + \frac{1}{3}\hat{j}$
(C) $\frac{7}{6}\hat{i} + \frac{2}{3}\hat{j} + \frac{1}{3}\hat{k}$ (D) none of these

10. If $\alpha(\vec{a}\times\vec{b}) + \beta(\vec{b}\times\vec{c}) + \gamma(\vec{c}\times\vec{a}) = 0$ and at least one of the numbers α, β and γ is non-zero, then the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are

(A) perpendicular (B) parallel
(C) co-planar (D) none of these

11. The vectors $\vec{a}$ and $\vec{b}$ are non-zero and non-collinear. The value of x for which vector $\vec{c} = (x-2)\vec{a} + \vec{b}$ and $\vec{d} = (2x+1)\vec{a} - \vec{b}$ are collinear.

(A) 1 (B) 1/2
(C) 1/3 (D) 2

12 $\vec{a}\times\vec{b} = \vec{c}$, $\vec{b}\times\vec{c} = \vec{a}$, then

(A) $|\vec{a}| = 1$, $|\vec{b}| = |\vec{c}|$ (B) $|\vec{c}| = 1$, $|\vec{a}| = 1$
(C) $|\vec{b}| = 2$, $|\vec{b}| = 2|\vec{a}|$ (D) $|\vec{b}| = 1$, $|\vec{b}| = |\vec{a}|$

13. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three non - coplanar vectors and $\vec{p}, \vec{q}, \vec{r}$ are vectors defined by the relations $\vec{p} = \frac{\vec{b}\times\vec{c}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, $\vec{q} = \frac{\vec{c}\times\vec{a}}{[\vec{a}\ \vec{b}\ \vec{c}]}$, $\vec{r} = \frac{\vec{a}\times\vec{b}}{[\vec{a}\ \vec{b}\ \vec{c}]}$ then the value of expression

$(\vec{a}+\vec{b}).\vec{p} + (\vec{b}+\vec{c}).\vec{q} + (\vec{c}+\vec{a}).\vec{r}$ is equal to

(A) 0 (B) 1
(C) 2 (D) 3

14. The value of $|\vec{a}\times\hat{i}|^2 + |\vec{a}\times\hat{j}|^2 + |\vec{a}\times\hat{k}|^2$ is

(A) a^2 (B) $2a^2$
(C) $3a^2$ (D) None of these

15. If $\vec{a} = \hat{i} + \hat{j}$, $\vec{b} = 2\hat{j} - \hat{k}$ and $\vec{r}\times\vec{a} = \vec{b}\times\vec{a}$, $\vec{r}\times\vec{b} = \vec{a}\times\vec{b}$, then a unit vector in the direction of $\vec{r}$ is;

(A) $\frac{1}{\sqrt{11}}(\hat{i} + 3\hat{j} - \hat{k})$ (B) $\frac{1}{\sqrt{11}}(\hat{i} - 3\hat{j} + \hat{k})$
(C) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$ (D) none of these

16. $(\vec{a}.\hat{i})(\vec{a}\times\hat{i}) + (\vec{a}.\hat{j})(\vec{a}\times\hat{j}) + (\vec{a}.\hat{k})(\vec{a}\times\hat{k})$ is equal to;

(A) $3\vec{a}$ (B) $\vec{r}$
(C) $2\vec{r}$ (D) none of these

17. If the vertices of a tetrahedron have the position vectors $\vec{0}, \hat{i}+\hat{j}, 2\hat{j}-\hat{k}$ and $\hat{i}+\hat{k}$ then the volume of the tetrahedron is

(A) 1/6 (B) 1

(C) 2 (D) none of these

18. $\vec{A}$ = (1, -1, 1), $\vec{C}$ = (-1, -1, 0) are given vectors; then the vector $\vec{B}$ which satisfies $\vec{A}\times\vec{B}=\vec{C}$ and $\vec{A}.\vec{B}=1$ is ___________________________________

19. If $\vec{a}, \vec{b}, \vec{c}$ are given non-coplanar unit vectors such that $\vec{a}\times(\vec{b}\times\vec{c})=\frac{\vec{b}+\vec{c}}{2}$, then the angle between $\vec{a}$ and $\vec{c}$ is ________________________________

20. Vertices of a triangle are (1, 2, 4) (3, 1, -2) and (4, 3, 1) then its area is_______________

21. A unit vector coplanar with $\vec{i}+\vec{j}+2\vec{k}$ and $\vec{i}+2\vec{j}+\vec{k}$ and perpendicular to $\vec{i}+\vec{j}+\vec{k}$ is _______________________

LEVEL−III

1. If $\bar{a}, \bar{b}, \bar{c}$ are coplanar vectors and $\bar{a}$ is not parallel to $\bar{b}$ then $(\bar{c} \times \bar{b}) \cdot (\bar{a} \times \bar{b})\bar{a} + (\bar{a} \times \bar{c}) \cdot (\bar{a} \times \bar{b})\bar{b}$ is equal to

   (A) $[(\bar{a} \times \bar{b}) \cdot (\bar{a} + \bar{b})]\bar{c}$
   (B) $(\bar{a} \times \bar{b}) \cdot (\bar{a} \times \bar{b})\bar{c}$
   (C) $(\bar{a} \times \bar{b}) \cdot (\bar{a} - \bar{b})\bar{c}$
   (D) none of these

2. The projection of $\hat{i} + \hat{j} + \hat{k}$ on the line whose equation is $\vec{r} = (3 + \lambda)\hat{i} + (2\lambda - 1)\hat{j} + 3\lambda\hat{k}$, λ being the scalar parameter is;

   (A) $\frac{1}{\sqrt{14}}$
   (B) 6
   (C) $\frac{6}{\sqrt{14}}$
   (D) none of these

3. If $\vec{p}, \vec{q}$ are two non-collinear and non-zero vectors such that $(b - c)\vec{p} \times \vec{q} + (c - a)\vec{p} + (a - b)\vec{q} = 0$ where a, b, c are the lengths of the sides of a triangle, then the triangle is

   (A) right angled (B) obtuse angled (C) equilateral (D) isosceles

L−I

1.	B	2.	A
3.	A	4.	D
5.	C	6.	B
7.	A	8.	
9.	C	10.	D
11.	B	12.	B
13.	C	14.	A
15.	B	16.	A
17.	A	18.	A
19.	C	20.	C
21.	B	22.	C
23.	D	24.	A
25.	B	26.	C
27.	B	28.	A
29.	A	30.	A
31.	D	32.	C
33.	C	34.	C
35.	O	36.	O
37.	B	38.	A

L−II

1.	A	2.	B
3.	B	4.	C
5.	A	6.	A
7.	A	8.	B
9.	D	10.	C
11.	C	12.	D
13.	D	14.	B
15.	A	16.	D
17.	A	18.	K
19.	$\theta = \pi/3$	20.	$5\sqrt{5/2}$

21. $- - \frac{\hat{J}+\hat{K}}{\sqrt{2}}$ ON $\frac{\hat{J}-\hat{K}}{\sqrt{2}}$

L−III

1.
2. C
3. C