SECTION - A

10 × 2 = 20

VERY SHORT ANSWER TYPE QUESTIONS

Answer All questions. Each question carries 2 marks.

1. If a function is defined as $f(x) = \begin{cases} 3x-2 & \text{if} \quad x > 3 \\ x^2 - 2 & \text{if} \quad -2 \le x \le 2 \\ 2x+1 & \text{if} \quad x < -3 \end{cases}$ then find the values of $f(4), f(2{\cdot}5)$.

2. Find the domain of the function $\log(x^2 - 4x + 3)$.

3. If the position vectors of A, B, C, D are $\mathbf{a} + 2\mathbf{b}$, $2\mathbf{a} - \mathbf{b}$, $\mathbf{a}$, $3\mathbf{a} + \mathbf{b}$ respectively, then find $\vec{AC}, \vec{DA}$.

4. Find the vector equation of the plane passing through the points $(1, -2, 5)$, $(0, -5, -1)$ and $(-3, 5, 0)$.

5. Find the angle between the vectors $6\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$, $2\mathbf{i} - 9\mathbf{j} + 6\mathbf{k}$

6. Find the value of $\cos^2 45 - \sin^2 15$.

7. Prove that $\cos 12^\circ + \cos 84^\circ + \cos 132^\circ + \cos 156^\circ = -1/2$

8. Prove that $(\cosh x + \sinh x)^n = \cosh nx + \sinh nx$

9. In a triangle ABC, show that $(b - a\cos C)\sin A = a\cos A \sin C$.

10. If $(x + iy) = \dfrac{1}{1 + \cos\theta + i\sin\theta}$, then show that $4x^2 = 1$.

SECTION - B

5 × 4 = 20

SHORT ANSWER TYPE QUESTIONS

Attempt any 5 questions. Each question carries 4 marks.

11. If $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are noncoplanar show that the position vector of the point of intersection of the line passing through $6\mathbf{a} - 4\mathbf{b} + 4\mathbf{c}$, $-4\mathbf{c}$ and the line passing through $-\mathbf{a} - 2\mathbf{b} - 3\mathbf{c}$, $\mathbf{a} + 2\mathbf{b} - 5\mathbf{c}$ is $-4\mathbf{c}$.

12. Find the area of the triangle with the points $A(1, 2, 3)$, $B(2, 3, 1)$ and $C(3, 1, 2)$.

13. Prove that $\cos 12^\circ + \cos 84^\circ + \cos 132^\circ + \cos 156^\circ = -1/2$.

14. Solve $4 \sin x \sin 2x \sin 4x = \sin 3x$.

15. If $Sin^{-1} x + Sin^{-1} y + Sin^{-1} z = \pi$, prove that $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$

16. If $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}$ then prove that $C = 60^\circ$.

17. Show that $\sin 6\theta = 6\cos^5\theta \sin\theta - 20\cos^3 \sin^3\theta + 6\cos\theta \sin^5\theta$.

SECTION - C

5 × 7 = 35

LONG ANSWER TYPE QUESTIONS

Attempt any 5 questions. Each question carries 7 marks.

18. If $f: A \to B, g: B \to C$ are two bijective functions, then prove that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

19. By using mathematical induction show that
$\frac{1}{1\cdot4} + \frac{1}{4\cdot7} + \frac{1}{7\cdot10} + \ldots$ upto n terms $= \frac{n}{3n+1}$ for all $n \in N$.

20. By vector method, prove that $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$.

21. If $A + B + C = 180^\circ$, then prove that $\sin^2\frac{A}{2} + \sin^2\frac{B}{2} - \sin^2\frac{C}{2} = 1 - 2\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$.

22. In ΔABC, show that $r_1 + r_2 + r_3 - r = 4R$..

23. From the top of a pillar of height of 80 metres, the angles of depression of the top and foot of another pillar are 30° and 45° respectively. Find the distance between the two pillars and the height of the second pillar.

24. Solve $x^{11} - x^7 + x^4 - 1 = 0$.