DAY-1

1. Define conjunction of a statement. Construct a truth table for the compound statement $\sim(p \wedge q)$
2. Define a statement. If P is true, q is true, find the truth value of $(p \vee q) \wedge (\sim q)$
3. Define negation of a statement. Construct a truth table for the compound statement $\sim (p \vee (\sim q))$
4. Define conditional statement. Compute the truth table of the statement $(p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$
5. If A,B and C be any three non-empty sets, prove that: $A - (B \cup C) = (A - B) \cap (A - C)$
6. Define the complement of a set. State and prove De-Morgan's laws.
7. Prove that $A \Delta B = (A \cup B) - (A \cap B)$
8. For any two real numbers x and y, prove that $|x + y| \leq |x| + |y|$
9. Rewrite, using absolute value sign for $|3x + 2| \leq 1$
10. Let p,q and r be statements, show that the statements $(p \wedge q \Rightarrow r) \Leftrightarrow [(p \Rightarrow (q \Rightarrow r)]$ is true.

DAY-2

11. For any two real numbers x and y
    a) $|x + y| \leq |x| + |y|$
    b) $|x - y| \geq |x| - |y|$
12. If $x \in R$ and a be any positive real number then $|x| < a \Rightarrow \quad a < x < a$ and conversely.
13. Solve the inequality $\frac{x+2}{x^2-3x} > 0$
14. Solve the inequality $|2x - 1| \geq 3$ and draw its graph.
15. Solve $x^2 - 2x - 3 \geq 0$
16. Solve the inequality $x^2 + 7x + 10 < 0$
17. Let $A = \{-1,0,2,4,6\}$ and a function $f: A \to R$ is defined by
    i) $y = f(x) = \frac{x}{x+2}$ Find the range of f
18. Let a function $f: A \to B$ be defined by $f(x) = \frac{x^2}{6}$ with $A = \{-2,-1,0,1,2\}$ and B=$\{0, \frac{1}{6}, \frac{2}{3}\}$.Find the range of f.Is the function f one to one and onto.
17. Define symmetric and skew-symmetric matrix with example.
18. If $A = \begin{pmatrix} 2 & 4 & 3 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{pmatrix}$ find A^T
    a) Show that the sum of the given matrix and its transpose is a symmetric matrix.
    b) Show that the difference of the given matrix and its transpose is a skew-symmetric matrix.
    c) Express the given matrix A as the sum of the symmetric and skew-symmetric matrix form
19. If A=$\begin{pmatrix} 0 & 2y-3 \\ 1-y & 0 \end{pmatrix}$ and $A = -A^T$, Find the value of y.

DAY-3

20. Without expanding the determinant show that the value of the determinant is zero

i) $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix}$ ii) $\begin{vmatrix} 1 & bc & bc(b+c) \\ 1 & ca & ca(c+a) \\ 1 & ab & ab(a+b) \end{vmatrix}$

21. Without expanding the determinant, prove that

i) $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$ ii) $\begin{vmatrix} 1 & bc & b+c \\ 1 & ca & c+a \\ 1 & ab & a+b \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$

22. Show that

i) $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix} = (a-b)(b-c)(c-a)$

ii) $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$

iii) $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

iv) $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = xyz(1+\frac{1}{x}+\frac{1}{y}+\frac{1}{z})$

v) $\begin{vmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{vmatrix} = 1 + x^2 + y^2 + z^2$

vi) $\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (b^2 - ac)(ax^2 + 2bxy + cy^2)$

23. If $A = \begin{pmatrix} 7 & -3 \\ 6 & 2 \end{pmatrix}$, prove that $A^{-1} = \frac{1}{32}\begin{pmatrix} 2 & 3 \\ -6 & 7 \end{pmatrix}$
24. Prove that the two matrices $\begin{pmatrix} -3 & -2 \\ 5 & 3 \end{pmatrix}$ and $\begin{pmatrix} 3 & 2 \\ -5 & -3 \end{pmatrix}$ are the inverse of each others.
25. Given a matrix $\begin{pmatrix} 3 & -1 \\ 5 & -2 \end{pmatrix}$, find a matrix $\begin{pmatrix} p & q \\ r & s \end{pmatrix}$ such that they are inverse of each other
26. Determine the nature of the roots of $x^2 - 6x + 5 = 0$

DAY -4

27. For what values of P will the equation $5x^2 - px + 45 = 0$ have equal roots?
28. If a,b,c are rational and $a + b + c = 0$, show that the roots of $(b + c - a)x^2 + (c + a - b)x + (a + b - c) = 0$ are rational.
29. Find a quadratic equation whose roots are the reciprocal of the roots of: $3x^2 - 5x - 2 = 0$
30. If the roots of the equation $x^2 + ax + c = 0$ differ by 1, prove that $a^2 = 4c + 1$
31. If the roots of the equation $ax^2 + bx + c = 0$ be in the ratio of 3:4 prove that: $12b^2 = 49ac$
32. For what value of m, the equation $x^2 - mx + m + 1 = 0$ may have its roots in the ratio 2:3
33. If α and β are the roots of $px^2 + qx + q = 0$ prove that $\sqrt{\alpha/\beta} + \sqrt{\beta/\alpha} + \sqrt{q/p} = 0$
34. If the quadratic equation $x^2 + px + q = 0$ and $x^2 + p'x + q' = 0$ have a common root, show that it must be either, $\frac{pq' - p'q}{q - q'}$ or $\frac{q - q'}{p' - p}$
35. If the equation $x^2 + px + q = 0$ and $x^2 + qx + p = 0$ have a common root, prove that either $p = q$ or $p + q + 1 = 0$
36. Prove that the roots of the equation $x^2 + (2k - 1)x + k^2 = 0$ are real if $k \leq \frac{1}{4}$
37. If -4 is a root of the equation $x^2 + px - 4 = 0$ and the equation $x^2 + px + q = 0$ has equal roots, find the value of q.
38. If the sum of the roots of the equation $ax^2 + bx + c = 0$ be equal to the sum of their squares, show that $2ac = ab + b^2$
39. If the difference of the roots of $x^2 + 2px + q = 0$ be equal to the difference of the roots of $x^2 + 2qx + p = 0$ prove that $p + q + 1 = 0$
40. If a+b+c=0 solve the equation $(b + c)x^2 + (c + a)x + (a + b) = 0$

DAY-5

41. Find the length of the perpendicular from a point on a straight line $x\cos\alpha + y\sin\alpha = p$
42. Find the length of the perpendicular from a point (x', y') on the line whose equation is $Ax + By + C = 0$
43. Find the acute angle between the lines $x - 3y - 6 = 0$ and $y = 2x + 5$
44. Find the equation of the bisectors of the angles between the lines
    a) $3x - 4y + 2 = 0$ and $5x + 12y + 5 = 0$
    b) $x - 2y = 0$ and $2y = 11x = 6$
45. The length of the perpendicular drawn from the point $(a, 3)$ on the line: $3x + 4y + 5 = 0$ is 4.Find the value of a.
46. What are the points on the axis of x whose perpendicular distance from the straight line $\frac{x}{a} + \frac{y}{b} = 1$ is a
47. Find the equation of the two straight lines each of which is parallel to and at a distance of $\sqrt{5}$ from the line $x + 2y - 7 = 0$
48. Find the equation of the two straight lines drawn through the point $(0, a)$ on which the perpendicular drawn from the point $(2a, 2a)$ are each of length a.
49. Find the equation of the line which is at right angles to $3x + 4y = 12$, such that its perpendicular distance from the origin is equal to the length of the perpendicular from (3,2). On the given line.
50. The equation of the diagonal of a parallelogram is $3y = 5x + k$.The two opposite vertices of a parallelogram are the points $(1, -2)$ and $(-2,1)$. Find the value of K.
51. Write the conditions of perpendicular Tyand parallelism of the lines represented by $lx^2 + 2hxy + ny^2 = 0$

DAY-6

52. Find the bisectors of the angles between the pair of lines represent by $ax^2 + 2hxy + by^2 = 0$
53. Find the angle between the line pair represented by $ax^2 + 2hxy + by^2 = 0$
54. Find the angle between the pair of lines $x^2 - 2xy\cot\theta - y^2 = 0$
55. Find the angle between the pair of lines $x^2 + 6xy + 9y^2 + 4x + 12y - 5 = 0$
56. Find the value o f k so that $x^2 + kxy + 2y^2 + 3x + 5y + 2 = 0$ may represent a pair of lines.
57. Find the equation of the straight lines through the origin and at right angles to the lines $x^2 - 5xy + 4y^2 = 0$
58. Find the equation to the straight lines passing through (1.1) and parallel to the lines represented by $x^2 - 5xy + 4y^2 + x + 2y - 2 = 0$
59. Show that the points (1,2,3),(-1,-2,-3),(2,3,2) and (4,7,6) are the vertices of a parallelogram.
60. Show that the points (1,1,1),(-2,4,1),(-1,5,5) and (2,2,5) are the vertices of a square.

61. Find the point where the line through the points (1,2,3) and (4,-4,9) meets the zx-plane.
62. Find the point where the line joining the points (2,-3,1) and (3,-4,-5) cuts the plane $2x + y + z = 7$

DAY-7

63. Compute the following limits

a) $\lim_{x \to 4} \frac{x^3-64}{x^2-16}$ b) $\lim_{x \to a} \frac{\sqrt{3x}-\sqrt{2x+a}}{2(x-a)}$ c) $\lim_{x \to 64} \frac{\sqrt[6]{x}-2}{\sqrt[3]{x}-4}$

d) $\lim_{x \to \infty} (\sqrt{x} - \sqrt{x-3})$ e) $\lim_{x \to \infty} (\sqrt{x-a} - \sqrt{bx})$ f) $\lim_{x \to a} \frac{\sin(x-a)}{x^2-a^2}$

g) $\lim_{x \to 0} \frac{1-\cos 6x}{x^2}$ h) $\lim_{x \to y} \frac{\tan x - \tan y}{x-y}$ i) $\lim_{x \to y} \frac{\cos x - \cos y}{x-y}$ j) $\lim_{x \to c} \frac{\sqrt{x}-\sqrt{c}}{\sin x - \sin c}$

64. Discuss the continuity of function at the given point

i) $f(x) = \begin{cases} 2-x^2 & for\ x \le 2 \\ x-4 & for\ x > 2 \end{cases}$ at x=2

ii) $f(x) = \begin{cases} 2x+1 & for\ x < 1 \\ 2 & for\ x = 1 \\ 3x & for\ x > 1 \end{cases}$ at x=1

65. A function f(x) is defined as follows $f(x) = \begin{cases} \frac{2x^2-18}{x-3} & for\ x \neq 3 \\ k & for\ x = 3 \end{cases}$

Find the value of k so that f(x) is continuous at x=3

66. Find from definition the derivative of

i) $x^2 - 2$ ii) $\frac{1}{x}$ iii) $\frac{1}{x-1}$ iv) $\sqrt{1+x}$ v) $\frac{1}{\sqrt{3x+4}}$

67. Find the derivative of

i) $(a + \sqrt{x})$ (a-$\sqrt{x}$) ii) $\frac{x^2-a^2}{x^2+a^2}$ iii) $\frac{1}{\sqrt{a^n-x^n}}$

68. Use the chain rule find $\frac{dy}{dx}$ of

i) $y = 2u^2 - 3u + 1$ and $u = 2x^2$

ii) $y = \frac{t}{t^2-1}$ and $t = 3x^2 + 1$

69. Find from the first principles, the derivative of

i) $sin4x$ ii) $\cos^2 x$

70. Find the angle between the two lines whose direction cosines are proportional to 1,2,3 and 3,4,5

71. Find the angle between the lines whose direction ratio are 1,2,4 and -2,1,5