346925 DCCA-103(A)

I Semester B.C.A. Degree Examination, December/January - 2025/26
(NEP Scheme)
MATHEMATICS - I
Mathematical Foundation
Paper - I

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Time : 2½ Hours **Maximum Marks : 60**

***Instructions*:**

Answer All the Sections.

SECTION - A

Answer any Six of the following questions. **(6×2=12)**

1. Define Tautology.

2. Write truth table for $\sim p \vee \sim q$.

3. If U = {1, 2, 3, 4, 5, 6, 7}, A ={1, 3, 4, 7} and B = {2, 3, 5} then find A' and B'.

4. If A = {1, 3, 5} and B = {2, 4} then find A×B.

5. If $\begin{bmatrix} a+b & 1 \\ 1 & a-b \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ 1 & 1 \end{bmatrix}$ then find 'a' and 'b'.

6. Define scalar matrix. Give an example.

7. Find the value of $\begin{vmatrix} 1 & 4 & 7 \\ 3 & 2 & 1 \\ 5 & 0 & 4 \end{vmatrix}$.

8. If $y = 2x^2-3x+1$ then find $\frac{dy}{dx}$.

9. Evaluate $\lim_{x \to 2}[x^2 + 2x - 3]$.

[P.T.O.

SECTION - B

Answer any Four of the following questions. **(4×6=24)**

10. Prove that $(p \wedge q) \wedge \sim (p \vee q)$ is contradiction.

11. If A = {1, 4}, B = {2, 3, 6}, C = {2, 3, 7} then verify $A \times (B \cup C) = (A \times B) \cup (A \times C)$.

12. If $F : R \to R$ is defind by $f(x) = 2x + 3$. Prove that 'f' is one-one and onto.

13. Solve using cramer's rule

$$3x + 3y + 5z = 1$$
$$3x + 5y + 9z = 0$$
$$5x + 9y + 17z = 0.$$

14. Verify the Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 3 & 2 \\ 4 & 5 \end{bmatrix}$.

15. If $y = x^3 + 5x^2 - 11x + 6$ then find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 2$ and $x = 3$.

SECTION - C

Answer any Three of the following questions. **(3×8=24)**

16. a) Prove that $\sim (p \vee q) \equiv \sim p \wedge \sim q$.

b) Prove that $(p \wedge \sim q) \wedge (\sim p \vee q)$ is a contradiction.

17. a) Show that the relation R in the set {1, 2, 3} given by R = {(1, 2), (2, 1)} is symmetric but neither reflexive nor transitive.

b) Let A= {1, 2, 3, 4, 5} and B = {0, 3, 6} Find.

i) $A \cup B$

ii) $A \cap B$

iii) $A - B$

iv) $B - A$

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18. a) If $A = \begin{bmatrix} 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix}$ then prove that $(A')' = A$.

b) If $A + B = \begin{bmatrix} 5 & 3 & 1 \\ 2 & 4 & 6 \\ 1 & 0 & 2 \end{bmatrix}$ and $A - B = \begin{bmatrix} 1 & 7 & 5 \\ 0 & 2 & 4 \\ 5 & 4 & 2 \end{bmatrix}$ then find A' and B'.

19. a) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ by reducing to echelon form.

b) Find the eigen values for the matrix $A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$.

20. a) Find the maximum value of the function $f(x) = 3x - x^2$.

b) Find the minimum value of $f(x) = x^2$.