DCCA – 103 (A)

I Semester B.C.A. Examination, February/March 2024
(NEP Scheme) (Freshers and Repeaters)
MATHEMATICS – I
Mathematical Foundation

Time : 2½ Hours	Max. Marks : 60

Instruction : *Answer **all** the Sections.*

SECTION – A

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

1. Define proposition. Give an example.
2. Write truth table for $\sim p \vee \sim q$.
3. If A = {1, 2, 3, 4}, B = {3, 4, 7, 8} find $A \cup B$ and $B \cap A$.
4. Define union of two sets. Give an example.
5. If $A = \begin{bmatrix} 2 & -1 \\ 4 & 2 \end{bmatrix}, B = \begin{bmatrix} 4 & 3 \\ -2 & 1 \end{bmatrix}$ then find 2A + 3B.
6. Define square matrix. Give an example.
7. If G = {7, 8} and H = {5, 4, 2} then find $G \times H$ and $H \times G$.
8. If $y = 3x^4 - 2x^3 + x + 8$ then find $\frac{dy}{dx}$.
9. Evaluate $\lim_{x \to 2} [x^2 + 2x - 3]$.

SECTION – B

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

10. Prove that $(p \wedge q) \wedge \sim(p \vee q)$ is a contradiction.
11. If A = {1, 4}, B = {2, 3, 6} and C = {2, 3, 7} then verify $A \times (B \cup C) = (A \times B) \cup (A \times C)$.
12. Show that the function $f : R \to R$ given by f(x) = 2x is one-one and onto.

P.T.O.

13. Solve : $3x + 3y + 5z = 01$
$3x + 5y + 9z = 0$
$5x + 9y + 17z = 0$ by Cramer's rule.

14. Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ and hence find A^{-1}.

15. If $y = 5x^6 + 6x^5 + 4x^4 + 3x^2 + 2x + 1$ 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) Show that $(p \to q) \Leftrightarrow (\sim q \to \sim p)$ is a tautology.

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

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.

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

b) If $A=\begin{bmatrix} -1 & 2 \\ -1 & 3 \end{bmatrix}, B=\begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix}$ and $C=\begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix}$ then show that

$A + (B + C) = (A + B) + C$ and find $3B + 2C$.

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) Prove that the function $f(x) = 2x^3 - 21x^2 + 36x - 30$ is maximum at x = 1.

b) Find the minimum value of $f(x) = x^3 + 1$.