



DCCA – 103A

I Semester B.C.A. Examination, December 2024/January 2025

(NEP) (Repeaters)

MATHEMATICS

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 with an example.
2. Write the truth table for the proposition $\sim (p \rightarrow q)$.
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 $A = \{2,3,7\}$ and $B = \{4,8\}$ then find $A \times A$ and $A \times B$.
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 Null matrix with an example.
7. Find the value of $\begin{vmatrix} 1 & 4 & 7 \\ 3 & 2 & 1 \\ 5 & 0 & 4 \end{vmatrix}$.
8. If $y = 5x^4 - 9x^3 + 11x + 6$ then find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.
9. Find the value of $\lim_{x \rightarrow 3} x^2 - 5x + 4$.

SECTION – B

Answer **any four** of the following questions.

(4×6=24)

10. Prove that $(p \rightarrow q) \vee (\sim p \rightarrow q)$ is a tautology.
11. If $A = \{2,5\}$, $B = \{3,4,7\}$ and $C = \{3,4,8\}$ then show that $A \times (B - C) = (A \times B) - (A \times C)$.
12. Prove that a function $f : R \rightarrow R$ defined by $f(x) = 4x+3$ is a bijective function.

P.T.O.



13. Find the inverse of $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$.
14. Solve using Cramer's rule :
 $x - y + 2z = 7$
 $3x + 4y - 5z = -5$
 $2x - y + 3z = 12$.
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 $\sim (p \rightarrow q) \equiv p \wedge \sim q$.
 b) Verify whether $(p \wedge \sim q) \wedge (\sim p \vee q)$ is a contradiction or not.
17. a) Show that a function $f : R \rightarrow R$ defined by $f(x) = 2x - 5$ is one-one and onto.
 b) Show that the relation $R = \{(1,2), (2,1)\}$ defined on the set $A = \{1,2,3\}$ is symmetric but neither reflexive nor transitive.
18. a) Find the characteristic equation of $A = \begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$.
 b) If $A = \{1,2,3\}$, $B = \{0,1,3\}$ then find i) $A \cup B$ ii) $A \cap B$ iii) $A - B$ iv) $B - A$.
19. a) Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$$

by reducing to the echelon form.

- b) Verify the Cayley-Hamilton theorem

for the matrix $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$.

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