DCCA -- 103(A)

I Semester B.C.A. Examination, February/March 2023
(NEP Scheme)
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. Write the truth table for the proposition $\sim(p \wedge q)$.

2. Define a proposition. Give an example.

3. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4, 5\}$, $B = \{5, 6, 7, 8\}$ find A' and B'.

4. If $A = \{7, 8\}$ and $B = \{5, 4, 2\}$ find

   i) $A \times A$

   ii) $A \times B$.

5. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ find $3A + 4B$.

6. Define a Null matrix and give an example.

7. Find determinant of the matrix A, if $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$.

8. If $y = 3x^4 - 2x^3 + x + 8$ find $\dfrac{dy}{dx}$.

9. Find the value of $\lim\limits_{x \to 1} \left(\dfrac{x^3 - 8}{x - 2} \right)$.

P.T.O.

SECTION – B

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

10. Prove that $(p \leftrightarrow q) \leftrightarrow [(\sim p \vee q) \vee (\sim q \vee p)]$ is a tautology.

11. Prove that a function $f : R \rightarrow R$ defined by $f(x) = 2x - 3$ is a bijective function.

12. 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) $B - A$.

13. Find the inverse of $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$.

14. Find the Rank of the matrix $A = \begin{bmatrix} 0 & -1 & 5 \\ 2 & 4 & -6 \\ 1 & 1 & 5 \end{bmatrix}$.

15. If $y = x^3 - 6x^2 - 5x + 3$, find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at $x = 1$ and $x = 2$.

SECTION – C

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

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

    b) Verify whether $(p \wedge \sim q) \wedge (\sim p \vee q)$ is a contradiction or not.

17. a) Show that the relation $R = \{(1, 2), (2, 1)\}$ defined on the set $A = \{1, 2, 3\}$ is symmetric but neither reflexive nor transitive.

    b) Show that the function $f : R \rightarrow R$ given by $f(x) = 2x$ is one-one and onto.

18. a) If $A = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$, then prove that $(A')' = A$.

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

    i) $A + (B + C) = (A + B) + C$

    ii) $A(BC) = (AB)C$.

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) Find the characteristic equation of $A = \begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$.

20. a) Find the derivative of $y = x^3$ using first principle.

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

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