Q.P. Code: 34123

First Semester BCA Degree Examinations
May / June 2022
(2021-22 CBCS NEP Scheme)

Paper : NBA 0230 : MATHEMATICAL FOUNDATION (NEP)

Time : 2 Hrs. Max. Marks : 60

Note: Student can use calculator.

1. **Select the most appropriate answer from the options provided:** **(10x1=10)**

i. Which of the following is not one of the five main logic connectives.

(a) negation (b) conditional

(c) conjunction (d) Production

ii. The disjunction of two statements p and q is denoted by.....

a) p<–>q b) p–>q

c) p<–q d) p v q

iii. A and B are said to be _____ sets if no elements is common in them

a) equal b) disjoint

c) equivalent d) overlapping

iv. The set (A ∩ (B U C)) is equal to

(a) A U B U C (b) (A ∩ B) U (A U C)

(c) A' U C' U B' (d) None of the above

v. A matrix whose each element is zero is called _____ matrix.

a) scalar b) diagonal

c) null d) identity

vi. If $|A| \neq 0$ then the matrix is known as _____ matrix.

a) Singular b) transpose

c) non-singular d) none

vii. Which is the characteristic equation of matrix A =

a) $|A - \lambda I| = 0$ b) $|A| = 0$ c) $|\lambda - A| = 0$ d) $|A - \lambda| = 0$

viii. If $\begin{bmatrix} x+3 & -1 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} 6 & y \\ z-3 & 5 \end{bmatrix}$, then x = _____

a) 7 b) –1 c) 6 d) 3

ix. $\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$

a) 6 b) 9 c) 3 d) 0

x. The order of differential equation $3x^2 \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = 0$

a) 2 b) 0 c) 3 d) 1

Write a short notes on any FIVE of the following: **(5x3=15)**

2. Find the truth table of

i. $[(p \to q) \wedge (q \to r)] \to (p \to r)$ ii. $p \to (u\ p\ v\ q)$

3. Explain conjunction, disjunction and Biconditional.

4. Let A = {a, b, d, e}, B = {b, c, e, f} and C = {d, e, f, g}

i) Verify $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

ii) Verify $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

5. If f and g are two real valued functions defined as $f(x) = 2x + 1$, $g(x) = x^2 + 1$ then find f + g, f o g, g o f.

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

7. Find the eigenvalues of $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

8. Find the derivative of the function.

$f(x) = 2x^2 + 3x - 5$ at $x = -1$. Also show that $f'(0) + 3f'(-1) = 0$

9. If $y = (x^2 - 5)(x^3 - 2x + 3)$, find $\frac{dy}{dx}$

Answer any THREE questions from the following: **(3x5=15)**

10. Find whether the following compound statements are tautology or contradiction.

(a) $(p \to q) \leftrightarrow (\sim q \to \sim p)$

(b) $(p \to q)\ (q \to r)$

11. Let A = {0, 1, 2, 3} and a relation R on A be given by R = {(0, 0), (0, 1), (0, 3), (1, 0), (1, 1), (2, 2), (3, 0), (3, 3)}. Is R is equavalence relation ?

12. Define matrix. Explain any 8 types of matrices with example.

13. Find the adjoint of matrix $A = \begin{pmatrix} 5 & 2 & 0 \\ 2 & 5 & 0 \\ -3 & 4 & 6 \end{pmatrix}$

14. Find all the maxima and minima of f(x)

$f(x) = \frac{3}{4}x^4 + 8x^3 + \frac{45}{2}x^2 + 250$

Answer the following: **(2x10=20)**

15. a) Using truth table prove the following are logical equivalence.

i. $p <-> q \equiv (p \wedge q) \vee (\sim p \wedge \sim q)$

ii. $(p \wedge q) \rightarrow r \equiv P \rightarrow (q \rightarrow r)$

b) Explain Reflexive, Symmetric and transitive relation with example. **(5+5)**

OR

a) Define set. Explain any 4 operations on set using venn diagram.

b) Show that the function f(x) = 5x + 2 is bijective function from R to R. **(5+5)**

16. a) Verify the Cayley - Hamilton theorem

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

b) Solve by using Cramer's rule.

$$x + y + z = 6$$
$$2x + 3y - z = 5$$
$$6x - 2y - 3z = -7$$

(5+5)

OR

a) Find the maxima and minima value of the function $4x^3 - 18x^2 + 24x - 7$.

b) Prove that $\frac{d(x^n)}{dx} = n\,x^{n-1}$, where n is rational number.

c) Find second order derivatives of $Y = 3x^4 - 2x^3 + 4x^2 - 5x + 1$

(4+4+2)

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