Roll No. .....

42001

BCA (NEP) 4 Year 1st Semester (w.e.f. Dec.-2025) Examination – December, 2025

MATHEMATICS FOUNDATIONS TO COMPUTER SCIENCES-I

Paper : 25BCA401DS01

Time : Three hours] *[Maximum Marks : 50*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all. Question No. **1** is ***compulsory***. In addition to compulsory question, attempt ***four*** more questions selecting ***one*** question from each Unit. All questions carry equal marks.

1. ***Compulsory Question :*** $5 \times 2 = 10$

(i) Write the recurrence relation for the Fibonacci sequence and state the first two base cases.

(ii) Define a weighted graph. Write any two applications.

(iii) Draw a Venn diagram for $A \cap B'$.

(iv) Draw the digraph for the relation R on $A = \{a, b, c\}$.

$R = \{(a, b), (b, c), (c, a), (a, a)\}$

(v) Differentiate between indegree and outdegree in graph.

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UNIT – I

2. (a) Define the term set and how sets are represented with suitable example. Enlist all the set operation using suitable example and Venn diagram. 6

(b) Write down the following sets in tabular form : 4

(i) $\{x : x$ is an integer between $-3/2$ and $11/2\}$

(ii) $\{x : x = n^2, n \in N$ and $1 \leq n \leq 10\}$

(iii) $\{x : x = 6y, y \in N$ and $1 \leq y \leq 8\}$

(iv) $\{x : x^2 - 8x + 15 = 0\}$

3. (a) Let f, g be functions from N to N, where N is set of naturals numbers so that $f(x) = x^2 + 3x + 1$ & $g(x) = 2x - 3$. Find the composition function : 5

(i) fof

(ii) fog

(iii) gof

(iv) gog

(b) Differentiate between following : 5

(i) Logarithmic and Exponential function

(ii) Floor and Ceiling Function

UNIT – II

4. Explain the following with the help of example :

(a) Pigeonhole principle 5

(b) Tower of Hanoi 5

5. A sequence $a_1, a_2, a_3, \ldots\ldots$ Is defined by $a_1 = k$ and $a_{n+1} = 2a_n - 7$, for $n \geq 1$, where k is a constant : 10

(i) Find an expression for a_2 in terms of k.

(ii) Show that $a_3 = 4k - 21$

(iii) Given that $\sum_{r=1}^{4} a_r = 43$, find the value of k.

UNIT – III

6. (a) Define and distinguish between paths and cycles in a graph. What are the necessary and sufficient conditions for a graph to contain a Hamiltonian cycle and Euler circuit ? 5

(b) What is a directed graph ? How is it different from an undirected graph ? Describe, how graphs are represented. 5

7. Explain the following terms in context of tree with example and figure :

(i) Complete Binary Tree Vs Binary Tree 5

(ii) Spanning tree Vs Minimum Spanning Tree 5

UNIT – IV

8. (a) Find the value of x and y from the following : 5

$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$$

(b) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, then show that : 5

$$A^3 - 23A - 40I = 0$$

9. Explain the following with example.

(i) Orthogonal matrix 2.5

(ii) Multiplication of matrices 2.5

(iii) Inverse of matrix 2.5

(iv) Addition of matrices 2.5