

End Semester/Reappear (Semester II) Examination, May 2025

Programme: BCA
Course: Discrete Mathematics
Course Code: 3CCC106
Enrolment no. _____

Full Marks: 70
Time: 3 Hrs.

Section I

1. Short Answer type questions.

4 x 5 = 20

- a. If $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6\}$. Find A^c , union and intersection of sets A and B. **Evaluate CO1**

or

- If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$, verify that $(A \cup B)' = A' \cap B'$. **Analyze CO1**

- b. Let $A = \{1, 2, 3, 4\}$ and $B = \{a, b, c, d\}$ and Let $f = \{(1, a), (2, a), (3, d), (4, c)\}$. Is f and f^{-1} function? **Understand CO2**

or

Consider the following relation R on *set of integers* \mathbb{Z} given by $R = \{(i, j) : |i - j| = 2\}$. Is R reflexive and symmetric relation? **Analyze CO2**

- c. Discuss all derived Connectors with truth table. **Remember CO3**

or

Discuss Conditional and Bi-Conditional connectors with truth table. **Remember CO3**

- d. Define Hamiltonian graphs and draw a Hamiltonian graph. **Remember CO4**

or

Define in degree and out degree of vertices of digraph with example. **Remember CO4**

Section II

Long Answer type questions.

3 x 10 = 30

2. Show that the relation R on set of natural numbers given by

$$R = \{(a, b) \mid |a - b| \text{ is a multiple of } 4\} \text{ is an equivalence relation.} \quad \text{Analyze CO1}$$

or

If $A = \{2x \mid x \in \mathbb{N} \text{ and } 1 \leq x \leq 4\}$, $B = \{x + 2 \mid x \in \mathbb{N} \text{ and } 2 \leq x \leq 5\}$ and $C = \{x \mid x \in \mathbb{N} \text{ and } 4 < x < 8\}$ find $(A \cup B) \cap C$ and $(A - B) \cap C$. **Analyze CO1**

3. Generate the truth table for following (i) $A \oplus B \oplus C$ (b) $A \uparrow B \uparrow C$

(ii) Prove that $X \oplus Y \equiv (X \wedge \sim Y) \vee (\sim X \wedge Y)$ **Apply CO3**

or

Construct the truth table for the following statement

(i) $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ (ii) $p \leftrightarrow (\sim p \vee \sim q)$. **Apply CO3**

4. Discuss incidence matrix representation with example. **Analyze CO4**

or

Discuss representation of multi graph. Also draw the multi graph G whose adjacency matrix M_A is shown in figure **Apply CO4**

$$M_A = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

Section III

Application based questions. Answer any one.

1 x 20 = 20

5. a. Consider the function $f, g : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2 + 3x + 1$, $g(x) = 2x - 3$

Find the composition function (a) $f \circ f$ (b) $f \circ g$ (c) $g \circ f$ **Apply CO2**

b. Let $A = \{X \in \mathbb{Z} : 0 \leq X \leq 12\}$. Show that $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$ is Reflexive, Symmetric and Transitive. **Apply CO2**

or

a. Prove that cartesian product of two posets is again a poset.

Apply CO2

b. Find the domain and range of the real function, defined by $f(x) = 1 / (1 - x^2)$.

Apply CO2
