

Exam Seat No :

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B.E 3rd SEMESTER EXAMINATION (April 2025)

SUBJECT: Discrete Mathematics (Code: CC302B N)

Date: 23/04/2025

Time: 3 hour

Marks: 70

Instruction:

1. Answer each section in separate Answer Sheet.
2. Use of scientific Calculator is permitted.
3. All questions are compulsory.
4. Indicate clearly the option you attempted along with its respective question number.
5. Use the last page of main supplementary for rough work.

Section:1

Q.1 (a) Let $A = \{a, b, c, d\}$ and $B = \{1, 2, 3\}$. Let R be relation define from set A [05]
to set B and is given as $R = \{(a, 1), (a, 2), (b, 1), (c, 2), (d, 1)\}$. Find matrix
relation M_R . Also, Draw arrow diagram.

(b) Draw the Hasse Diagram for the following POSETs and Where D is the
Division Relation. [05]
(i) $\langle S_{12}, D \rangle$ (ii) $\langle S_{1001}, D \rangle$

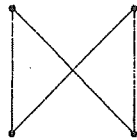
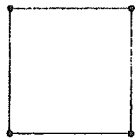
(c) Show that fourth root of unity form a group under multiplication. [05]

OR

(c) Let p , q and r be the statement then construct the truth table for the [05]
statement formula A , $A : (\sim (p \vee q)) \rightarrow (q \wedge p)$.

Q.2 (a) Prove that the set $G = \{0, 1, 2, 3, 4\}$ is an abelian group under addition modulo [05]
5.

(b) Prove that the pair of the graphs are isomorphic [05]



OR

Q.2 (a) Prove that $\langle \{1, 2, 2^2, 2^3, 2^4, \dots\}, D \rangle$ is are poset and chain. [05]

(b) Prove that (S_3, o) is non-abelian permutation group. [05]

Q.3 (a) Show that $\langle \mathbb{N}, \leq \rangle$ is Poset. where relation " \leq " is smaller or equal. [05]

(b) Show that $\langle S_{1001}, D \rangle$ is lattice.

OR

Q.3 (a) If p and q are any two statement then verify, $\sim (p \leftrightarrow q) = \sim p \leftrightarrow q = p \leftrightarrow \sim q$. [05]

(b) Define following terms with graph

- (i) Tree
- (ii) Rooted tree
- (iii) Forest tree

Section:2

- Q.4** (a) Prove that H is subgroup of the group G and also find the all the cosets for H where $(G = Z_6, +_6)$ and $(H = \{0, 3\}, +_6)$ [05]
- (b) Prove that Sub group $H = \{1, -1\}$ is normal subgroup for the group $\langle G = \{1, -1, i, -i\}, \times \rangle$. [05]
- (c) Define the following terms of Directed graph with example. [05]
 (i) Directed graph (ii) Isolated and Pendant vertex. (iii) Incident and adjacent relation (iv) In degree and Out degree (v) Multiple edges

OR

- (c) Define the following terms with example and truth table . [05]
 (i) Negation (ii) Conjunction (iii) Disjunction
- Q.5** (a) Let $R = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 3), (3, 3), (2, 2), (3, 2), (3, 4), (4, 4), (4, 1), (4, 3)\}$ be the relation define on set $A = \{1, 2, 3, 4\}$ then find the matrix for relation R , draw its diagram and also find in-degree and out-degree. [05]
- (b) Show that $\langle S_{30}, *, \oplus, 0, 1, ' \rangle$ is boolean algebra. [05]

OR

- Q.5** (a) Define lattice as poset and Prove that $\langle P(A), \leq \rangle$ is lattice for $A = \{a, b\}$. [05]
- (b) Let $f : \mathbb{Z} \rightarrow \mathbb{Z}$ be define by $f(x) = 9x + 5$. Then check that f is one-one and onto. [05]
- Q.6** (a) Define the following terms for Undirected graphs with example. [05]
 (i) Complete Graph (iv) Path
 (ii) Regular Graph (v) Walk.
 (iii) Simple Graph
- (b) Expressed the boolean expression $x_1 * x_2$ in an equivalent sum of products canonical form of three variable. [05]

OR

- Q.6** (a) Define Join Irreducible and Meet Irreducible. Find the Join Irreducible, Meet Irreducible, Atom, and Antiatom of the Lattice $\langle S_{70}, D \rangle$, [05]
 where $S_{70} = \{1, 2, 5, 10, 14, 35, 70\}$.
- (b) Find the number of positive integers ≤ 200 and divisible by 2 or 5. Using set theoretical argument and venn diagram [05]

