

H

Roll No.

TMC-105(3)

M. C. A. (FIRST SEMESTER)

MID SEMESTER

EXAMINATION, Oct., 2023

DISCRETE STRUCTURE AND

COMBINATORICS

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any *one* of the sub-questions.

(ii) Each sub-question carries 10 marks.

1. (a) Draw the Hasse diagram for the divisibility relation on the following sets :

(CO1)

(i) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

(ii) {1, 2, 5, 8, 16, 32}

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(2)

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OR

- (b) The relation R on a set $A = \{1, 2, 3, 4\}$ is defined by $R = \{(1, 3), (1, 4), (3, 2), (3, 3), (3, 4)\}$. Draw the directed graph of R and hence R^{-1} . (CO1)

2. (a) Let $A = \{1, 2, 3, 4\}$ and consider the relation $R = \{(1, 1), (2, 1), (2, 2), (3, 1), (3, 3), (3, 4), (4, 4)\}$. Show that R is a partial order relation. (CO1)

OR

- (b) Show that the mapping $f : R \rightarrow R$ be defined by $f(x) = ax + b$, where $a, b, x \in R$, $a \neq 0$ is invertible. Define its inverse. (CO1)

3. (a) Show that the following statement is a tautology : (CO2)

$$(\sim P \wedge (P \rightarrow Q)) \rightarrow \sim Q$$

(3)•

OR

- (b) Use the principle of Mathematical induction to verify that, for n any positive integers $6^n - 1$ is divisible by 5. (CO2)

4. (a) Show that $(p \vee q) \wedge (\sim p \wedge \sim q)$ is a contradiction. (CO2)

OR

- (b) There are two restaurants next to each other one has signboard that says "Good food is not cheap" and other has signboard that says "cheap food is not good." Are the sign board saying same thing. (CO2)

5. (a) Use truth table to show that : (CO2)

$$p \rightarrow q \equiv \sim p \vee q$$

OR

- (b) Prove the following propositions are tautology : (CO2)

(i) $p \vee \sim p$

(ii) $\sim(p \wedge q) \vee q$