

(4)

TMC-104

OR

- (b) (i) Write converse and contrapositive of the following statement : (CO1)

Indian teams win whenever match is played in Kolkata; hometown of Ganguly.

- (ii) Write the Disjunctive normal form of

$$Q \vee (P \wedge R) \wedge \neg((P \vee R) \wedge Q).$$

TMC-104

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TMC-104

M. C. A. (FIRST SEMESTER)

MID SEMESTER

EXAMINATION, Nov., 2022

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 poset  $(P(S), \subseteq)$ , where  $S = \{1, 2, 3, 4\}$ . (CO4)

OR

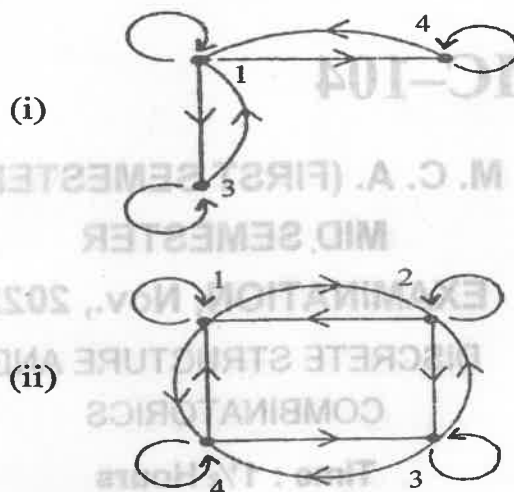
- (b) Determine whether the relation with directed graphs is an equivalence relation.

(CO4)

P. T. O.

(2)

TMC-104



2. (a) State and prove the De Morgan's laws using truth table. (CO1)

OR

- (b) Show that the following statement is a tautology : (CO1)

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

3. (a) Define the inverse of a function. When does a function have an inverse? Does the function  $f(n) = 10 - n$  from the set of integers to the set of integers have an inverse? If so, what is it? (CO4)

(3)

TMC-104

OR

- (b) Let  $f: \mathbb{R}^+ \rightarrow \mathbb{R}^+$  and  $g: \mathbb{R}^+ \rightarrow \mathbb{R}^+$  be function defined by  $f(x) = \sqrt{x}$  and  $g(x) = 3x + 1$  for all  $x \in \mathbb{R}^+$ , find  $f \circ g$  and  $g \circ f$ . (CO4)

4. (a) Prove or disprove the validity of the following arguments using the rules of inference. (CO2)

- (i) All men are fallible
- (ii) All kings are men
- (iii) Therefore, all kings are fallible

OR

- (b) Define logical implication. Also show that  $((P \vee Q) \wedge \neg Q) \rightarrow P$  is a logical implication. (CO2)
5. (a) Use the Principle of Mathematical Induction to verify that, for  $n$  any positive integers  $6^n - 1$  is divisible by 5. (CO1)

P. T. O.