



SPRING MID SEMETER EXAMINATION-2022

Subject: **Discrete Mathematical Structure**

Code: **MA2013**

B.Tech  
4th Semester (Regular)  
SAS-2023(SET-01)

Full Marks: 20

Time: 1.5 Hrs

Answer any FOUR QUESTIONS including question No. 1 which is compulsory. The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only

1. Answer the following questions [5×1=5]
  - (a) What is negation of the statement “All poor people are sad.”
  - (b) State which rule of inference is used in the argument: “If it rains today, the University will close. The University is not closed today. Therefore, it did not rain today.”
  - (c) Translate the English sentence into propositional logic. “Fido is neither a dog nor a cat, but rather a goose.”
  - (d) Write the no of reflexive and symmetric relations of a set with  $n$  distinct elements.
  - (e) Express the proof technique in mathematical induction as a rule of inference.
2. (a) Suppose  $x$  is a real number. Consider the statement “If  $x^2 = 4$ , then  $x = 2$ .” Construct its converse, inverse, and contrapositive. Also determine the truth values of each of the statement. [3]  
(b) Show that the statements  $\sim(p \vee (\sim p \wedge q))$  and  $\sim p \wedge \sim q$  are logically equivalent. [2]
3. (a) What is strong mathematical induction? Use it to prove  $a_n = 2n - 1$  for all  $n \in \mathbb{N}$ , where  $a_1 = 1, a_2 = 3$  and  $a_n = 2a_{n-1} - a_{n-2}$  for  $n \geq 3$ . [3]  
(b) Use De Morgan’s law to write the negation the following statement, simplifying so that only simple statements are negated. “If Phoebe buys a pizza, then Calvin buys popcorn.” [2]
4. (a) Given  $R$  is a relation on the set of integers defined by  $R = \{(x, y) | x^2 \equiv y^2 \pmod{4}\}$ . Is the relation  $R$  reflexive, symmetric, antisymmetric, or transitive? [3]  
(b) How many integers are there between 1 and 1000 which are not divisible by 2,3,5 or 7. [2]
5. (a) Show that the premises “A student in this class has not read the book” and “Everyone in this class passed the first exam” imply the conclusion “Someone who passed the first exam has not read the book”. [3]  
(b) If  $R$  and  $S$  are relations defined on the set of integers given by  $R = \{(x, y) | x > y\}$  and  $S = \{(x, y) | x < y\}$  then find  $R \cup S, R \cap S, R - S$  and  $R \oplus S$ . [2]

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