B. Tech.
Fourth Semester (_*AB & Back)*
Spring 2023-2024 (SAS)

MID SEMETER EXAMINATION, SPRING 2023-2024
Subject: Discrete Mathematics
Code: MA21002

Full Marks: 20 **Time: 90 minutes**

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.
All parts of a question should be answered at one place only.

Q.1 **Answer the following Questions**

a) Let p: It is below freezing, q: It is snowing.
Express the English sentence "That it is below freezing is necessary and sufficient for it to be snowing" as a proposition using p, q, and logical connectives. [1]

b) Find the converse and contrapositive of the conditional statement "I come to class whenever there is going to be a quiz." [1]

c) What is the negation of the statement "All Indians eat vegetables" [1]

d) How many reflexive relations are there if the relation is defined on a set with 5 elements. [1]

e) Find the power set of the set $A = \{\varphi, \{\varphi\}\}$ [1]

Q.2

a) Show that $p \wedge (q \vee r)$ and $(p \wedge q) \vee (p \wedge r)$ are logically equivalent. [2.5]

b) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology by developing a series of logical equivalences. [2.5]

Q.3

a) Using mathematical induction prove that for every positive integer n, [2.5]

$$1.2 + 2.3 + 3.4 + \ldots\ldots\ldots + n(n+1) = \frac{n(n+1)(n+2)}{3}.$$

b) Find M_{R^3}, where $R = \{(1,1), (1,3), (2,2), (3,1), (3,3)\}$ is a relation on $A = \{1,2,3\}$. [2.5]

Q.4

a) How many positive integers are not exceeding 1500 is divisible by 7, 13, or 21. [2.5]

b) Show that the argument form is valid using rules of inference with premises $(p \wedge t) \rightarrow (r \vee s), q \rightarrow (u \wedge t), u \rightarrow p, \neg s$ and conclusion $q \rightarrow r$. [2.5]

Q.5 Find reflexive closure and symmetric closure of the relation $R = \{(p,q), (q,p), (q,r), (r,s), (s,p)\}$ on the set $A = \{p,q,r,s\}$ Find the transitive closure of R using Warshall's algorithm. [5]

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