MID-SEMESTER EXAMINATION, February-2023
DISCRETE MATHEMATICS (CSE 1002)

Programme:B.Tech
Full Marks: 30

Semester:1st
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Able to analyze and apply rules of logic to distinguish between valid and invalid arguments and use them to prove mathematical statements.	L1, L3, L3, L2, L2, L3	1(a),1(b), 1(c),2(a), 2(b),2(c)	2, 2, 2, 2, 2, 2,
Able to understand sets, their various operations and use them to analyze functions and its various concepts as well as study sequences and summations.	L3, L3, L3	3(a),3(b), 3(c)	2, 2, 2
Able to analyze the searching and sorting algorithms and use the growth of functions to study the time complexity of algorithms as well as apply some of the important concepts of number theory to divisibility and modular arithmetic, integer representation of algorithms, congruences and cryptography.	L2, L3, L3, L3, L3, L3	4(a),4(b), 4(c) 5(a), 5(b),5(c)	2, 2, 2, 2, 2, 2

Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Applying (L3), Analysing (L4), Evaluating (L5), Creating (L6)

Answer all questions. Each question carries equal mark.

1. (a) State the converse, contrapositive and inverse of the given conditional statement.   2
   'I go to the beach whenever it is a sunny summer day.'

   (b) Determine whether $(p \rightarrow r) \vee (q \rightarrow r)$ and $(p \wedge q) \rightarrow r$ are logically equivalent or not.   2

   (c) Use a proof by contradiction to prove that if n is an integer and $3n+2$ is even, then n is even.   2

2. (a) Translate the following statement into a logical expression using predicates, quantifiers and logical connectives. 2

'Atleast one of your friends is perfect.'

(b) Translate the following logical expression into English, where the domain for each variable consists of all real numbers. 2

$$\forall x \forall y \exists z (xy = z)$$

(c) Use rules of inference to show that the hypotheses 'Randy works hard.' 'If Randy works hard, then he is a dull boy.' and 'If Randy is a dull boy, then he will not get the job.' imply the conclusion 'Randy will not get the job.' 2

3. (a) Show that if A and B are sets, then $A \cap (B - A) = \phi$. 2

(b) Determine whether the function $f : Z \times Z \to Z$ is onto if 2

$$f(m, n) = m + n + 1.$$

(c) Evaluate $\sum_{i=0}^{2} \sum_{j=0}^{3} i^2 j^3$. 2

4. (a) Convert $(135AB)_{16}$ to binary notation. 2

(b) Use the binary search algorithm to search for 9 in the sequence 2

$$1, 3, 4, 5, 6, 8, 9, 11$$

(c) Determine whether $3x^2 + 8x \log x$ is $O(x^2)$. 2

5. (a) Express the greatest common divisor of 124 and 323 as the linear combination of these integers. 2

(b) Solve the congruence $2x \equiv 7 \pmod{17}$. 2

(c) Define Carmichael number and determine whether 1729 is a Carmichael number or not. 2

End of Questions