MID SEMESTER EXAMINATION, OCTOBER-2018
DISCRETE MATHEMATICS (CSE 1002)

Programme:B.Tech

Full Marks: 30

Semester:1st

Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Mark
Analyze and apply rules of logic to distinguish between valid and invalid arguments, prove mathematical statements and verify the correctness of program.	L1, L3, L3, L2, L3,L3	1(a),1(b), 1(c),2(a), 2(b), 2(c)	2,2, 2,2, 2,2
Analyze the searching and sorting algorithms and use the growth of functions to study the time complexity of algorithms.	L3, L3, L3	3(a),3(b), 3(c)	2,2, 2
Apply some basic concepts of number theory to solve various problems.	L3, L3, L3	4(a), 4(b), 4(c)	2,2, 2
Analyze the syntax and semantics of SC and use the SC rules to test and justify the soundness of arguments and perform the SC derivations.	L3, L3, L3	5(a), 5(b), 5(c),	2,2, 2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) State the converse, contrapositive and inverse of the given conditional statement.

    'I come to class whenever there is going to be a quiz.'

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

    (c) Determine whether $(p \vee q) \wedge (\neg p \vee r) \to (q \vee r)$ is a tautology or not. 2

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

    'All your friends are perfect.'

    (b) Use rules of inference to show that the premises *'It is not sunny this afternoon and it is colder than yesterday,' 'We will go swimming only if it is sunny,' 'If we do not go swimming, then we will take a canoe trip'* and *'If we take a canoe trip, then we will be home by sunset'* imply the conclusion *'We will be home by sunset'*. 2

    (c) Use a proof by contradiction to prove that the sum of an irrational number and a rational number is irrational. 2

3. (a) Use the binary search algorithm to search for 9 in the sequence   2
$$2,4,5,6,8,9,10,11$$

(b) Use the bubble sort to sort 3, 1, 5, 7, 4 showing the lists   2
obtained at each step.

(c) Show that $x \log x$ is $O(x^2)$.   2

4. (a) Determine the greatest common divisor of 7 and 26 and   2
express it as a linear combination of 7 and 26.

(b) Determine an inverse of 4 modulo 9.   2

(c) Solve the congruence $4x \equiv 5 (\text{mod } 9)$.   2

5. (a) Identify whether the given expression is an SC sentence or not   2
and if it is an SC sentence then sketch it's tree structure.
$$((P \vee \neg Q) \rightarrow S)$$

(b) Show that the following set of sentences is satisfiable.   2
$$\{A \vee (B \vee \neg C), \ \neg A \wedge P, \ P \rightarrow \neg B, \ C \leftrightarrow A\}$$

(c) Show that S is not a tautological consequence of   2
$$\Gamma = \{(Q \rightarrow P), (R \vee S), (R \rightarrow P)\}.$$

End of Questions

A = F

B = ~~V~~ F

C = F

P = T

π `F V (T V 7F)

F V (T V T)

F V T = T

7 F ∧

T ∧ T

T

T → 7F

T → ~~M~~ 7

~~F~~ T

7×4 -