Printed Pages: 02 **Sub Code: NOE048 / EOE048**

Paper Id: | 1 | 9 | 9 | 4 | 1 | 8 | **Roll No.** | | | | | | | | | | |

B.TECH

(SEM IV) THEORY EXAMINATION 2017-18

DISCRETE MATHEMATICS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. Define power set? Also find power set of a set A = { Ø, { Ø}}

b. Define a relation R which is neither reflexive nor irreflexive but symmetric and transitive for a set A= { 1, 2, 3, 4}.

c. Define truth table of a statement of two variables which is always true

d. Find a formula F that uses the variable p, q and r such that F is a contradiction.

e. Write a recurrence relation of homogeneous and non homogeneous both of order 2 and degree 2.

f. Define generating function with example.

g. Define semi-group.

h. Define permutation group.

i. Give an example of graph which is connected, regular and complete.

j. What is DFA machine?

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Define relations and its different representations. Let S be a binary relation defined as S = { (a, b) : a – b ≤ 3 and a, b ∈ R}. Determine whether S is reflexive, symmetric, anti-symmetric and transitive

b. Define proposition and its connectives. Also prove that $(p \vee q) \rightarrow (p \wedge q)$ is logically equivalent to $p \leftrightarrow q$.

c. Solve the recurrence relation

$$a_n - 4a_{n-1} + 4a_{n-2} = 1, \forall\ n \geq 2 \text{ with } a_0 = 0, a_1 = 1$$

d. What is abelian group? Also show that the set of rational numbers Q forms a group under the binary operation * defined by a* b = a+b-ab, ∀a,b∈Q. is this abelian group?

e. Define tree and its properties. Also explain preorder, inorder and postorder of tree with the help an example.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Define function and its type with example.

(b) To prove that $X - (Y \cup Z) = (X - Y) \cap (X - Z)$

Also verify for the set $X = \{1,2,3\}$, $Y = \{2,3,4\}$, $Z = \{1,2,3\}$

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the quantifiers in details. Also write the following English language into symbolic statement.

"Every students of this class is either hosteller or non-hosteller"

(b) Define converse, inverse and contra-positive statements. Also write converse, inverse and contra-positive statements for the following statement.

" If I will secure position in university then I will be awarded by university"

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Define recurrence relation of n^{th} order. Solve the following recurrence relation with $a_0 = a_1 = 3$,

$a_n = 5a_{n-1} + a_{n-2}$, $n > 1$

(b) What is mathematical induction? Also prove that $n < 2^n$ for all positive integral value of n.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is Ring? Prove that set I of all integers is a ring with respect to addition and multiplication of integers as the ring composition.

(b) Show that the set of all n^{th} roots of unity forms a group with respect to multiplication

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Make a Binary search tree for the following sequence of numbers:

76, 45, 36, 23, 89, 115, 98, 39, 41, 56, 69, 48.

Also find the preorder, inorder and postorder of the resultant tree.

(b) Define NFA machine. Design a NFA machine for the language ending with ab over $\sum = \{ a, b \}$. Also convert into its equivalent DFA machine.