Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.C.A.- SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 620007 Date: 31-12-2012

Subject Name: Theory of Computation

Time: 02:30 pm – 05:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (i) List the elements of $2^{\{1,2,3\}}$ **14**

(ii) Describe logical quantifiers.

(iii) Define relation and its properties: reflexive, symmetric and transitive.

(iv) Distinguish L^* and L^+

(v) Give example of a function which is one-to-one but not onto.

(vi) State the principle of mathematical induction.

(vii) Give recursive definition of Palindrome over Σ.

Q.2 (a) Answer the following

(1) In each case, find a string of minimum length in {0,1}* **NOT** in the language corresponding to the given regular expression. **03**

(i) 1*(01)0*

(ii) (0*+1*)(0*+1*)(0*+1*)

(iii) 1*(0+10)*1*

(2) Find a regular expression corresponding to each of the following subsets of {0,1}* **04**

(i) The language of all strings containing at least two 0's

(ii) The language of all string in which the number of 0's is even.

Q.2 (b) Define finite automaton. Draw an FA recognizing the following languages. **07**

(i) A language over {a, b} where all strings containing substring ab or bba.

(ii) A language over {0, 1} where all strings that do not end with 01.

OR

Q.2 (b) 1. Prove that √2 is Irrational **04**

2. Give example of following relations. **03**

(i) Transitive but not reflexive.

(ii) Symmetric but not transitive.

(iii) Equivalence relation (other than =).

Q.3 (a) Define NFA. For the regular expression aa(ba)* + b*aba* draw an NFA-□ **07**

(b) 1. An NFA with states 1-5 and input alphabet {a, b} has the following transition table. **04**

q	δ(q,a)	δ(q,b)
1	{1,2}	{1}
2	{3}	{3}
3	{4}	{4}
4	{5}	ϕ
5	ϕ	{5}

Draw NFA and FA.

2. Give the recursive definition of δ^* for an NFA. **03**

OR

Q.3 **(a)** Define regular languages and Regular expressions over ∑. **07**
Describe how the accepting states are considered in the FA for L1 U L2, L1 ∩ and L1 – L2 is drawn.

(b) Draw NFA-□ and Transition table for the language **07**
{0}*({01}*{0}*. Convert it to NFA and FA.

Q.4 **(a)** Find minimum FA for the following FA **07**
Q={1,2,3,4,5,6,7} A={2,6} and q0=1.

State	a	b
1	2	3
2	4	5
3	6	7
4	4	5
5	6	7
6	4	5
7	6	7

(b) (i) State the pumping lemma for regular languages. Prove that the language L = {ww | w ε {0,1}} is not regular. **07**

OR

Q.4 **(a)** Define Context-Free Grammar. Describe and Derive a CFG for the language {x ε {0,1}* | n0(x) ≠ n1(x) } **07**

(b) Write a note on PDA. Design a PDA for L = { x ε {0,1}* | n0(x) > n1(x)} **07**

Q.5 **(a)** Define Turing machine. Draw and describe a TM accepting the language of palindromes over {a,b}. **07**

(b) What do you mean by unambiguous Context free grammar? State ambiguous and unambiguous grammar for the algebraic expression involved operations +, -, * and /. **07**

OR

Q.5 **(a)** State the Chomsky Normal Form. Convert the following CFG into Comsky Normal Form **07**

S → ABAC
A → aAb | □
B → aBa | bBb | □
C → aC | a

(b) Write a note on recursively enumerable languages. **07**