## **GUJARAT TECHNOLOGICAL UNIVERSITY** M.C.A.- SEMESTER – II • EXAMINATION – WINTER 2012

•		code: 620007 Date: 31-12-2012 Name: Theory of Computation	Date: 31-12-2012		
Time	e: 02	2:30 pm – 05:00 pm Total Marks: 70 ions:			
	1. 2.	Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.			
Q.1		<ul> <li>(i) List the elements of 2<sup>{1,2,3}</sup></li> <li>(ii) Describe logical quantifiers.</li> <li>(iii) Define relation and its properties: reflexive, symmetric and transitive.</li> <li>(iv) Distinguish L* and L+</li> <li>(v) Give example of a function which is one-to-one but not onto.</li> <li>(vi) State the principle of mathematical induction.</li> <li>(vii) Give recursive definition of Palindrome over Σ.</li> </ul>	14		
Q.2	(a) (1)	Answer the following	03		
	(2)		04		
Q.2	(b)	<ul> <li>Define finite automaton. Draw an FA recognizing the following languages.</li> <li>(i) A language over {a, b} where all strings containing substring ab or bba.</li> <li>(ii) A language over {0, 1} where all strings that do not end with 01.</li> </ul>	07		
Q.2	(b)		04 03		
Q.3	(a) (b)	Define NFA. For the regular expression $aa(ba)^* + b^*aba^*$ draw an NFA- 1. An NFA with states 1-5 and input alphabet {a, b} has the following transition table. $ \frac{q  \delta(q,a)  \delta(q,b)}{1  \{1,2\}  \{1\}} $ $ \frac{q  \delta(q,a)  \delta(q,b)}{2  \{3\}  \{3\}} $ $ \frac{q  \{3\}  \{4\}  \{4\}}{4  \{5\}  \Phi} $ $ \frac{q  \{5\}  \Phi}{5  \Phi}  \{5\} $	07 04		
		Draw NFA and FA. 2. Give the recursive definition of $\delta^*$ for an NFA.	03		

OR

- Define regular languages and Regular expressions over  $\Sigma$ . 07 Q.3 **(a)** Describe how the accepting states are considered in the FA for L1 U L2,  $L1 \cap$  and L1 - L2 is drawn.
  - Draw NFA- and Transition table for the language 07 **(b)** {0}\*({01}\*{0}\*. Convert it to NFA and FA. 07
- Q.4 Find minimum FA for the following FA **(a)** 
  - $Q = \{1, 2, 3, 4, 5, 6, 7\}$  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	

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

OR

- Q.4 **(a)** Define Context-Free Grammar. Describe and Derive a CFG for the 07 language {x  $\epsilon$  {0,1}\* | n0(x)  $\neq$  n1(x) }
  - Write a note on PDA. Design a PDA for  $L = \{x \in \{0,1\}^* | n0(x) > n1(x)\}$ **(b)** 07
- (a) Define Turing machine. Draw and describe a TM accepting the language of 07 Q.5 palindromes over {a,b}.
  - (b) What do you mean by unambiguous Context free grammar? State ambiguous 07 and unambiguous grammar for the algebraic expression involved operations +, -, \* and /.

OR

- Q.5 State the Chomsky Normal Form. Convert the following CFG into Comsky 07 (a) Normal Form
  - $S \rightarrow ABAC$
  - $A \rightarrow aAb \mid$
  - $B \rightarrow aBa | bBb |$
  - $C \rightarrow aC \mid a$
  - (b) Write a note on recursively enumerable languages.

07