

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**MCA Sem-II Examination July 2010****Subject code: 620007****Subject Name: Theory of Computation****Date: 09 / 07 /2010****Time: 11.00 am – 01.30 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
- 4.

- Q.1** (a) Define surjection, injection and bijection. **05**
- (b) Explain $p \rightarrow q$ and $p \Rightarrow q$. **05**
- (c) Find regular expression for **04**
- (i) Only two 0 and 1 in any order.
 - (ii) String doesn't end with 11.
- Q.2** (a) Give recursive definition for **04**
- Set of all strings in $\{0,1\}^*$ containing substring 00.
- (b) Prove that if either of a and b is even number the $a*b$ is even number. **03**
- (c) Draw FA to recognize the following languages defined over $\{0,1\}^*$. **07**
- (i) $(0+1)^*(110)$
 - (ii) Language containing string of exactly two zeros.
- OR**
- (c) Find languages corresponding to following CFG production. **07**
- (i) $S \rightarrow aSa \mid bSb \mid \Lambda$
 - (ii) $S \rightarrow aS \mid bS \mid a$
 - (iii) $S \rightarrow aSb \mid bSa \mid \Lambda$
- Q.3** (a) Given that $L1 = \{x \in (0,1)^* \mid x \text{ ends with } 01\}$ **07**
- $L2 = \{x \in (0,1)^* \mid x \text{ ends with } 11\}$
- Give FA for $L1$, $L2$ and $L1 \cup L2$.
- (b) Define NFA and $\bar{\phi}^*$ for NFA. **07**
- OR**
- Q.3** (a) Find minimal FA for following FA. **07**

$$Q = \{1,2,3,4,5,6\} \quad A = \{3,6\} \quad \text{and} \quad q_0 = 1$$

State	input - a	input -b
1	2	6
2	1	3
3	2	4
4	4	2
5	4	5
6	5	4

- (b) Explain NFA - Λ . What are different kind of non-determinism possible in NFA - Λ ? Also define Λ closure. **07**

- Q.4 (a)** Let $M = (Q, \Sigma, q_0, \delta, A)$ where $Q = \{a,b,c,d\}$, $q_0 = a$ and $A = \{d\}$ and δ is given as follows. **07**

State	input - 0	input -1
a	{b,d}	{c,d}
b	{b}	{d}
c	{d}	{c}
d	Φ	Φ

Give transition diagram for above NFA & find whether string 100101 will be accepted by it or not.

- (b)** Give transition table for deterministic PDA recognizing following languages. **07**
 $\{x \in (a,b)^* \mid N_a(x) > N_b(x)\}$

OR

- Q.4 (a)** Let NFA - $\hat{}$ machine $M = (Q, \Sigma, q_0, \delta, A)$ where $Q = \{a,b,c,d\}$ and $A = \{d\}$ and δ is given as follows. **07**

State	input - 0	input -1	$\hat{}$
a	{d}	{c,d}	{b}
b	{b}	{d}	{c}
c	{d}	{c}	{a}
d	Φ	Φ	Φ

Find equivalent NFA and FA for above NFA - $\hat{}$.

- (b)** Draw Turing machine to accept palindromes over $\{a, b\}$. **07**

- Q.5 (a)** Consider CFG with production **05**
 $S \rightarrow S+S \mid S-S \mid S*S \mid S/S \mid (S) \mid a$

Draw derivation trees corresponding to two different left most derivation of $a + (a * a) / a - a$.

- (b)** Write a short note on recursive enumerable and recursive language. **05**
(c) Construct Turing machine to reverse a string. **04**

OR

- Q.5 (a)** Convert following grammar into Chomsky normal form. **05**
 $S \rightarrow AACD$
 $A \rightarrow aAb \mid \hat{}$
 $C \rightarrow aC \mid a$
 $D \rightarrow aDa \mid bDb \mid \hat{}$

- (b)** Define & describe PDA. **05**
(c) Draw NFA - $\hat{}$ corresponding to following regular expression over $\Sigma = \{0,1\}$. **04**
 $010^* + 0(01+10)^*11$
