T.E. (Computer) (Semester – I) Examination, 2010
THEORY OF COMPUTATIONS
(2003 Course)

Time : 3 Hours Max. Marks : 100

***Instructions** :1) Answer **three** questions from **each** Section.*
*2) Answer to the **two** Sections should be written in **separate** answer books.*
*3) **Neat** diagrams must be drawn **whenever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) Assume suitable data, if **necessary**.*

SECTION – I

1. a) Construct a NFA that accept the set of strings in (0+1)* such that some two 0's are separated by string whose length is 4i, for some i>=0. 6

b) For each of the following regular expression, draw an Finite Automata recognizing the corresponding language 8

1) (1+10+110)*0

2) 1(01+10)*+0(11+10)*

3) (010+00)*(10)

4) 1(1+10)*+10(0+01)*

c) Prove : 4

a) $\Phi^* = \in$

b) <u>(r*s*) = (r+s)*</u>.

OR

2. a) A transition table is given for another NFA with NULL with seven state. 6

q	δ(q,a)	δ(q,b)	δ(q,∅)
1	{5}	∅	{4}
2	{1}	∅	∅
3	∅	{2}	∅
4	∅	{7}	{3}
5	∅	∅	{1}
6	∅	{5}	{4}
7	{6}	∅	∅

a) Draw a transition diagram b) Calculate $\delta^*(1,ba)$.

b) Give the Mealy and Moore machine for the following processes. "For input from (0+1)*, if inputs ends in 101, output X; if input ends in 110, output Y, otherwise output Z". 8

c) Let L be a language. It is clear from the definition that $L^+ \subseteq L^*$. Under what circumstances are they equal ? 4

3. a) Show whether the language $L = \{0^n 1^{2n} \mid n>0\}$ is regular or not. 6

b) Let $L = \{0^n \mid n \text{ is prime}\}$ show that L is not regular. 6

c) Let L be any subset of 0*. Prove that L* is regular. 4

OR

4. a) Explain your answer in each of the following : 6

1) Every subset of a regular language is regular

2) Every regular language has a regular proper subset.

b) With suitable example, prove the following theorem : 10

"The regular sets are closed under union, concatenation, and kleene closure".

5. a) Find the CNF for the following grammar **10**

i) $A \rightarrow B1B1B$

$B \rightarrow 1B \mid 0B \mid \varepsilon$

ii) $S \rightarrow AB0$

$A \rightarrow 001$

$B \rightarrow A2$

b) Eliminate all unit, useless and null productions from the grammar given below : **6**

$S \rightarrow 0X \mid 011$

$X \rightarrow 00X \mid \in$

$Z \rightarrow 1Z \mid 11C$

$C \rightarrow Z$

OR

6. a) Find the GNF for the following Grammar : **10**

i) $A \rightarrow B1B1B$

$B \rightarrow 1B \mid 0B \mid \varepsilon$

ii) $S \rightarrow AA10$

$A \rightarrow SS11$

b) Eliminate all unit, useless and null productions from the grammar given below : **6**

$S \rightarrow XYaC$

$X \rightarrow YC$

$Y \rightarrow b \mid \in$

$C \rightarrow D \mid \in$

$D \rightarrow d$

SECTION – II

7. a) Construct the PDA that recognizes the languages

$L = \{a^i b^j c^k \mid i, j>0 \text{ and } i = j \text{ or } i = k\}$. **8**

b) Give PDA for following Regular Expression : **10**

i) $r = (0+1)^* \ 111 \ (0+1)^*$

ii) $r = 0^* \ 11 \ (0+1)^*$.

OR

8. a) Give the regular expression and language generated by following grammar **12**

$A \rightarrow BC$

$B \rightarrow 0B1 \mid 01$

$C \rightarrow 2C3 \mid 23$

Convert the grammar into NPDA.

b) Show that the language $L = \{0^n 1^j \mid n = j^2\}$ is not CFG. **6**

9. Explain the following : **16**

i) Basic Turing machine

ii) Different types of Turing machine

iii) Halting problem of Turing machine

iv) Difference between Turing machine and finite state machine.

OR

10. a) Design a turing machine for the following language :
"the set of all strings with an equal number of 0' sand 1's". **6**

b) Draw a transition diagram for a turing machine accepting each of the following languages : **10**

1) $\{a^i b^j / i < j\}$ 2) $\{www / w \in \{a,b\}^*\}$

11. a) Show that the following problem is undecidable : "Given a TM, T is L(T) regular or context free or recursive or none ?" **8**

b) i) Prove that "The set of real numbers, R, is not countable"

ii) Show that any subset of a countable set is countable. **8**

OR

12. a) If L1 and L2 are two recursive languages and if L is defined as : L = {w | w is in L1 and not in L2, or w is in L2 and not in L1}. Prove or disprove that L is recursive. **10**

b) Show that an infinite recursively enumerable set has an infinite recursive subset. **6**
