sem IV / Automata Theory / 04-06-14 / IT

QP Code : **NP-19812**

(3 Hours) [Total Marks : 80

N.B. : (1) Question No. **1is compulsory.**
(2) Solve any **three** questions from remaining questions.
(3) **Draw** suitable **diagrams** wherever **necessary.**
(4) Assume suitable **data, if necessary.**

1. (a) Design a DFA to accept strings over the alphabet $\sum=\{a,b\}$ containing even numberof 'a's. 5
(b) Let G be the grammar. Find the leftmost derivation, rightmost derivation and parse tree for the expression a*b+a*b 5

G: $S \rightarrow S + S \mid S * S$
$S \rightarrow a \mid b$

(c) Give formal definition *of* a Push Down Automata (PDA) 5
(d) State and explain closure properties of regular languages. 5

2. (a) Design a DFA to accept 10
(i) Binary strings in which every 0 is followed by 11
(ii) Strings over the binary alphabet that do not contain the substring 010

(b) Design a Mealy machine over the alphabet {0,1} which outputs EVEN,ODD according to the number of 1's encountered as even or odd. 10

3. (a) (a) Using pumping lemma prove that the following language is not regular 10
$L = \{ ww \mid w \in \{0, 1\}^* \}$
(b) Design a NFA for accepting input strings that contain either the keyword 000 or the keyword 010 and convert it into an equivalent DFA. 10

4. (a) Construct a PDA accepting the following language $L = \{a^n b^m a^n \mid m,n >= 1\}$ 10
(b) Design a Turing machine to recognize the language $L = \{a^n b^n a^n \mid n >= 1\}$ 10

5. (a) Explain algorithm for the conversion of a Context Free Grammar (CFG) to Chomsky Normal Form (CNF) and use it to convert the following CFG to CNF. **10**

$S \rightarrow bA \mid aB$

$A \rightarrow bAA \mid aS \mid a$

$B \rightarrow aBB \mid bS \mid b$

(b) Convert the following Context Free Grammar to GNF **10**

$S \rightarrow AB \mid BC$

$A \rightarrow AB \mid a$

$B \rightarrow AA \mid CB \mid b$

$C \rightarrow a \mid b$

6. Write short notes on (any **two**) **20**

(a) Variants of a Turing Machine

(b) Post Correspondence Problem

(c) Chomsky Hierarchy

(d) Recursive and recursively enumerable languages.