Automata Theory :- S.E. Sem-IV (CBGS).
I.T- June 2014.

QP Code : NP-19812

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. 1 is **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.