K15P 0534

Reg. No. : .....

Name : .....

**Third Semester M.C.A. Degree (Reg./Supple./Improve.) Examination, January 2016**

**(2014 Admn.)**

**MCA3C15 : THEORY OF COMPUTATION**

Time : 3 Hours Max. Marks : 80

***Instructions :*** *1) Answer **any ten** questions from Section – **A**. **Each** question carries **three** marks.*

*2) Answer **all** questions from Section – **B**. **Each** question carries **10** marks.*

SECTION – A

**Note** : Answer **any ten** questions from the following. **Each** question carries **three** marks. **(10×3=30)**

1. a) What is the difference between DFA and NFA ?

   b) Design DFA to accept strings over $\Sigma=(0,1)$ with two consecutive 0's.

   c) Construct a parse tree of (a + b)*c for the grammar

   $E \rightarrow E + E / E * E / (E) / id$.

   d) Define CFG.

   e) What is meant by empty production removal in PDA ?

   f) Define the instantaneous description of PDA.

   g) Write a note on Non-deterministic PDA.

   h) Define Turing Machine Halting Problem.

   i) Write a note on closure properties for CFL.

   j) State pumping lemma for regular languages.

   k) What is post correspondence problem ?

   l) When a language is said to be recursively enumerable ?

P.T.O.

## SECTION – B

**Note** : Answer **all** the questions. **Each** question carries **ten** marks. (5×10=

2. a) Design a DFA to accept language with even number of a's and odd number of b's over L = {a, b} and process the string U = aaaabbb.

   b) Convert the following $\in$ – NFA to DFA.


OR

3. a) Design a DFA to accept the following languages :

   i) Language having set of all string on the alphabet $\Sigma=\{0,1\}$ that either begins or ends or both with substring '01'.

   ii) $L = \{(0, 1)^i 1^{2j} \mid i \geq 1, j \geq 1\}$

   b) Write a short note on the applications of Finite Automata.

4. a) Prove that the following are not regular languages.

   i) $\{0^n \mid n$ in a perfect square$\}$

   ii) The set of strings of 0's and 1's beginning with a 1. Such that when interpreted as an integer, that integer is prime.

   b) Prove the following :

   If L is a regular language, so is $L^R$.

OR

5. a) If L is language, and a is a symbol, then a/L is the set of strings w such that aw is in L. Prove that if L is regular, so is a/L.

   b) Show that the following grammar G is ambiguous. S → SbS/a.

6. Design PDA for the language

$L = \{a^{3n} b^n \mid n \geq 0\}$ and simulate its action on the input string aaaaaabb.

OR

7. a) What is Chomsky normal form ? Convert the given grammar into Chomsky normal form.

$S \rightarrow ABa$

$A \rightarrow aab$

$B \rightarrow Ac$

b) Convert the following grammar to a PDA :

$S \rightarrow aABB/aAA$

$A \rightarrow aBB/a$

$B \rightarrow bBB/A$

$C \rightarrow a.$

8. What is Turing Machine ? Explain the working of Turing Machine with a neat sketch.

OR

9. Design Turing Machine for the following language :

$L = \{0^n 1^n : n \geq 1\}$.

10. Explain in detail :

i) Multi tape Turing Machine.

ii) Non-Deterministic Turing Machine.

OR

11. a) Explain the halting problem. Is it decidable or undecidable problem ?

b) Show that the language L and its complement $L^1$ are both recursively enumerable then L is recursive.