III Semester M.C.A. Examination, January 2016  
(CBCS)  
COMPUTER SCIENCE  
MCA 303 : Theory of Computation  

Time : 3 Hours  
Max. Marks : 70  

Instructions:  
1) Answer any five questions from Section – A, each carries six marks.  
2) Any four questions from Section – B, each carries 10 marks.  

SECTION – A  

Answer any 5 questions. Each question carries 6 marks.  

(5 x 6 = 30)  

1. What is finite automata? What are the applications of finite Automata?  
2. Define NFA and ε-NFA. Explain with suitable example.  
3. Define Regular Expression. Explain the meaning of the regular expression \((a+b)^*\).  
4. Define context free grammar. Show that if \(L_1\) and \(L_2\) are context free languages then \(L_1 \cup L_2\) is also context free.  
5. Construct a pushdown automata that accepts the following language. \(L_{01} = \{0^n1^n | n \geq 1\}\) and illustrate its working.  
7. Write a note on pumping lemma for regular languages.  

P.T.O.
8. a) Define μ-Recursive function.  

b) Convert the following CFG to CNF

\[ S \rightarrow 0A|1B \]
\[ A \rightarrow 0AA|1S|1 \]
\[ B \rightarrow 1BB|0S|0 \]

SECTION B

Answer any 4 questions. Each question carries 10 marks. \((4 \times 10 = 40)\)

9. Construct a Deterministic finite Automation (DFA) for the following:
   a) The String Ends with 10.
   b) Even number of 0's and odd number of 1's.
   c) To accept the language

   \[ L = \{ W : |W| \mod 4 = 0 \} \text{ on } \sum = \{0,1\} \]

10. a) Explain parse tree and its properties.  

b) Convert the following NFA into an equivalent DFA:

11. a) Define PDA and Instantaneous description of PDA.  

b) Obtain a PDA to accept the language \( L(M) = \{ WCWR | W \in (a+b)^* \} \) where \( WR \) is the reverse of \( W \) and hence say whether its is a Deterministic PDA or not.