

Duration : 3 hours

Total marks : 80

N.B. (1) Question No. 1 is compulsory

(2) Attempt any three out of remaining five questions

(3) Assumptions made should be clearly stated

- Q. 1 a) Differentiate between NFA and DFA 5
 b) Give regular expression for 5
 i) Set of all strings over $\{0, 1\}$ that end with 1 has no substring 00
 ii) Set of all strings over $\{0, 1\}$ with even number of 1's followed by odd number of 0's
 c) Construct an NFA with epsilon transition for $(00 + 11)^* (10)^*$ 5
 d) Give applications of regular expression and finite automata 5
- Q. 2 a) Construct PDA accepting the language $L = \{a^n b^n \mid n \geq 1\}$ 10
 b) Design minimized DFA for accepting strings ending with 100 over alphabet $\{0, 1\}$ 10
- Q. 3 a) Convert following CFG to CNF 10

 $S \rightarrow ASA \mid aB$ $A \rightarrow B \mid S$ $B \rightarrow b \mid \epsilon$

- b) Convert Moore and Mealy machine to find out 2's complement of a binary number 10
- Q. 4 a) Convert following ϵ -NFA to NFA without ϵ 10



- b) Using pumping lemma prove that language 10
 $L = \{0^n 1^n 2^n \mid n \geq 1\}$ is regular language or not
- Q.5 a) Design Turing machine that recognizes palindrome strings over $\Sigma = \{0, 1\}$ 10
 b) Define context free grammar. 10
 Obtain the CFG for the regular expression $(110 + 11)^* (10)^*$
- Q.6 Write short note on (any four) 20
 a) Halting problem
 b) Universal Problem
 c) Post correspondence problem
 d) Chomsky Hierarchy
 e) Differentiate between FSM and TM
