

(3 Hours)

Marks:80

Note: Question No. 1 is CompulsoryAttempt **any three** out of the remaining **five** questions

Assumptions made should be clearly stated

Q.1 Attempt any four sub-questions.

- a) Construct the Finite Automata for binary number divisible by 2 (05)
- b) Design FA for decimal number divisible by 5 (05)
- c) Give formal definition of Turing Machine (05)
- d) State and explain closure properties of regular languages (05)
- e) Construct DFA accepting all the strings corresponding to the Regular expression
 $1^* 0 1 (0 + 11)^*$ (05)

Q2. a) Construct the following grammar to CNF (10)

$$S \rightarrow Ba / aB$$

$$A \rightarrow bAA / aS / a$$

$$B \rightarrow aBB / bS / b$$

b) Design Moore machine for binary adder. (10)

Q3.a) Design a DFA corresponding to the regular expression $(a+b)^* aba (a+b)^*$ (10)b) Define CFG, obtain CGF for the following grammar (10)
 $(110+11)^* (10)^*$ Q4.a) Design a PDA for CFL that checks the well formedness of parenthesis i.e. the language L of all balanced string of two types of parenthesis “()” and “[]”. Trace the sequence of moves made corresponding to input string $[() (())]$. (10)

b) Construct a TM for 2's complement of a binary number. Simulate it for 1 0 1 0 (10)

Q5. a) Let G be the grammar. Find the leftmost derivation, rightmost derivation and parse tree for the string 001222. (10)

G: $S \rightarrow 0S \mid 1A \mid 2B \mid \epsilon$ $A \rightarrow 1A \mid 2B \mid \epsilon$ $B \rightarrow 2B \mid \epsilon$ b) Consider the CFG $S \rightarrow aSb \mid bSa \mid SS \mid \epsilon$, consider the string *babbabaaaababb*. prove that given grammar is ambiguous by generating more than one parse tree for a given string (10)

Q6. Write short notes on

- a) Applications of Automata Theory
- b) Chomsky Hierarchy
- c) Power and limitations of PDA
- d) Halting Problem.

(20)
