(3 Hours) Marks:80

Note: Question **No. 1** is **Compulsory**
Attempt **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 umber 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→ Ba / aB
A→bAA / aS / a
B→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: $S \rightarrow 0S \mid 1A \mid 2B \mid \varepsilon$
$A \rightarrow 1A \mid 2B \mid \varepsilon$
$B \rightarrow 2B \mid \varepsilon$

b) Consider the CFG S→aSb | bSa | SS | ε , 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 (**20**)

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

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