11/12/2024 IT SEM-IV C SCHEME AUTOMATA THEORY QP CODE: 10066471

3 Hours **Total Marks: 80**

N.B.: 1) All Question carry equal Marks.
2) Solve any Four from the six questions.
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks.

Q.1) Answer the following questions:

a. What do you mean by Right-Linear and Left-Linear grammars? **[05]**
b. What is Finite Automata (FA)? List the limitations of FA. **[05]**
c. Explain the need for normalization in grammars. **[05]**
d. Design Turing Machine to multiply two unary numbers. **[05]**

Q.2) a) I. Define the terms: Regular Expression, Regular Grammar and Regular Language. **[06]**

II. Write down the regular expressions for the following language L: **[04]**
a) For all strings over {0, 1} having no consecutive 1s.
b) For all strings over {0, 1} containing the sequence 011
c) For all strings over {a, b} whose length is a multiple of 3.
d) For all strings over {0, 1} containing no more than two 0s.

b) What are Moore and Mealy machines. Design Moore and Mealy machines to convert each occurrence of aaa with bbb. **[10]**

Q.3) a) Design Push Down Automata (PDA) for the language $L=\{a^{2n}ba^n \mid n\geq 0\}$ **[10]**

b) What do you mean by Deterministic Finite Automata (DFA)? Construct an automaton for binary numbers divisible by 5 excluding numbers with leading zeroes. **[10]**

Q.4) a) Consider the grammar $S \rightarrow aSa \mid bSb \mid SS \mid \lambda$. Given the string "babbabaaba", find a leftmost and rightmost derivations with corresponding parse trees. **[10]**

b) What is a compiler? Explain the different phases of a compiler. **[10]**

Q.5) a) Convert the following grammar into Chomsky Normal Form (CNF) **[10]**
$S \rightarrow aSa \mid bSb \mid A \mid \lambda$
$A \rightarrow a \mid b \mid \lambda$

b) Design a Turing machine over Σ {0,1} to accept the language $L=\{0^{2m}\,1^m \mid m > 0\}$ **[10]**

Q.6) Write short notes on **(Any FOUR):** **[20]**
a. Non-Deterministic Finite Automata
b. Power and Limitations of PDA.
c. Greibach Normal Form (GNF)
d. Chomsky hierarchy
e. Universal Turing Machine
