

TE / SEM V / C-SCHME / COMP / CSE / 11-11-24

(3 hours)

[80 marks]

NOTE:

1. Question No 1 is compulsory.
2. Attempt any three questions from remaining.
3. Assume suitable data if necessary and state the same.



Q1 Solve all questions below

20

- a) Design a Mealy Machine to identify if string starts with prefix ab over $\{a,b\}^*$.
- b) Construct a DFA for accepting all strings over $\{a,b\}$ with substring abb.
- c) Explain Universal Turing Machine.
- d) Compare DFA and PDA

Q2

- a) Find regular expression (RE) for all strings starting with b and ending in ba over $\{a,b\}$. Design NFA with epsilon moves for this RE. Convert it to equivalent DFA. 10
- b) Find the Context Free Grammar for following 10
 - i. $L = \{a^i b^j c^k \mid i = j + k\}$
 - ii. $L = \{x \in \{0,1\}^* \mid x \text{ has equal number of zeros and ones}\}$

Q3

- a) Convert following grammar to Chomsky Normal Form 10

$$S \rightarrow AACD, A \rightarrow aAb \mid \epsilon, C \rightarrow aC \mid a, D \rightarrow aDa \mid bDb \mid \epsilon.$$
- b) State closure properties of Regular languages and Context Free Languages. 10

Q4

- a) Design PDA for $\{a^n x^n \mid n \geq 0, x \in \{b\}^*\}$. Comment if it is deterministic or not. 10
- b) Find minimum state Finite Automata accepting $(01^*0 + 10^*)$. First design a NFA with epsilon moves. 10

Q5

- a) State pumping lemma for context-free-languages. Apply pumping lemma to $L = \{ss \mid s \in \{a,b\}^*\}$. 10
- b) Design a Turing Machine to add two unary numbers. Show simulation of the machine 10

Q6 Write Detailed note on (Any two) 20

- a) Applications of FA, PDA and TM.
- b) Types of Turing Machines.
- c) Chomsky Hierarchy.
