

TCS

QP Code : NP-19836

(3 Hours)

[Total Marks : 80]

N.B. : (1) Questions No.1 is compulsory.

(2) Attempt any **three** questions out of remaining **five** questions.(3) Assumptions made should be **clearly** stated.(4) **Figures** to the **right** indicate **full** marks(5) Assume **suitable** data wherever **required** but **justify** the same.

1. (a) Differentiate between NFA and DFA. 5
- (b) Explain CNF and GNF with example. 5
- (c) State and prove closure properties of Context Free Languages. 5
- (d) Give Applications of Regular Expression and Finite Automata. 5
  
2. (a) Construct an NFA with epsilon transition for following RE. 5  
 $(00 + 11)^*(10)^*$
- (b) Give formal definition of Regular expression. Give R.E. for following :— 5
  - (i) Set of all strings over  $\{1, 0\}$  that end with 1 and has no substring 00.
  - (ii) Set of all strings over  $\{1, 0\}$  with even number of 1's followed by odd number of 0's.
- (c) Compare and Contrast Moore and Mealy Machine. Construct Moore Machine 10  
to find out the residue-modulo-3 for binary numbers.
  
3. (a) Consider the following grammar :— 10  

$$S \rightarrow i C t S \mid i C t S \epsilon S \mid a$$

$$C \rightarrow b$$

For the String 'ibtibtaea' find the following :

  - (i) Leftmost derivation
  - (ii) Rightmost derivation
  - (iii) Parse Tree
  - (iv) Check if the above grammar is Ambiguous
- (b) Design PDA that checks for well- formed parentheses. 10
  
4. (a) Design a TM that recognizes palindrome strings where  $\Sigma = \{0, 1\}$  10
- (b) Construct NFA that accepts a set of all strings over  $\{a, b\}$  ending with "abb" Convert this NFA to Equivalent DFA. 10

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5. (a) Convert the following Grammar to CNF form :— 10

$$S \rightarrow ABA$$

$$A \rightarrow aA \mid bA \mid \epsilon$$

$$B \rightarrow bB \mid aA \mid \epsilon$$

- (b) Give and explain the formal statement of Pumping Lemma for regular languages and use it to prove that the following language is not regular : 10

$$L = \{ a^n b^n \mid n \geq 1 \}$$

6. Write short note on :— 20

- (a) Chomsky Hierarchy of Grammar
- (b) Variants of Turing Machine
- (c) Rice's Theorem
- (d) Recursive and Recursively enumerable languages.