

Time: 3 Hours

Total Marks: 80

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

(2) Attempt any three questions from the remaining five questions.

(3) Make suitable assumptions wherever necessary but justify your assumptions.

1. (a) Explain Chomsky Hierarchy. 05

(b) Differentiate between PDA and NPDA. 05

(c) Define Regular Expression and give regular expression for 05

i) Set of all strings over $\{0, 1\}$ that end with 1 has no substring 00

(d) Explain Halting Problem. 05

2. (a) Design a Finite State Machine to determine whether ternary number (base 3) is divisible 5. 10

(b) Give and Explain formal definition of Pumping Lemma for Regular Language and prove that following language is not regular. 10

$$L = \{ a^m b^{m-1} \mid m > 0 \}$$

3. (a) Construct PDA accepting the language $L = \{ a^{2^n} b^n \mid n \geq 0 \}$. 10

(b) Consider the following grammar 10

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

$$C \rightarrow b$$

For the string 'ibtaeibta' find the following:

(i) Leftmost derivation

(ii) Rightmost derivation

(iii) Parse tree

(iv) Check if above grammar is ambiguous.

4. (a) Construct TM to check wellformedness of parenthesis. 10
(b) Convert following CFG to CNF 10
 $S \rightarrow ASA \mid aB$
 $A \rightarrow B \mid S$
 $B \rightarrow b \mid \epsilon$
5. (a) Convert $(0+1)(10)^*(0+1)$ into NFA with ϵ -moves and obtain DFA. 10
(b) Construct Moore and Mealy Machine to convert each occurrence of 100 by 101. 10
6. Write short note on following (any 4) 10
(a) Closure properties of Context Free Language 10
(b) Applications of Regular expression and Finite automata
(c) Rice's Theorem
(d) Moore and Mealy Machine
(e) Universal Turing Machine