

(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. [20]

- a) Show that grammar represented by production rules given below is ambiguous.

$$S \rightarrow S + S \mid S - S \mid S * S \mid S / S \mid (S) \mid a$$

- b) Construct a Moore machine to output remainder modulo 4 for any binary number.
c) Differentiate between NPDA and PDA.
d) Explain Chomsky Hierarchy.

Q2. [10]

- a) Write steps for converting CFG to CNF form. Convert the following CFG to CNF. [10]

$$S \rightarrow ASB \mid \epsilon \quad A \rightarrow aAS \mid a \quad B \rightarrow SbS \mid A \mid bb$$

- b) Convert following RE to NFA- ϵ and convert it to minimised DFA corresponding to it

$$(0+11)^*(10)(11+0)^* \quad [10]$$

Q3. [10]

- a) Construct a PDA for accepting $L = \{a^n b^m c^n \mid m, n \geq 1\}$

- b) Give formal Definition of Pumping Lemma for Regular Language. Prove that the following language is not regular. $L = \{wrw^r \mid w \in \{a,b\}^*, r \in \{c\}, |w| \geq 1\}$ [10]

Q4. [03]

- a) Construct CFG for following

i. Alternate sequence of 0 and 1 starting with 0 [03]

ii. Do not contain 3 consecutive a over $\{a,b\}$ [04]

iii. $L = \{x \in \{0,1\}^* \mid x \text{ has equal number of 0's and 1's}\}$ [03]

- b) Explain applications for FA, PDA and TM [10]

Q5. [10]

- a) Construct a Moore machine to convert all occurrences of 100 to 101 in a string over $\{0,1\}^*$. convert it to equivalent Mealy Machine [10]

- b) Design a TM accepting all palindromes over $\{0,1\}$ [10]

Q6. Write short note (Solve Any 4) [20]

- a) Decision Properties of Regular Languages
- b) Post Correspondence Problem
- c) Variants of Turing Machine
- d) Acceptance by a PDA
- e) Conversion of Moore to Mealy Machines
