

**Duration: 3 hours**

**Total marks: 80**

Note (1) Question No. 1 is compulsory

- (2) Attempt any three questions from remaining questions
- (3) Draw suitable diagrams wherever necessary
- (4) Assume suitable data, if necessary

Q 1. (a) Find the CFG for the regular expression  $(10)^*(110+01)^*$ . (05)

(b) Write short note on Universal Turing Machine. (05)

(c) Difference between FA and PDA (05)

(d) Design moore machine to convert each occurrence of 111 to 101 (05)

Q 2. (a) Construct NFA with epsilon which accept a language consisting the string of any number of a's followed by any number of b's followed by any number of c's. (10)

Also convert it into NFA without epsilon.

(b) Design a Moore and Mealy machine for a binary input sequence such that if it has a substring 011 the machine outputs A if input has substring 001 it outputs B otherwise it outputs C. (10)

Q 3 (a) Minimize the following DFA where A is a start state and B, C and E are final states. (10)

|            |   |   |
|------------|---|---|
| $\partial$ | 0 | 1 |
| A          | D | B |
| B          | C | F |
| C          | C | F |
| D          | A | E |
| E          | C | F |
| F          | F | F |

Q.P. Code: 25528

(b) Use pumping lemma prove that whether following language is regular or not (10)

$$(a^n b^n c^n \mid n \geq 1)$$

Q 4 (a) Define context free grammar. Obtain the CFG for the following regular expression: (10)

$$(110 + 11)^* (10)^*$$

(b) Convert given CFG to GNF where  $V = \{S, A\}$ ,  $T = \{0, 1\}$  and P is (10)

$$S \rightarrow AA \mid 0$$

$$A \rightarrow SS \mid 1$$

Q 5 (a) Design a PDA to accept a string of balanced parentheses. The parentheses (10)

to be considered ( , ) , { , }.

(b) Construct TM for  $L = \{a^n b^n c^n \mid n \geq 1\}$  (10)

Q 6 Write short notes on (Any two) (20)

(a) Pumping Lemma for Regular Languages

(b) Recursive and Recursively enumerable languages

(c) Unsolvable Problems