

Prelim Paper

Time: 3 Hrs.]

Automata Theory

[Marks : 80

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

(2) Attempt any three questions out of remaining questions.

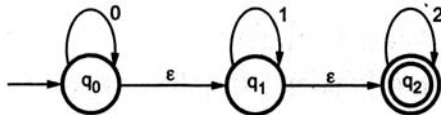
(3) Draw suitable diagrams wherever necessary.

(4) Assume suitable data, if necessary.

1. (a) Design a FA to check whether a given decimal number is divisible by three. **05**
(b) Differentiate between NFA and DFA with example. **05**
(c) Design a DFA to accept a set of all strings which began and end with different letters. **05**
(d) Derive a string abaaba for CFG given by G **05**
where $P = \{S \rightarrow aSa$
 $S \rightarrow bsb$
 $S \rightarrow a/b/\epsilon\}$

2. (a) Convert the given CFG to CNF consider $G(V, T, P, S)$ **10**
where $v = \{S, A, B\}$ $T = \{a, b\}$ P consists of
 $S \rightarrow aB$
 $S \rightarrow bA$ $A \rightarrow baa$
 $A \rightarrow a$ $B \rightarrow b$
 $A \rightarrow as$ $B \rightarrow as$
 $B \rightarrow aBB$

- (b) Convert the given NFA into its equivalent DFA : **10**



3. (a) Design a Moore machine and mealy machine for a binary input sequence such that if it has a substring 101 the machine outputs A if input has a substring 110 the machine outputs B otherwise it outputs C. **10**
(b) Convert the following grammar to CNF form : **10**
 $S \rightarrow ABA$
 $A \rightarrow aA/bA/E$
 $B \rightarrow bB/aA/E$

4. (a) Construct a PDA for the language **10**
 $\alpha = \{a^n b^m a^n \mid m, n \geq 1\}$
(b) Design a PDA to accept a string of balanced parenthesis the parenthesis can contain (,), {, }. **10**
5. (a) Construct a TM for $L = \{a^n b^n c^n \mid n \geq 1\}$. **10**
(b) Construct a TM for checking palindrome of string of odd palindrome for $\Sigma = (0, 1)$. **10**

6. Write short notes on :

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- (a) Applications and limitations of finite automata.
- (b) Comparison between Moore and Mealy machine.
- (c) Halting problem of TM.
- (d) Chomsky Hierarchy of grammar.

