

16059(J)

3-16

B. Tech 4th Semester Examination
 Theory of Automata Computation (NS)

IT-223

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, by selecting one question from each of sections A, B, C & D. Question no. 9 in section E is compulsory.

SECTION - A

1. Design an NFA that accepts all inputs with a triple letter, like 111,000. (20)
2. (a) Design NDFA with five states for $\{abab^n: n \geq 0\} \cup \{aba^n: n \geq 0\}$. (10)
- (b) Design a Moore and Mealy machine for input alphabet $\Sigma = \{0, 1\}$ and output alphabet $\Sigma = \{0, 1\}$. The transition table is given below:

Q \ Σ	0	1	O/P
q_0	q_0	q_2	0
q_1	q_1	q_0	0
q_2	q_2	q_1	0

(10)

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SECTION - B

3. (a) Give properties and limitations of FSM. (10)
- (b) State Myhill-Nerode relations. (10)
4. (a) Construct transition graph for given regular expression: $r = a(a+b)^* ab$. (8)
- (b) Show an finite automata that accepts words of odd length. (12)

SECTION - C

5. (a) Define context free grammar and context sensitive grammar. (8)
- (b) Convert the following CFG with unit productions into CNF.
 $S \rightarrow X$
 $X \rightarrow Z$
 $Z \rightarrow aa$ (12)
6. (a) Construct a push down automata accepting the string $\{a^n b^n c^n\}$. (10)
- (b) Convert $S \rightarrow abSb|aa$ into GNF. (10)

SECTION - D

7. What is recursively enumerable language? Give example. (20)
8. (a) What is a linear bounded automata? What are end markers? What is type-0- grammar for Turing machine? (12)
- (b) Discuss post correspondence problem. (8)

**SECTION - C
(COMPULSORY)**

9. (i) What do you mean by equivalence class?
- (ii) What is DFA? Show an example.
- (iii) Prove that if $\delta(q, x) = \delta(q, y)$, then $\delta(q, xz) = \delta(q, yz)$ for all strings z in Σ^* .
- (iv) Find a regular expression R over $\Sigma\{a, b\}$ for $L = \{a, ab, ab^2, \dots\}$.
- (v) Write the regular expression for the language.
$$L = \{w \mid n_{a(w)} \bmod 3 = 0, w \in (a, b)^*\} R \text{ over } S = \{a, b\}$$
- (vi) Explain significance of My-Hil-Nerode theorem.
- (vii) Design a CFG for generating string having any combination of 0's and 1's except null string.
- (viii) What is a non-deterministic pushdown automata?
- (ix) What is the halting problem?
- (x) Design the Mealy machine to get 1's complement of a given binary number. (10×2=20)