

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2064)

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B. Tech 4th Semester Examination
Theory of Automata & Computation (O.S.)
CS-4003

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 selecting one from each of the section A, B, C & D and the entire parts of section E.

SECTION - A

1. (a). Construct a Deterministic Finite Automata (DFA) for the language $L = (a+b)^* aabb$. (10)
- (b) Let r_1 , r_2 and r_3 be three regular expressions. Is the language associated with $(r_1 + r_2)r_3$ is same as language associated with $r_1r_3 + r_2r_3$? Justify your answer. (10)
2. (a) Construct a DFA equivalent to the following grammar:
 $S \rightarrow aS|bS|aA$
 $A \rightarrow bB$
 $B \rightarrow aC$
 $C \rightarrow \epsilon$ (10)
- (b) Describe various applications of finite automata. (10)

SECTION - B

3. (a) Describe the method of conversion from Moore machine to Mealy with suitable example. (10)

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- (b) Prove that $\{a^n b^n c^n\}$ is non context free using pumping lemma theorem. (10)
4. (a) Discuss the limitations of finite state machines (FSM). (10)
- (b) Briefly explain Arden's method for the conversion of NFA into DFA with example. (10)

SECTION - C

5. (a) Consider a Finite State Machine (FSM) having at least 5 states, and convert it into its Equivalent Push Down Machine (PDM). (10)
- (b) Convert the following grammar into Griebach Normal Form (GNF):
- $$A \rightarrow aAa|bAb|a|b|aa|bb \quad (10)$$
6. (a) Write a CFG for the language of all words of the form $a^r b^s c^t$ where $r, s, t = 1, 2, 3, \dots$ and $s=2r+t$. (10)
- (b) Determine whether the following grammar is ambiguous or not:
- $$A \rightarrow aAAb \mid bAAa \mid \varepsilon \quad (\text{abab is a string in } L(G)) \quad (10)$$

SECTION - D

7. (a) Construct a Turing Machine that recognizes the set of all strings that contain an even no. of 1's. (10)
- (b) Differentiate between deterministic and non-deterministic Turing machines. 10
8. Discuss the following:
- (a) Halting problem of Turing machine
- (b) Unrestricted grammar (20)

SECTION - E (Compulsory)

9. (a) What are the applications of unit productions?
- (b) What are Type -2 grammars?
- (c) List the various characteristics of regular expressions. ,
- (d) What are the applications of Mealy machine?
- (e) Define Myhill-Nerode theorem.
- (f) Show that exponentiation function is primitive recursive function.
- (g) What do you understand by Kleene's closure?
- (h) List the limitations of Push down Automata. ($8 \times 2\frac{1}{2} = 20$)