

II B. Tech II Semester Regular Examinations, August/September - 2021
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours

Max. Marks: 75

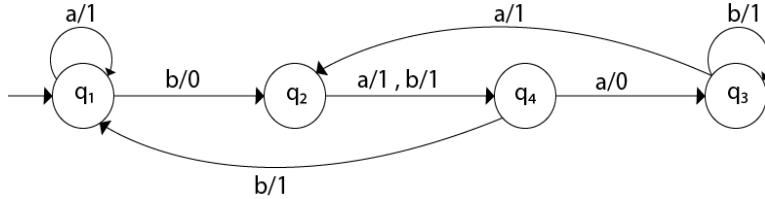
Answer any **FIVE** Questions each Question from each unitAll Questions carry **Equal** Marks

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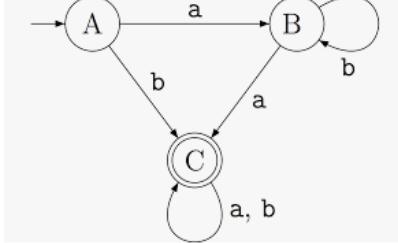
- |   |                                                                                                       |    |
|---|-------------------------------------------------------------------------------------------------------|----|
| 1 | a) Why do we need to study automata theory and formal languages?                                      | 4M |
|   | b) Define NFA with $\epsilon$ - moves and give example.                                               | 4M |
|   | c) Depict the steps in converting an NFA with $\epsilon$ into NFA without $\epsilon$ with an example. | 7M |

Or

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|---|---------------------------------------------------------------------------------------------------------------|----|
| 2 | a) Design a DFA $L(M) = \{w \mid w \in \{0, 1\}^*\}$ and W is a string that does not contain consecutive 1's. | 8M |
|   | b) Convert the following Mealy machine into equivalent Moore machine.                                         | 7M |



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|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 3 | a) Write the regular expression for the language L over $\Sigma = \{0, 1\}$ such that all the strings<br>i) do not contain the substring 01.<br>ii) should have at least one 0 and at least one 1. | 8M |
|   | b) Construct a Regular expression corresponding to the following finite automata.                                                                                                                  | 7M |



Or

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|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 4 | a) Prove that the language $L = \{ a^{2n} b^{3n} a^n \mid n \geq 0 \}$ is not regular.                                                                                                                                                                                                                                                                           | 10M |
|   | b) What is Chomsky hierarchy? explain with diagram.                                                                                                                                                                                                                                                                                                              | 5M  |
| 5 | a) Consider the CFG with {S,A,B} as the non-terminal alphabet, {0,1} as the terminal alphabet, S as the start symbol and the following set of production rules<br>$S \rightarrow A1B$<br>$A \rightarrow 0A / \epsilon$<br>$B \rightarrow 0B / 1B / \epsilon$<br>For the string $w = 00101$ , find the Leftmost derivation, Rightmost derivation, and Parse Tree. | 5M  |
|   | b) Show that language $L = \{ WW \mid W \text{ belongs to } \{a, b\}^* \}$ is not context free.                                                                                                                                                                                                                                                                  | 10M |

Or

1 of 2



- 6 a) Define Context Free Grammar. State and Explain the closure properties of CFG. 5M
- b) Consider the CFG with  $\{S, A, B\}$  as the non-terminal alphabet,  $\{a, b, \epsilon\}$  as the terminal alphabet,  $S$  as the start symbol and the following set of production rules 10M  
 $S \rightarrow ASA \mid aB \mid b$   
 $A \rightarrow B$   
 $B \rightarrow b \mid \epsilon$   
Convert the given grammar into CNF
- 7 a) Describe the components of Push Down Automata. 5M
- b) Construct a PDA from the following CFG. 10M  
 $G = (\{S, X\}, \{a, b\}, P, S)$  where the productions are given below.  
 $S \rightarrow XS \mid \epsilon,$   
 $A \rightarrow aXb \mid Ab \mid ab$

Or

- 8 a) Design a PDA for accepting a language  $\{a^n b^{2n} \mid n \geq 1\}$ . 10M
- b) Is a push-down automaton with two stacks equivalent to a turning machine? 5M  
Justify your answer with proper explanation.
- 9 a) Construct Turing machine for  $L = \{a^n b^m a^{(n+m)} \mid n, m \geq 1\}$  10M
- b) Explain in brief about Church's Turing thesis. 5M

Or

- 10 a) Describe the closure properties of recursive and recursively enumerable languages. 8M
- b) Explain the differences between NP complete and NP-hard problems. 7M

