

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

Time: 3 hours

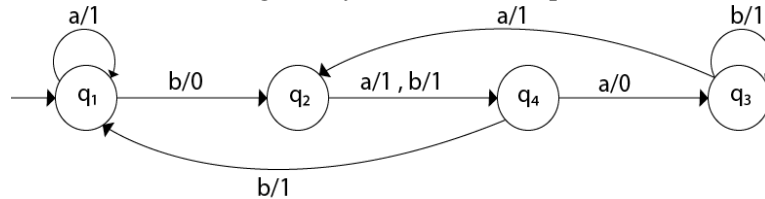
Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
 All Questions carry **Equal** Marks

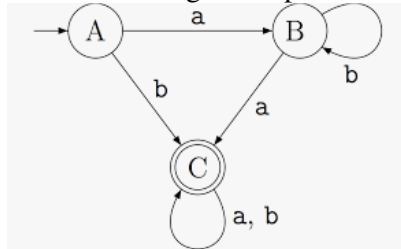
- 1 a) Why do we need to study automata theory and formal languages? 4M
 b) Define NFA with ϵ - moves and give example. 4M
 c) Depict the steps in converting an NFA with ϵ into NFA without ϵ with an example. 7M

Or

- 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



- 3 a) Write the regular expression for the language L over $\Sigma = \{0, 1\}$ such that all the strings
 i) do not contain the substring 01.
 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

- 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
 $S \rightarrow A1B$
 $A \rightarrow 0A \mid \epsilon$
 $B \rightarrow 0B \mid 1B \mid \epsilon$
 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

- 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
 $S \rightarrow ASA \mid aB \mid b$
 $A \rightarrow B$
 $B \rightarrow b \mid \epsilon$
 Convert the given grammar into CNF 10M
- 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 Turing 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