

BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-IV INFORMATION TECHNOLOGY : SUMMER : 2025
SUBJECT: FORMAL LANGUAGES & AUTOMATA THEORY

Day : Tuesday
Date : 27/05/2025

S-29315-2025

Time : 10:00 AM-01:00 PM
Max. Marks : 60

NB :

1. Assume suitable data, if necessary.
2. Draw neat labelled diagrams WHEREVER necessary.
3. Figures to the right indicate FULL marks for the question.
4. All questions are COMPULSORY.

- Q. 1 Given the following ϵ -NFA over the alphabet $\Sigma = \{a, b\}$, convert it into an equivalent DFA. (10)
Provide the complete state transition table of the resulting DFA.

Current State	Input	Next State
Q ₀	ϵ	Q ₁
Q ₀	ϵ	Q ₂
Q ₁	a	Q ₁
Q ₁	a	Q ₂
Q ₂	b	Q ₃

OR

- Q. 1 Prove that no DFA can accept the language of all palindromes over $\{0,1\}$. (10)
- Q. 2 List and prove at least five algebraic laws of regular expressions using set-theoretic interpretations. Show how these laws help in simplifying regular expressions. (10)

OR

- Q. 2 Differentiate between regular and non-regular languages with respect to memory requirements. Explain with examples and formal definitions. (10)
- Q. 3 Compare right-linear and left-linear grammars. Are they equivalent in expressive power? Justify your answer with a formal proof or example. (10)

OR

- Q. 3 Define Chomsky Normal Form (CNF). Explain the algorithm to convert a CFG into CNF. Apply it to the grammar:
 $S \rightarrow ASA \mid aB, A \rightarrow B \mid S, B \rightarrow b$ (10)

- Q. 4 Explain the limitations of finite automata in recognizing non-regular languages. Give an example language that cannot be accepted by a DFA. (10)
- OR
- Q. 4 Construct a PDA that accepts the language generated by the grammar:
 $S \rightarrow aS \mid aSbS \mid \epsilon$ (10)
- Q. 5 Draw and explain the TM model. Describe the working of the read/write head, tape, and finite control. (10)
- OR
- Q. 5 Compare Turing Machines with FSM and PDA. Use a comparative table to highlight differences in power and capabilities. (10)
- Q. 6 Explain how lexical analysis in a compiler corresponds to finite automata. Can this be extended to a TM? (10)
- OR
- Q. 6 Describe the role of context-free grammars in syntax analysis. How can PDAs and TMs simulate this? (10)

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