

Roll No.

Total No. of Pages : 02

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B.Tech. (CSE/Artificial Intelligence & Machine Learning) (Sem-5)

FORMAL LANGUAGE & AUTOMATA THEORY

Subject Code :BTCS 502-18

M.Code :93172

Date of Examination : 24-11-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

- a) What is a formal language?
- b) Define nondeterministic finite automaton.
- c) Give a regular expression for the language of all strings over {a, b} ending with 'a'.
- d) Define a context-free language with an example.
- e) State the pumping lemma for CFLs.
- f) What is a linear bounded automaton?
- g) What is the role of the tape head in a Turing Machine?
- h) Define a nondeterministic Turing Machine.
- i) Define the class NP.
- j) What is the Church-Turing thesis?

SECTION - B

2. What is a formal grammar? Define its four components with examples.
3. What is a regular expression? Construct a regular expression for a language over $\{a, b\}$ that contains all strings ending with 'ab'.
4. Describe the characteristics and limitations of context-free languages.
5. Prove that every language accepted by a Linear Bounded Automaton is a Context-Sensitive Language.
6. Define unrestricted grammars and explain their production rules.

SECTION - C

7. a) Convert the following CFG into Chomsky Normal Form : $S \rightarrow aSb | SS | \epsilon$.
b) Define deterministic pushdown automata. Differentiate it with NPDA.
8. What is Turing machine? Design a Turing Machine which recognizes the language $L = \{0^n 1^n \mid n \geq 0\}$.
9. State and explain Rice's Theorem. How it can be used to prove that certain properties of languages recognized by Turing machines are undecidable? Explain.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.