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Reg. No.

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I Semester M.C.A. Degree Examination May/June - 2025

COMPUTER APPLICATIONS

Theory of Computation  
(CBCS 2020-21 Scheme)

Paper : 1MCA4

Time : 3 Hours

Maximum Marks : 70

**Instructions to Candidates :**

- 1) Answer any **five** questions from Section - A, each question carries **6** marks.
- 2) Answer any **four** questions from Section-B, each question carries **10** marks.

**SECTION - A**Answer any **Five** of the following questions. Each question carries **6** marks. (5×6=30)

1. Differentiate between DFA, NFA and  $\epsilon - NFA$ .
2. Design a DFA that accepts binary strings divisible by 5. Verify the string "1101" is accepted or not.
3. Define Regular expression. Show that the language  $L = \{ww \mid w \in \{a,b\}^*\}$  is not regular.
4. What you mean by ambiguity of grammar? Check whether below grammar is ambiguous

$$S \rightarrow aY \mid bX$$

$$X \rightarrow aS \mid bXX \mid a$$

$$Y \rightarrow bS \mid aYY \mid b$$

On string "aabbab"

5. Briefly explain Universal languages and Linear Bounded Automata.
6. What is Turing machine? Explain different types of Turing machines.
7. Simplify the following grammar by eliminating left recursion

$$S \rightarrow Ab \mid a$$

$$A \rightarrow Ab \mid Sa$$

8. Prove that complement of recursively enumerable language is recursive.

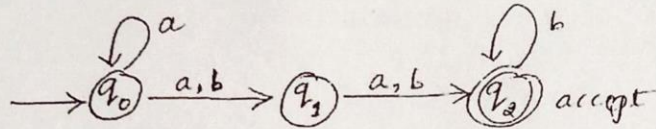
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## SECTION - B

Answer any **Four** of the following questions. Each question carries **10** marks. (4×10=40)

9. a) What is Finite Automata? Explain the applications of finite automata. (4)  
b) Convert the following NFA to equivalent DFA. (6)



10. a) Obtain an NFA which accepts strings of a's & b's starting with string "ab". (5)  
b) Show that regular languages are closed under union, concatenation and star operations. (5)
11. a) Convert the following CFG to CNF (6)

$$S \rightarrow 0A \mid 1B$$

$$A \rightarrow 0AA \mid 1S \mid 1$$

$$B \rightarrow 1BB \mid 0S \mid 0$$

- b) Write a note on Mealy and Moore machine. (4)
12. a) What is PDA? Obtain a PDA to accept the Language  $L = \{0^n 1^n \mid n \geq 1\}$  by a final state. Verify the string "000111" is accepted or not. (7)  
b) Briefly explain Instantaneous Description of PDA. (3)
13. Design a Turing machine to accept the language  $L = \{0^n 1^n \mid n \geq 1\}$  and verify the string "0011" is accepted or rejected. (10)
14. Write a note on:  
a) Pumping Lemma for regular languages. (5+5)  
b) Halting problem in Turing machine.
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