

MCA-302

December - Examination 2025
MCA 3rd Year Examination
FORMAL LANGUAGE AND AUTOMATA
Paper : MCA-302

[Time: 3 Hours]

[Maximum Marks: 80]

Note :- The question paper is divided into three Sections A, B and C. Write answers as per the given instructions.

Section-A

8×2=16

(Very Short Answer Type Questions)

Note :- Answer **all** questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries **2** marks.

1. (i) State Post Correspondence Problem.
- (ii) Prove that the proposition $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.
- (iii) What are the various representations of Turing Machine? Explain it with an example.
- (iv) What is a context free grammar? Explain it with an example.
- (v) Explain the P problem and NP problem.
- (vi) List out application of the pumping lemma.
- (vii) What is a PDA? Write its components.
- (viii) What is Graph? Give one example.

Section-B

4×8=32

(Short Answer Type Questions)

Note :- Answer **any four** questions. Each answer should not exceed **200** words. Each question carries **8** marks.

2. Design a DFA for the following language $L = \{0^m 1^n \mid m \geq 0 \text{ and } n \geq 1\}$.
3. What do you mean by LBA? Explain it with a suitable example.
4. Construct a PDA for the following grammar $S \rightarrow AA/a, A \rightarrow SA/b$.
5. Discuss the Universal Turing Machine.
6. Explain the concepts of undecidable problems about Turing Machines.
7. Consider the grammar : $E \rightarrow E + E \mid E * E \mid id$. Prove that the given grammar is ambiguous.
8. Discuss the Halting problem in brief with a suitable example.
9. Design a finite automata accepting all decimal numbers divisible by 4.

Section-C

2×16=32

(Long Answer Type Questions)

Note :- Answer **any two** questions. You have to delimit your each answer maximum up to **500** words. Each question carries **16** marks.

10. Explain the Chomsky Classification of Languages with a suitable example.
11. Illustrate an example to explain the process used to convert a non-deterministic automaton to a deterministic automaton.
12. Write briefly about the applications of Automata.
13. Discuss with an example how to simplify context-free grammar :
 - (a) By removing the useless production
 - (b) By moving λ -production
 - (c) By removing unit production
