

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. Solve the following decision problem using a Turing Machine :

“Given a binary string, determine if the number of 0’s is equal to the number of 1’s”.

11. Discuss how automata theory is applied in the field of Artificial Intelligence (AI). Provide examples of specific AI applications where automata theory plays a crucial role.

12. Construct a Push Down Automaton (PDA) that accepts the language $\{ww^R \mid w \in \{0, 1\}^*\}$, where w^R represents the reverse of w .

13. Convert the following NFA to equivalent DFA (q_0 is the starting state and q_2 is final state :

State	0	1
q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_0, q_2\}$
q_2	$\{q_2\}$	$\{q_1\}$

MCA–302**June – Examination 2024****MCA (IIIrd 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) What is the role of the transition function in a finite automaton ? Give an example.

- (ii) What is the cardinality of the power set of a set with 3 elements ?
- (iii) Consider the regular expression $(a + b)^*c$. Generate strings of length 4 that match this regular expression.
- (iv) Discuss the difference between a predicate and a proposition with suitable examples.
- (v) What is a Directed Cyclic Graph ? Give one example.
- (vi) What is Linear Bound Automata (LBA) ?
- (vii) Give a formal definition of Finite Automata.
- (viii) State Post Correspondence Problem.

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. Describe the difference between Regular and Context-free languages.

- 3. Briefly discuss the Chomsky classification of Languages with examples.
- 4. Show that the grammar $S \rightarrow Aa \mid BC; A \rightarrow ab \mid a; B \rightarrow bB \mid b; C \rightarrow cC \mid c;$ is ambiguous.
- 5. Explain the Pumping Lemma for regular sets. Show that $L = \{a^p \mid p \text{ is a prime}\}$ is not regular.
- 6. Define the Halting problem for turing machines. Explain why the halting problem is undecidable and provide an informal proof or explanation for its undecidability.
- 7. How to convert the given Mealy machine to an equivalent Moore Machine ? Explain with a suitable example.
- 8. What do you mean by Parsing ? Distinguish between Top-down Parsing and Bottom-up Parsing.
- 9. Design a finite automata accepting all decimal numbers divisible by 4.