A–0844

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MCS-E13/MCA-E4

FORMAL LANGUAGES AND AUTOMATA

(MCA)

Examination, June 2025

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. (A) Let $L_1 = \{a, b, ab\}$ and $L_2 = \{a, b, aba\}$. Find the following languages :

   (i) $L_1 \cup L_2$

   (ii) $L_1 \cap L_2$

   (iii) $L_1 L_2$

   (iv) $L_1 - L_2$

   (iv) L_1^R (10)

   (B) Define reversal, concatenation and star closure of languages. (9)

2. (A) Define non-deterministic finite automaton. Also define λ – closure of a state and extended transition function. (10)

   (B) Let $\Sigma = \{a, b\}$. Design a DFA that accepts all string starting with *a* and terminating with *b*. (9)

3. (A) Define regular expressions with the help of suitable examples. (10)

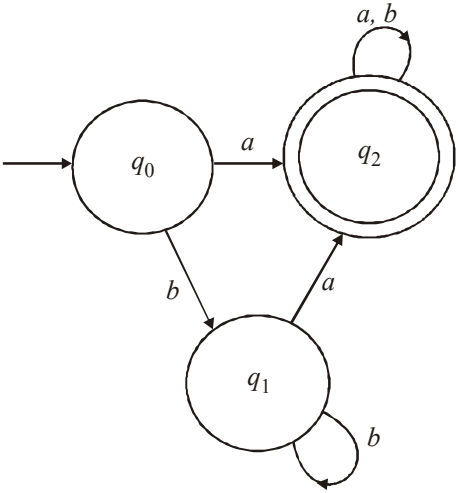
   (B) Let $\Sigma = \{a, b\}$. Write Regular expressions for the following languages : (9)

   (i) Set of all the words starting with *aba*.

   (ii) Set of all the words starting with *a* and ending with *ba*.

   (iii) Set of all the words ending with *bb*.

4. (A) Find the minimal state automata for the following DFA.



(B) Define Mealy machine with suitable example.

5. (A) Define Turing machine with the help of a suitable example. (10)

(B) Define Recursive language, Recursively enumerable language with the help of suitable examples. (9)

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Define grammar of formal languages with the help of suitable example.
2. If L_1 and L_2 are regular languages, then prove that $L_1 \cup L_2$, $L_1 \cap L_2$ are regular languages.
3. Define derivation tree in context free grammar with the help of suitable example.
4. Define Greibach normal form. Convert the following CFG into Greibach normal form.

   $S \rightarrow AB$

   $A \rightarrow aA$

   $A \rightarrow bB$

   $A \rightarrow b$

   $B \rightarrow b$
5. Define pumping lemma for context free languages.
6. Discuss Chomsky Hierarchy.
7. Explain deterministic pushdown automata.
8. Define modified post correspondence problem with the help of suitable example.

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