Total No. of printed pages = 7

63/2 (SEM-3) MCA 3.5 (O/N)

2021

(held in 2022)

MCA

(Theory Paper)

Paper Code : MCA-3.5 (Old/New)

(Formal Language And Automata Theory)

Full Marks – 75

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instruction :

This paper contains three parts– PART–A, PART–B and PART–C. PART–A contains 10 questions, each question carries 1 mark. From PART–B out of 8 questions you are to answer only 5 questions each question carries 5 marks. In PART–C out of 6 questions you are to answer only 5 questions, each question carries 8 marks.

[Turn over

PART – A

1: Answer the following : 1×10=10

(a) Match the following :

List A	List B
(i) Type 0	(a) Regular Grammar
(ii) Type 1	(b) CFG
(iii) Type 2	(c) Context-sensitive
(iv) Type 3	(d) Turning Machine

(A) (i) - (b), (ii) - (a), (iii) - (d), (iv) - (c)

(B) (i) - (d), (ii) - (a), (iii) - (a), (iv) - (c)

(C) (i) - (c), (ii) - (a), (iii) - (b), (iv) - (d)

(D) (i) - (d), (ii) - (c), (iii) - (b), (iv) - (a)

(b) What is the Regular expression matching one or more specific characters ?

(i) x (ii) +

(iii) * (iv) &

(c) Which of the following string is not generated by the following grammar ?

$S \rightarrow Sa\,Sb\,S/\in$

(i) aabb (ii) abab

(iii) aababb (iv) aaabbb

(d) Regular expression (x + y) (x + y) denotes the set

(i) {xy, xy} (ii) {xx,xy, yx, yy}

(iii) {x, y} (iv) {x, y, xy}

(e) Given grammar S → (L) / a, L → L, S / S, which of the following input recognised by the grammar

(i) ((a, a),a) (ii) (a, a)

(iii) (a, a, a), a) (iv) All of the above

(f) The grammar $E \rightarrow E+E \ / E*E / a$ is

(i) Ambiguous

(ii) Unambiguous

(iii) Depends on the given sentence

(iv) None of the above

(g) The set {a, aa, aaaa, aaaaaa, ... } represent the regular expression.

(i) a^* (ii) $(aa)^*$

(iii) aa^* (iv) None of the above

(h) A Moore machine accepts a string w of length n. The length of the output string is

(i) $n+1$ (ii) $n-1$

(iii) n^2 (iv) n

(i) The output of a Mealy machine depends on

(i) the present state only

(ii) the present state and the input symbol

(iii) the input symbol only

(iv) None of the above

(j) The regular expression $(P+Q)^*$ is equal to

(i) $(P^*+Q)^*$ (ii) (P^*+Q^*)

(iii) $P^* Q^*$ (iv) $(P^* Q^*)^*$

PART – B

Answer any *five* of the following questions : 5×5=25

1. Construct the following DFA.

   (a) The set of string over {a, b, c} having abc as a substring.

   (b) The set of string over {0, 1} ends in the substring 01.

2. Construct the following Regular expression :

   (a) The set of string over {a, b} containing exactly 2a's.

   (b) The set of string over {0, 1} such that every string contains alternate O's and 1's.

3. Construct a finite automaton for the regular language $(ab + c^*) b$.

4. Define Mealy and Moore machine.

5. Construct a regular grammar G generating the regular set represented by

   $P = a^* b (a + b)^*$

6. If G is the grammar $S \rightarrow SbS / a$, show that G is ambiguous.

7. Discuss the model of PDA with ID.

8. Explain different parameters used in DFA and NDFA. Write differences in between them.

PART – C

Answer any *five* of the following questions : 5×8=40

1. Construct a minimum state automaton equivalent to the finite automata from the given transition table

State/Σ	0	1
$\rightarrow q_0$	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

2. Construct the finite automaton equivalent to the regular expression

$(0 + 1)^*\ (00 + 11)\ (0 + 1)^*$

3. Define Chomsky classification of languages with example.

4. Define Chomsky normal form (CNF). Find a grammar in CNF equivalent to

$S \rightarrow aAbB, \quad A \rightarrow aA / a, \quad B \rightarrow bB / b.$

5. Design a PDA M to accept the language $L = \{ WCW^R / W \in (a, b)^+ \}$

6. If a be the grammar

$S \rightarrow aB / bA$

$S \rightarrow aS / bAA / a$

$B \rightarrow bS / aBB / b$

For the string aaabbabbba, find Leftmost derivation and Rightmost derivation.