Show that the string w = aaabbbaaa€ L using:
(a) Derivative approach.
(b) Recursive inference approach.

7. Explain the basic structure of pushdown automata. Define Turing Machine. 5+5=10

8. What is automata? What are the characteristics of automata? Define alphabets, strings & language, length of strings. 1+5+4=10

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MASTER OF COMPUTER APPLICATION
FOURTH SEMESTER
FORMAL LANGUAGE AND AUTOMATA THEORY
MCA-401

(Use separate answer scripts for Objective & Descriptive)

Duration: 3 hrs. Full Marks: 70

[PART-A: Objective]

Time: 20 min. Marks: 20

Choose the correct answer from the following: *1×20=20*

1. The output of Moore machine depends on:
   a. The present state only
   b. The present state and the input symbol
   c. The input symbol only
   d. None of these

2. Two finite automata are equivalent if:
   a. The number of states in them is the same
   b. Their character set is same.
   c. Their string recognition behavior is the same
   d. None of these

3. A string 'w' is accepted by an NFA:
   a. If at least one path among all possible paths lead to the final state.
   b. If all states in the NFA are final states.
   c. If the initial state in the NFA is a final state.
   d. None of these.

4. The string 1111 can be generated through the regular expression:
   a. (01)*
   b. (11)*
   c. (101)*
   d. None of these

5. The regular set denoted by the regular expression (a+b)(a+b) is:
   a. {a,b}
   b. {a,b,ab,ba}
   c. {aa,ab,ba,bb}
   d. {a,b,bb,aa}

6. If R1 and R2 are two regular expressions then which of the following is not true?
   a. R1 + R2 is a regular expression
   b. R1R2 is a regular expression
   c. R1 cannot be
   d. (R1+R2) is a regular expression

7. The language L = {00,0000,000000,.....} is represented by the regular expression:
   a. 0*
   b. (00)*
   c. 0(00)*
   d. None of these

8. A regular expression representing all possible strings over a and b including null strings is:
   a. (a+b)*
   b. (a+b)(a+b)*
   c. (aa+ab+bb)*(a+b)
   d. None of these

9. A context free language is accepted by a:
   a. Push down automata
   b. Finite automata
   c. Turing Machine
   d. None of these

10. The context free grammar corresponding to the language L = {0^k1^k | k>=1} is:
    a. S -> 0S1 | 01
    b. S -> 0S1 | 01 | €
    c. S ->0A1,A -> 01
    d. None of these

11. A context free grammar is:
    a. Type 0 grammar
    b. Type 1 grammar
    c. Type 2 grammar
    d. Type 3 grammar

12. The string generated by the grammar S ->aS | bA,A->d | ccA:
    a. aaabb
    b. Bbbddd
    c. dad
    d. None of these

13. A Turing machine is more powerful than the PDA because:
    a. The head can move in both directions.
    b. The current input symbol can be changed.
    c. The tape is infinite.
    d. All of the above.

14. If P = Q+PR then P = QR* belongs to:
    a. Arden's theorem
    b. Ogden's theorem
    c. Pumping lemma
    d. None of these

15. If L1 and L2 are regular languages, then L1L2 will be:
    a. Regular
    b. Non-regular
    c. Maybe regular
    d. None of these

16. Which of the following conversions is not feasible?
    a. Regular expression to automata
    b. Automata to regular expression
    c. NFA to DFA
    d. None of these

17. A ->aA | a | b, the number of steps to form aab is:
    a. 2
    b. 3
    c. 4
    d. 5

18. A grammar with more than one parsed tree is called:
    a. Unambiguous
    b. Ambiguous
    c. Regular
    d. None of these

19. Sentence formation starts from:
    a. Terminals
    b. Non-terminals
    c. The starting symbol
    d. The production set

20. A Turing machine is an automaton for:
    a. Context-sensitive grammar
    b. Context-free grammar
    c. Regular grammar
    d. Unrestricted grammar

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(PART-B :Descriptive)

Time: 2 hrs. 40min. **Marks: 50**

[Answer question no.1 & any four (4) from the rest]

1. Explain Chomsky classification of grammars with examples. 10

2. Define finite automata. Design the DFA both table and diagram equivalent for the NFA given in the following table: 5+5=10

Current State	Input Symbol	
	0	1
→ q_0	q_1	q_0, q_2
q_1	q_2	q_0
q_2	q_0	-

3. a. What is the difference between Moore machine and Mealy machine? 3+7=10
   b. For the Mealy machine given in the following table, find the equivalent Moore machine.

Current State	Input Symbol			
	a		b	
	Next state	Output	Next state	Output
→q_0	q_1	1	q_3	1
q_1	q_1	0	q_0	1
q_2	q_0	1	q_2	0
q_3	q_3	0	q_1	1

4. a. Write regular expressions for the following: 6+4=10
   i. The set of all strings s over {a,b} having exactly one a.
   ii. The set of all strings over {0,1} beginning with 0 and ending with 11.
   iii. {2,12,112,1112,.....}
   b. Construct the finite automata for the following regular expression:
   (ab+bc)d

5. a. What is regular expression? Explain the operators used in regular expression. 4+6=10
   b. Write the regular set for the following:
   i. a(aa)*
   ii. (a+b)*c
   iii. a(a+b)*

6. Explain context-free grammar. The grammar G is represented by the following production: 2+4+4=10
   S →ASA | BSB | a | b
   A → a
   B → b