

Roll No _____

**RE-APPEAR, EXAMINATION
DEC, 2024**

**Course Code: - ETCS214A
Course Name: - Theory of Computation**



Programme Name: B.Tech(CSE)/B.Tech(CSE-AI/ML)/B.Sc(CS)

Time: 2.5 Hours

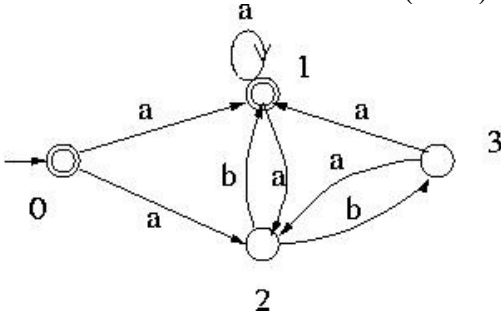
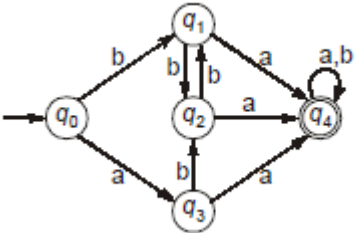
Maximum Marks: 50

Instructions: All questions are compulsory. The question paper consists of 11 questions divided into three parts A, B and C. Section-A comprises 5 questions of 2 marks each, Section-B comprises 4 questions of 5 marks each and Section-C comprises 2 questions of 10 marks each. Q. No. 7, Q. No. 10 and Q. No. 11 have internal choices.

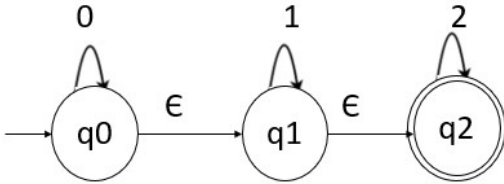
Section-A (5 X 2 = 10 Marks)

1	Design a finite automata that accepts all strings over input {a, b} such that the numbers of a's are exactly two.	CO1
2	Let L denotes the language generated by the grammar $S \rightarrow OSO/00$. Which of the following is true? (a) $L = O$ (b) L is regular but not O (c) L is context free but not regular (d) L is not context free Justify your answer.	CO2
3	Construct a finite automata that accepts all strings over input {a, b} such that the numbers of a's mod 3=0 and number of b's mod 2=0.	CO3
4	Define Moore machine with respect to automata theory.	CO4
5	If G is a grammar with productions $S \rightarrow SaS \mid aSb \mid bSa \mid SS \mid \epsilon$ where S is the start variable, then which one of the following strings is not generated by G? (a) abab (b) aaab (c) abbaa (d) babba Justify your answer.	CO3

Section B (4 X 5 = 20 Marks)

6	Which one of the following regular expressions represents the language: the set of all binary strings having two consecutive 0's and two consecutive 1's? A. $(0 + 1)^* 0011(0 + 1)^* + (0 + 1)^* 1100(0 + 1)^*$ B. $(0 + 1)^* (00(0 + 1)^* 11 + 11(0 + 1)^* 00)(0 + 1)^*$ C. $(0 + 1)^* 00(0 + 1)^* + (0 + 1)^* 11(0 + 1)^*$ D. $00(0 + 1)^* 11 + 11(0 + 1)^* 00$ Explain your example with the help of suitable example.	CO2
7	Construct a PDA(Pushdown Automata) that accept the language, $L = \{ a^n b^{2n}, n \geq 1 \}$. OR Consider the following non-deterministic finite automata (NFA). Convert the NFA into equivalent Deterministic Finite Automata (DFA). 	CO3
8	Which of the following regular expressions represent(s) the set of all binary numbers that are divisible by three? Assume that the string ϵ is divisible by three. (A) $(0+1(01^*0)^*1)^*$ (B) $(0+11+10(1+00)^*01)^*$ (C) $(0^*(1(01^*0)^*1)^*)^*$ (D) $(0+11+11(1+00)^*00)^*$ Justify your answer.	CO2
9	Minimize the following deterministic finite automata. 	CO1

Section C (2 X 10 = 20 Marks)

10	Convert the given NFA with epsilon to NFA without epsilon.  <pre> graph LR start(()) --> q0((q0)) q0 -- 0 --> q0 q0 -- ε --> q1((q1)) q1 -- 1 --> q1 q1 -- ε --> q2(((q2))) q2 -- 2 --> q2 </pre> OR Consider the following statements about the context free grammar $G = \{ S \rightarrow SS, S \rightarrow ab, S \rightarrow ba, S \rightarrow \epsilon \}$ i) G is ambiguous ii) G produces all strings with equal number of a's and b's iii) G can be accepted by a deterministic PDA. Which combination below expresses all the true statements about G? A. I only B. I and III only C. II and III only D. I, II and III Justify Your answer.	CO2
11	Design a Turing Machine that recognizes the strings generated by the language, $L = \{a^n b^n c^n, n \geq 1\}$. Draw the transition table and transition diagram. OR Design a PDA (Pushdown Automata) that accepts the strings of the form $\{ww^R, w \text{ belongs to } \{a, b\}^+\}$. Draw the transition table and transition diagram.	CO4