



VIT[®]

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

SLOT: E2+ TE2

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

Programme Name & Branch : B.Tech. & CSE
Course Code and Course Name : BCSE304L & Theory of Computation
Faculty Name(s) : Applicable to all
Class Number(s) : Applicable to all
Date of Examination : 31.01.2026
Exam Duration : 90 minutes **Maximum Marks: 50**

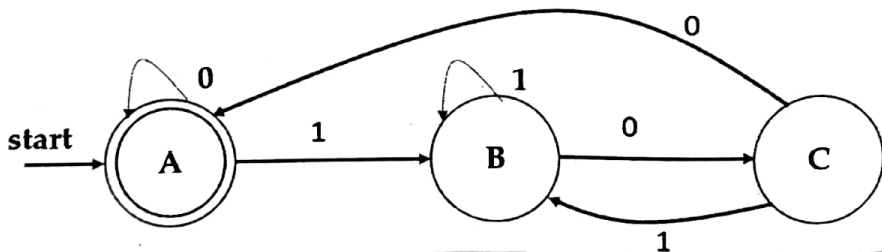
General instruction(s):

- Answer All Questions
- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyse, 5 - Evaluate, 6 - Create)
- Course Outcomes: (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)
 CO1. Compare and analyse different computational models.
 CO2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
 CO4: Represent the abstract concepts mathematically with notations

Q.No.	Question	Module	Marks	CO	BL
1.	a) Prove using a contradiction argument and by contrapositive reasoning, that for any sets A, B , and C , $A \subseteq B$ implies $A \cap C \subseteq B \cap C$.	1	4	4	2
	b) Observe the given series, conjecture a general formula and prove, using mathematical induction, that the formula holds for all positive integers $n \geq 1$. $\frac{1}{1 \cdot 3} = \frac{1}{3},$ $\frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} = \frac{2}{5},$ $\frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} = \frac{3}{7},$ $\frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} + \frac{1}{7 \cdot 9} = \frac{4}{9}$	1	6		
2.	a) Let $L_1 = \{w \mid w \in \{a, b\}^*, w \text{ starts with } a \text{ or ends with } b \text{ but its length is } 3\}$ and $L_2 = \{w \mid w \in \{a, b\}^*, w =3\}$. Find the following: i. $L_3 = (L_1 \cap L_2) \cup L_2$ ii. $L_4 = (L_3 - L_1) \cdot aba$ iii. $L_5 = (L_3)^R - L_2$	1	3*1	1	2
	b) Given the grammar, $G = (\{S, X, Y\}, \{a, b\}, P, S)$ where the production, P is given below. Obtain the $L(G)$ and identify the type of language. Productions P : $S \rightarrow XY, X \rightarrow aXb, bY \rightarrow bbY, aXb \rightarrow aaa, Y \rightarrow \epsilon$	1	2	1	2
	c) Construct DFA for set of all strings containing exactly two 0's and at least three 1's.	2	5	1	3



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3.	<p>Consider the language, $L = \{w \in \{a, b\}^* \mid \text{the last three symbols of } w \text{ contain exactly two occurrences of } a\}$.</p> <p>a) Construct a Non-Deterministic Finite Automaton with ϵ-moves (NFA-ϵ) that recognizes the language, L. [4]</p> <p>b) Convert the NFA-ϵ constructed in part (a) into an equivalent Deterministic Finite Automaton (DFA). Draw the state transition diagram of the resulting DFA. [6]</p>	2	10	1	3																								
4.	<p>Given the state transition table of a finite automaton, construct the equivalent minimized Deterministic Finite Automaton (DFA):</p> <table border="1"> <thead> <tr> <th>State</th> <th>a</th> <th>b</th> </tr> </thead> <tbody> <tr> <td>$\rightarrow q_0$</td> <td>q_1</td> <td>q_3</td> </tr> <tr> <td>q_1</td> <td>q_2</td> <td>q_4</td> </tr> <tr> <td>$*q_2$</td> <td>q_2</td> <td>q_1</td> </tr> <tr> <td>q_3</td> <td>q_6</td> <td>q_2</td> </tr> <tr> <td>$*q_4$</td> <td>q_4</td> <td>q_4</td> </tr> <tr> <td>q_5</td> <td>q_6</td> <td>q_6</td> </tr> <tr> <td>$*q_6$</td> <td>q_6</td> <td>q_6</td> </tr> </tbody> </table>	State	a	b	$\rightarrow q_0$	q_1	q_3	q_1	q_2	q_4	$*q_2$	q_2	q_1	q_3	q_6	q_2	$*q_4$	q_4	q_4	q_5	q_6	q_6	$*q_6$	q_6	q_6	2	10	1	4
State	a	b																											
$\rightarrow q_0$	q_1	q_3																											
q_1	q_2	q_4																											
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q_5	q_6	q_6																											
$*q_6$	q_6	q_6																											
5.	<p>a) Construct the Finite automata from the given regular expression using Thompson's construction method. $R = (((10)+(0+1))^*01(0+1)^*)^*$</p>	3	5	2	3																								
	<p>b) Determine the regular expression for the following DFA:</p>  <pre> graph LR start((start)) -- 0 --> A(((A))) A -- 1 --> B((B)) B -- 1 --> B B -- 0 --> C((C)) C -- 0 --> A C -- 1 --> B style start fill:none,stroke:none style A stroke-width:4px </pre>	3	5																										