

Continuous Assessment Test (CAT) – I AUGUST 2025

Programme	: B.TECH	Semester	: Fall 25-26
Course Code & Course Title	: BCSE304L Theory of Computation	Class Number	: CH2025260100994 CH2025260100995 CH2025260100996 CH2025260100997 CH2025260100998
Faculty	: ANAND M, UMMITY SRINIVASA RAO, JAYARAM B, SHIVANI GUPTA, BENIL T	Slot	: D1+TD1
Duration	: 90 Minutes	Max. Mark	: 50

General Instructions:


- Write only your registration number on the question paper in the box provided and do not write other information

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1.		<p>Let $\Sigma = \{0,1\}$ and $\Omega = \{a, b\}$ be two alphabets. A function $H : \Sigma^* \rightarrow \Omega^*$ is defined as follows: $H(\epsilon) = \epsilon$, $H(0) = a$, $H(1) = ab$, and for any string $a_1a_2\dots a_n \in \Sigma^* - \{\epsilon, 0, 1\}$, $H(a_1a_2\dots a_n) = H(a_1)H(a_2)\dots H(a_n)$. For example: $H(01101) = H(0)H(1)H(1)H(0)H(1) = a ab ab a ab = aababaab$.</p> <p>For a language $L \subseteq \Sigma^*$, the language $H(L)$ is defined as: $H(L) = \{H(w) \mid w \in L\}$. Now, let $L = \{w \in \{0,1\}^* \mid w \text{ ends with } 000\}$. Is $H(L)$ a regular language? Justify your answer. If your answer is 'yes,' design a deterministic finite automaton to justify it.</p>	10	1	K4
2.		<p>Let $\Sigma = \{0,1,2,3,4,5,6,7,8,9\}$ be an alphabet and Σ^+ represent the whole numbers. Let $L \subseteq \Sigma^+$ be a language defined as</p> $L = \{n : (n \bmod 5) \bmod 7 = 0, n \in \Sigma^+\}$ <p>For example, $5 \in L$, $10 \in L$ but $22 \notin L$. Write a regular grammar G for representing the language L.</p>	10	2	K3
3.		<p>In the C programming language, <i>delimited comments</i> are enclosed between the delimiters <code>/*</code> (opening) and <code>*/</code> (closing). Let L be the language of all syntactically valid delimited comments. A string $w \in S$ must:</p> <p>(a) Begin with the opening delimiter <code>/*</code> and end with the closing delimiter <code>*/</code>.</p> <p>(b) Contain no occurrence of the sequence <code>*/</code> except</p>	10	2	K3

	<p>at its termination.</p> <p>(c) Be composed solely of symbols from the alphabet $\Sigma = \{/, *, a, b, c\}$</p> <p>Design an ϵ-NFA (Nondeterministic finite automaton) to recognize the language L and convert the ϵ-NFA into an equivalent nondeterministic finite automaton without epsilon transitions. Illustrate the computation of your model on any sample input.</p>			
4.	<p>Let L be a language defined as: $L = \{(ab)^{(5k+2)} \mid k \text{ is an integer and } k \geq 0\}$. Is L a regular language? Justify your answer. If your answer is 'yes,' design a minimum state deterministic finite automaton to justify it.</p>	10	1	K4
5.	<p>Given k is a fixed positive integer. Let $L = \{a^n b^k : 1 \leq k \leq 2\}$ with $n \geq 1$ be a language on an alphabet $\{a, b\}$. Design a deterministic finite automaton (DFA) to recognize the language L and find an equivalent regular expression that can be generated by the DFA.</p>	10	1	K4

*****All the best *****


 13/8/2025
 Dr. Susheela.S