



VIT

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

REG.NO.:

SLOT: A1+TA1+TAA1

SCHOOL OF COMPUTER SCIENCE ENGINEERING AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2026-2027

Session: IV

Programme Name & Branch : BTECH - Computer Science and Engineering (Artificial Intelligence and Data Engineering), BTECH - Computer Science and Engineering (Cyber Security)
Course Code and Course Name : BACSE201 – Models of Computation
Faculty Name(s) : Dr. Dharmendra Singh Rajput(14049), Dr. Yusuf Akhtar(22528), Dr. Sivashankari R (11995)
Class Number(s) : VL2026270102657, VL2026270103387, VL2026270103384
Date of Examination : 27th September 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
 2. Design and analyze finite automata and regular expressions to solve lexical analysis problems and recognize regular languages
 3. Construct and simplify context-free grammar and apply parsing algorithms to determine syntactic structure in languages
 4. Develop pushdown automata and understand parsing strategies such as LL(1) and LR for context-free languages

Q. No	Questions	M	CO	B L
1.	(a) Using the Pumping Lemma, prove rigorously that the language: [6 Marks] $L = \{ a^i b^j c^k \mid i < j < k \}$ is not regular. (b) Consider the Context-Free Grammar G defined by the following productions with start symbol S: Formally express the language L(G) generated by this grammar [4 Marks] $S \rightarrow A \mid B$ $A \rightarrow aAb \mid ab$ $B \rightarrow aBbb \mid abb$	10	2	4
2.	Consider the language $L = \{ w \in \{a, b\}^* \mid n_a(w) \neq n_b(w) \}$, where $n_a(w)$ and $n_b(w)$ represent the total number of 'a's and 'b's in string w, respectively. (a) Construct a Context-Free Grammar (CFG) G that generates L. [4 Marks] (b) Show that your constructed grammar G is ambiguous by choosing a string $w \in L$ of length $w \geq 4$ and demonstrating two distinct Leftmost Derivations (LMD). [4 Marks] (c) For the same string w chosen in part (b), provide the complete Rightmost Derivation (RMD). [2 Marks]	10	3	6
3.	Convert the following CNF grammar $G = (\{A1, A2, A3\}, \{a, b\}, P, A1)$ into Greibach Normal Form (GNF):	10	3	3



VIT

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

REG.NO.:

SLOT: A1+TA1+TAA1

SCHOOL OF COMPUTER SCIENCE ENGINEERING AND INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2026-2027

Session: IV

	$A1 \rightarrow A2A3$ $A1 \rightarrow a$ $A2 \rightarrow A3A1$ $A2 \rightarrow b$ $A3 \rightarrow A1A2$			
4.	(a) Construct a NPDA for the language $L_{\text{odd}} = \{ waw^R \mid w \in \{a, b\}^* \}$ and explain why the presence of the single character center marker 'a' does NOT make the language deterministic (unlike $w c w^R$ where $c \notin \{a, b\}$). [6 Marks] (b) Consider the union language $L = \{ a^n b^n c^m \mid n, m \geq 1 \} \cup \{ a^n b^m c^m \mid n, m \geq 1 \}$. [2+2 Marks] i. Explain theoretically why a Deterministic Pushdown Automaton (DPDA) cannot accept L, even though $L = \{ a^n b^n c^m \}$ and $L = \{ a^n b^m c^m \}$ are individually deterministic context-free languages. ii. Describe the exact point during string processing where a Non-Deterministic Pushdown Automaton (NPDA) must make a non-deterministic choice, and specify the stack operations for both computational branches.	10	4	6
5.	Consider the CFG G: $S \rightarrow iEtSS' \mid a$ $S' \rightarrow eS \mid \epsilon$ $E \rightarrow b$ (a) Compute the exact set values for FIRST(S), FIRST(S'), FOLLOW(S), and FOLLOW(S'). [6 Marks] (b) Remove epsilon productions from G. [4 Marks]	10	4	3
