

**VIT**

Vellore Institute of Technology

REG.NO.:

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: D2 + TD2

Programme Name & Branch : B. Tech. (BBS)
 Course Code and Course Name : Formal Languages and Automata Theory (CBS2002)
 Faculty Name(s) : Debi Prasanna Acharjya
 Class Number(s) : VI_2024250107120
 Date of Examination : 16/10/2024
 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)
- CO 1: Demonstrate the knowledge of mathematical models of computation and describe how they relate to formal languages
 CO 2: Derive an appropriate model of computation for a given language and vice versa
 CO 3: Infer the equivalence of languages described using different automata or grammars

Q. No	Question	M	CO	BL
1.	(a) Show that the following language is not regular. Use pumping lemma to support your answer. $L = \{a^n b^m \mid n \neq m, n, m \in \mathbb{N}\}$	5	1	3
	(b) Obtain a context free grammar to generate the following language. $L = \{a^n b^m \mid m > n, n \geq 0, n \in \mathbb{N}\}$	5		
2.	(a) Show that the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow iCtS \mid iCtSeS$, $a, C \rightarrow b \mid d$ is ambiguous.	5	3	3
	(b) Eliminate the useless symbols from the context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow aA \mid a \mid Bb \mid cC$, $A \rightarrow aB$, $B \rightarrow a \mid Aa$, $C \rightarrow cCS$, $D \rightarrow ddd \mid F$, and $F \rightarrow d$.	5		
3.	(a) Obtain an equivalent context free grammar by eliminating the unit productions of the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow aA \mid a \mid B \mid C$, $A \rightarrow aB \mid \Lambda$, $B \rightarrow aA$, $C \rightarrow cCD$, and $D \rightarrow abd$.	5		3
	(b) Obtain an equivalent context free grammar in Chomsky Normal form for the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow AB \mid 00A0B$, $A \rightarrow 00A \mid \Lambda$, and $B \rightarrow 1A1 \mid 00$.	5		
4.	Construct a pushdown automaton that accepts the following language by empty stack, where $n_a(w)$ refers to number of a 's in w . Illustrate the construction by considering even and odd strings. $L = \{n_a(w) = n_b(w) \mid w \in \{a, b\}^*\}$	10		2
5.	Prove or disprove that the string $z = 10001$ belongs to the language generated by the following context free grammar $G(V_N, T, P, S)$ having productions $S \rightarrow 1S \mid ABC \mid 0$, $A \rightarrow 10 \mid BB$, $B \rightarrow 0 \mid 1$, $C \rightarrow AB \mid 1$. Use CYK algorithm to support your answer.	10		2