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

School of Computer Science and Engineering

Winter Semester 2023-24

Continuous Assessment Test – II

SLOT: B2+TB2

Programme Name & Branch: B.Tech

Course Name & Code: Theory of Computation & BCSE304L

Class Number (s): VL2023240500789, VL2023240501047, VL2023240501029, VL2023240500774, VL2023240500845, VL2023240500760, VL2023240501015, VL2023240500784, VL2023240501045, VL2023240500861, VL2023240501036, VL2023240500763, VL2023240501026, VL2023240500766, VL2023240500771, VL2023240501043, VL2023240500797, VL2023240501049, VL2023240501037, VL2023240501042, VL2023240501051, VL2023240501014.

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Exam Duration: 90 Min. **Maximum Marks: 50**

Q. No.	Question	Max Marks	CO	BL
1.	a) The derivative of a language for a string x is defined as follows: $L_x = \{ y \mid xy \in L\}$. 1) what is L_{aa} for the language $L=\{a^{n+1}b^n \mid n \geq 1\}$. (1mark) 2) what is L_b for the language $L=\{a^{n+1}b^n \mid n \geq 1\}$. (1 mark) 3) Prove that when L is regular, the derivative of L (ie., L_x) is also regular. (3 marks)	5	CO3	BL3
	b) Consider the language $L_1=\{a^pb^qa^r \mid pq,r \geq 1 \text{ and } p+q \neq r\}$. Prove or disprove that the language L is regular.	5	CO3	BL2
2.	a) Design a CFG for the language $\Upsilon = \{a^nb^ma^{2n}: n, m \geq 0\}$.	5	CO3	BL2
	b) Consider the grammar $S \rightarrow 0S1 \mid 1S0 \mid \lambda$, where S is the start symbol, {0,1} are terminals . You can see that for every 0 there is a 1 and vice versa in the rule (other than $S \rightarrow \lambda$). Is the grammar generates the language $L_2 = \{w : \lvert w\rvert_0 = \lvert w\rvert_1\}$ where $\lvert w\rvert_a$ refers to the occurrences of a in w. If not, justify with a string in the language L_2 that cannot be produced by the given grammar rules. What further changes you need to do in the given grammar in order to generate L_2.	5	CO3	BL2
3.	a) Construct the CYK algorithm for the following CFG and check whether the string **"aabcb"** is derivable from the grammar. The Start Symbol is A.	10	CO3	BL3

	A→ CB **B → DC | b** **C → BD | a** **D → AD | c**			
4.	a) Construct the given Context Free Grammar **G=(V,T,P,S)** into Chomsky normal form. P is the start symbol. **P→ RPT** **Q→ RP/Ra** **R→ bRPR|b|ε** **T→ PaP|R|aa**	5	CO3	BL3
	b) Derive the CFG for the given Context Free Language **L= {$v^r i^{r+s} t^s$ | r, s ≥ 0}** and check the ambiguity of the given grammar.	5	CO3	BL3
5.	The language L have a strings of balanced "#" symbol and "@" symbol : every "#" symbol can be paired with a unique subsequent of "@" symbol , and every "@" symbol can be paired with a unique preceding "#" symbol. Moreover, the string between any such pair has the same property. Derive the language for the given condition and Construct the PDA for the derived language.	10	CO4	BL4