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

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CONTINUOUS ASSESSMENT TEST - II

SLOT: B1 + TB1

WINTER SEMESTER 2023-2024

Programme Name & Branch : **B.Tech**
Course Code : **BCSE304L**
Course Name : **Theory of Computation**

Faculty Name(s) : **Prof. Sathiyakumar, Prof.Anand M, Prof. Lakshmanan K, Prof. Viswanathan P, Prof. Arumuga Arun R, Prof. Shalini L, Prof. Kannadasan R, Prof. Gunavathi C, Prof. Navamani T M, Prof. Rajarajan G, Prof. Madiajagan M, Prof. Saritha Murali, Prof. Delhibabu R, Prof. Vishnupriya, Prof. Krishnaraj N, Prof. Bhuvaneswari M, Prof. Kanagaraj R, Prof. Sathya K, Prof. Anand Bihari, Prof. Baskaran P, Prof. Hussain Ahmed Chowdhury**

Class Number(s) : **VL2023240500758, 0762, 0764, 0767, 0769, 0770, 0773, 0783, 0788, 0794, 0842, 0859, 1011, 1013, 1024, 1027, 1028, 1031, 1034, 1038, 1040**

Duration: 90 min. **Max. Marks: 50**

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	a) For languages A and B, let the perfect shuffle of A and B be the language **{w |w = $a_1b_1\cdots a_kb_k$, where $a_1\cdots a_k \in A$ and $b_1\cdots b_k \in B$, each $a_i,b_i \in \Sigma$}**. Show that the class of regular languages is closed under perfect shuffle.	5	CO3	BL3
	b) Prove using pumping lemma, the following language is not regular **L={w ∈{0,1}*| w contains more 0's than 1's}**	5	CO3	BL2
2.	(a) Design a CFG for the language **L={ww^Rzz^R | w,z ∈ {0,1}$^+$, 011 is a substring of w and |z| is odd, w^R is the reverse of w, z^R is the reverse of z}**. Explain the use of each production in the constructed grammar?	5	CO3	BL2
	(b) Convert the given Context free grammar G into an equivalent context free grammar G_1 in Chomsky normal form (CNF) **$S \rightarrow aXbX$** **$X \rightarrow aY \mid bX \mid \lambda$** **$Y \rightarrow X \mid c$**	5	CO3	BL2
3.	(a) Show that the language **L = {β#β^R#β | where Σ= {a,c,#} and β∈{a,c}*}** is not context free (β^R is the reverse of β).	5	CO3	BL3
	(b) Write the above language L (in Question 3(a)) as the intersection of two context-free languages (over Σ).	5	CO3	BL3

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4.	Consider the following context free grammar (where A is the start symbol) **A → BA | AC | a** **B → CB | BA | b** **C → AC | CB | a** Apply CYK algorithm for the input string ***abbaa***. Find the nonterminal set where X is marked in the table. Without steps full marks will not be awarded. X X X X X a b b a a	10	CO3	BL3
5.	Give a push down automata (PDA) that recognizes the language L of all strings w∈{0,1}* such that the first and last symbol of w are the same, and moreover, if the length of w is odd, then the middle symbol of w is different from the first and the last. For example, strings 00, 11, 010, 010100010010, 0101010 are in L, but λ, 0, 1, 000, 111, 110, 00001, 1001001 are not. Show the configurations made by the constructed PDA for the input strings **(a) 0101010 (b) 111**	10	CO4	BL4

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