U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Computer Science and Engineering **Duration: 3 hrs.**

Course Code: 23CS4PCTFC / 22CS4PCTFC **Max Marks: 100**

Course: Theoretical Foundation of Computations

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	List out the difference between DFA and NFA. Draw a deterministic finite automaton which accept a string containing "the" anywhere in a string of {a-z}, e.g., "there" but not "those".	CO1	PO2	10
	b)	Convert the following NFA to its equivalent DFA along with construction of transition table and show the step-by-step procedure involved in constructing the DFA.	CO1	PO2	10
		OR			
2	a)	Design DFA for accepting binary strings that i)start with 00 ii) having 001 iii) ending with 01 iv) not having 111 v) whose value is multiple of 2	CO3	PO3	10
	b)	Design a NFA for accepting binary strings that have 1 in second last position. Convert the same to DFA.	CO3	PO3	10
		UNIT - II			
3	a)	Obtain an Non- Deterministic Finite Automata (NFA) for the regular expression (a+b)*aa(a+b)*. Show the step-by-step procedure involved in constructing the NFA.	CO3	PO3	10
	b)	Obtain the distinguishable table for the automaton and then minimize the states of the following DFA.	CO1	PO3	10

δ	a	b
→A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

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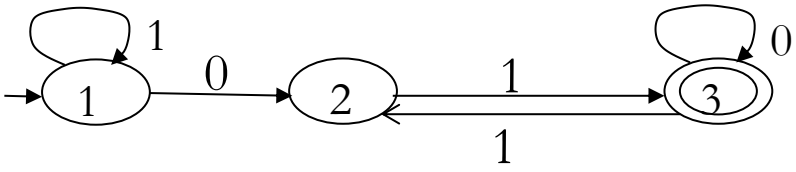
			OR			
	4	a)	Apply Pumping Lemma theorem to show that the language, i. L= $\{a^{n!}, n>=0\}$ is not regular ii.L= $\{0^n$, n is a perfect square$\}$	*CO3*	*PO3*	**10**
		b)	Convert the following Finite Automata to Regular Expression, using the Kleene's technique.  	*CO1*	*PO3*	**10**
			UNIT - III			
	5	a)	List out the Applications of Context Free Grammars.	*CO1*	*PO1*	**4**
		b)	Show that the below grammar is ambiguous. S → iCtS | iCtSeS | a , C → b.	*CO2*	*PO2*	**6**
		c)	Consider the grammar. S → AA | 0 A → SS | 1 Obtain the grammar in Greibach Normal Form (GNF).	*CO2*	*PO2*	**10**
			OR			
	6	a)	Consider the grammar. S -> 0A | 1B A -> 0AA | 1S | 1 B -> 1BB | 0S | 0 Obtain the grammar in Chomsky Normal Form (CNF).	*CO2*	*PO2*	**10**
		b)	Design Context Free Grammar (CFG) to accept the following languages (i) L= $\{a^{n+2}\, b^m \mid n\geq 0$ and m>n$\}$ (ii) L= $\{a^n\, b^m c^k \mid n\geq 0$ and m>n$\}$	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Design PDA to accept the language L(M) = $\{wCw^R \mid w \in (0,1)^*\}$, where w^R is reverse of w .Show that the string 01C10 is accepted	*CO3*	*PO3*	**10**
		b)	For the grammar: S → aABB | aAA A → aBB | a B → bBB | A C → b Obtain the corresponding PDA	*CO3*	*PO3*	**10**
			OR			
	8	a)	Design Deterministic Push Down Automata for the language L= $\{W, W \in (a+b)^*$ and $n_a(w) < n_b(w)\}$ by final state. Show instantaneous description for the string **abbab.**	*CO3*	*PO3*	**10**

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		b)	Obtain CFG that generates the language accepted by the PDA P= (Q, ∑, Γ, q0, Z0, δ, F) Q = {q0, q1} ∑ = {a, b} Γ = {A, Z} q0 = q0 Z0 = Z F = {q1} δ(q0 , a, Z)=(q0, AZ) δ(q0 , b, A)=(q0, AA) δ(q0 , a, A)=(q1, $\boldsymbol{\varepsilon}$)	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Design Turing Machine for L= $\{0^n1^n \mid n>=1\}$. Show that the string 0011 is Accepted.	*CO3*	*PO1*	**10**
		b)	Find a Post Correspondence Solution for following two lists given. A = (abb , aa , aaa) and B = (bba ,aaa ,aa)	*CO3*	*PO3*	**5**
		c)	Explain the programming techniques for Turning Machine.	*CO1*	*PO1*	**5**
			OR			
	10	a)	Design a Turing Machine that accepts palindrome strings of a and b.	*CO3*	*PO3*	**10**
		b)	Elaborate on the various components of Turing machine model.	*CO1*	*PO1*	**5**
		c)	Explain Multi stack and Multi tape Turing machine.	*CO1*	*PO1*	**5**

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