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

Autonomous Institute Affiliated to VTU

June / July 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

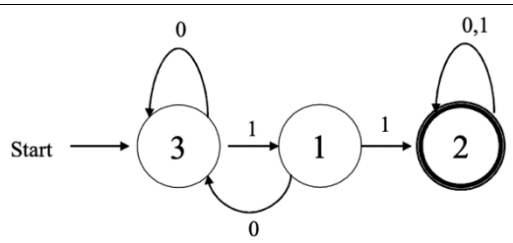
Course Code: 22AM3PCTFC **Max Marks: 100**

Course: Theoretical Foundations 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

			UNIT - I	*CO*	*PO*	Marks
1	a)		Explain Type 2 and Type 3 grammars.	*CO1*	*PO1*	**06**
	b)		Design a Finite Automaton that accepts the words “the”, “this”, “that” and “to”.	*CO3*	*PO3*	**08**
	c)		Differentiate between Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), and Epsilon-NFA (ϵ-NFA).	*CO2*	*PO2*	**06**
			OR			
2	a)		Write any 3 real time applications of DFA and explain.	*CO1*	*PO1*	**06**
	b)		Design a NFA for a set of strings such that the 5^{th} symbol from the right end is 1.	*CO3*	*PO3*	**08**
	c)		Elaborate on the process of determining the Epsilon closure of an Automaton states with an example.	*CO2*	*PO2*	**06**
			UNIT - II			
3	a)		Construct NFA for the Regular Expression (RE): (1+0)0*	*CO3*	*PO3*	**10**
	b)		Write any 5 closure properties of Regular Languages.	*CO1*	*PO1*	**05**
	c)		Explain the process of minimizing an Automaton.	*CO2*	*PO2*	**05**
			OR			
4	a)		Apply Kleene’s theorem and convert the given DFA to its equivalent RE representation.	*CO3*	*PO3*	**10**

						
		b)	Prove that L = $\{a^n b^n \mid n>0\}$ is not regular.	*CO2*	*PO2*	**05**
		c)	Describe the following in the form of Regular Expression (RE) i. Set of all strings of 0's and 1's ending in 00 ii. All strings of 0's and 1's	*CO3*	*PO3*	**05**
			UNIT - III			
	5	a)	Write 5 applications of Context Free Grammar (CFG).	*CO1*	*PO1*	**05**
		b)	Eliminate useless symbols in G S → AB | CA S → BC | AB A → a C → aB | b	*CO3*	*PO3*	**08**
		c)	Write the procedural steps that is to be followed to convert the given grammar to Chomsky Normal Form (CNF).	*CO2*	*PO2*	**07**
			OR			
	6	a)	Prove that Context Free Languages are closed under Union.	*CO2*	*PO2*	**06**
		b)	Eliminate unit productions in the grammar S → A | bb A → B | b B → S | a	*CO3*	*PO3*	**08**
		c)	Check whether the given Grammar with the following productions is Ambiguous or not. S → aS | aSb | X X → Xa | a	*CO2*	*PO2*	**06**
			UNIT - IV			
	7	a)	Design a Pushdown Automata (PDA) to accept the language $L = \{0^n 1^{2n} \mid n >=1\}$	*CO3*	*PO3*	**10**
		b)	Differentiate between PDA and Non-Deterministic PDA (NPDA).	*CO2*	*PO2*	**05**
		c)	Explain the process to be followed to construct a CFG for the given PDA.	*CO1*	*PO1*	**05**
			OR			
	8	a)	Design a NPDA that accepts the language $L = \{WW^r \mid W \in (a+b)^*\}$	*CO3*	*PO3*	**10**

		b)	Write any 2 real time applications of PDA and explain.	*CO1*	*PO1*	**05**
		c)	How does PDA accept a language? Explain.	*CO2*	*PO2*	**05**
			UNIT - V			
	9	a)	Is it possible for Turing Machines (TMs) to function as language accepters and transducers? Justify.	*CO2*	*PO2*	**06**
		b)	Does the following Post Correspondence Problem (PCP) has a solution: X = {b, babbb, ba} Y = {bbb, ba, a}	*CO3*	*PO3*	**08**
		c)	Elaborate on any 2 applications of TM.	*CO1*	*PO1*	**06**
			OR			
	10	a)	Illustrate Multitape and Multidimensional TM with appropriate block diagrams and examples.	*CO2*	*PO2*	**10**
		b)	Design TM to add 2 numbers a and b.	*CO3*	*PO3*	**10**

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