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**

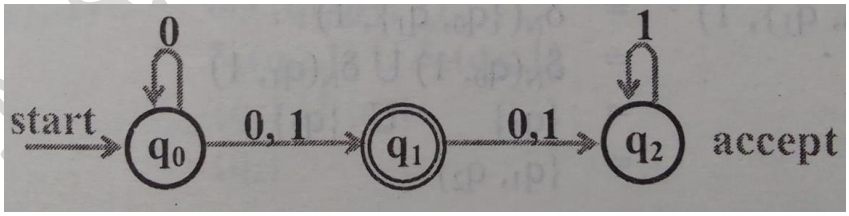
Branch: Computer Science and Engineering **Duration: 3 hrs.**

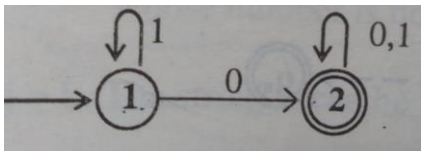
Course Code: 19CS4PCTFC **Max Marks: 100**

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 malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Construct a DFA to accept strings of a's and b's having even number of a's and even number of b's.	*CO1*	*PO1*	**8**
	b)		Construct DFA's accepting the following strings over the alphabet set Σ ={a,b} i. Not more than three a's in the strings ii. The set of all strings except those which ends with 'abb' iii. Set of all strings containing the substring 'abb'	*CO3*	*PO3*	**8**
	c)		Write the formal definition of DFA.	*CO1*	*PO1*	**4**
			OR			
2	a)		i. Design a deterministic finite automaton which accepts a string containing "the" anywhere in a string of {a-z} ii. Design a deterministic finite automaton which accepts a string containing "ing" at the end of a string in a string of {a-z}	*CO1*	*PO1*	**8**
	b)		Convert the below NFA to its equivalent DFA. 	*CO3*	*PO3*	**8**
	c)		Write the formal definition of ε - NFA.	*CO1*	*PO1*	**4**
			UNIT - II			
3	a)		Minimize the following DFA using table filling algorithm. δ | a | b → A | B | E B | C | F *C | D | H D | E | H E | F | I	*CO2*	*PO2*	**8**

			*F | G | B G | H | B H | I | C *I | A | E			
		b)	Obtain Regular Expressions (RE) for the following languages i. All strings containing at least one a and at least one b where ∑ = {a,b,c} ii. All strings that do not end with 01 where ∑ = {0,1} iii. All strings whose length is a multiple of 3 given ∑={a,b}.	*CO3*	*PO3*	**8**
		c)	Elaborate on homomorphism and inverse homomorphism properties of a regular expression.	*CO1*	*PO1*	**4**
			OR			
	4	a)	Obtain a regular expression for the FA shown below using Kleen's theorem. 	*CO2*	*PO2*	**8**
		b)	i. Obtain a Regular Expression for Language L={w: string ends with ab or ba where w ε {a,b} ii. Obtain an NFA for the regular expression a*+b*+c*	*CO3*	*PO3*	**8**
		c)	Show that L = $\{a^{n!} \mid n>=0\}$ is not regular.	*CO1*	*PO1*	**4**
			UNIT - III			
	5	a)	Obtain a grammar to generate the language L=$\{a^n b^m \mid n>=0, m>n\}$	*CO2*	*PO2*	**7**
		b)	Consider the grammar E ➔ E+E | E*E | (E) | I I ➔ a | b | c Obtain the leftmost and right most derivation for a+b*c.	*CO2*	*PO2*	**5**
		c)	Convert the following grammar to CNF. S → aXbX, X → aY | bY | **ε**, Y → X | c	*CO1*	*PO1*	**8**
			OR			
	6	a)	Obtain CFG for L = $\{w \mid n_a(w) > n_b(w), \Sigma = \{a,b\}\}$	*CO2*	*PO2*	**8**
		b)	Given the grammar S → aS | aSbS | ε, check whether it is ambiguous or not.	*CO2*	*PO2*	**5**
		c)	Eliminate Useless symbols in the grammar G=(V, T, P, S) V={S, A, B, C, D, E} , T= {a, b, d}, S= S P={S →aA | bB , A → aA | a , B →bB , D →ab | Ea , E →aC | d}	*CO1*	*PO1*	**7**

			UNIT - IV			
	7	a)	Obtain a PDA to accept the language L={w|w ∈ (a,b)* and $n_a(w)>n_b(w)$}	*CO3*	*PO3*	**10**
		b)	Obtain the corresponding PDA for the grammar given below. S → aABC A → aB|a B → bA|b C →a Give the instantaneous description of aabba.	*CO2*	*PO2*	**10**
			OR			
	8	a)	Obtain a PDA to accept a string of balanced parenthesis. The parentheses to be considered are (,), [,].	*CO3*	*PO3*	**10**
		b)	Obtain a CFG for the given PDA. $\delta(q_0, a, Z) = (q_0, AZ)$ $\delta(q_0, a, A) = (q_0, A)$ $\delta(q_0, b, A) = (q_1, \varepsilon)$ $\delta(q_1, \varepsilon, Z) = (q_2, \varepsilon)$	*CO2*	*PO2*	**10**
			UNIT - V			
	9	a)	Design a Turing Machine for L={ww^R }. Trace and show the traversal for the string abbaabba.	*CO2*	*PO2*	**10**
		b)	Design a Turing Machine for L={$a^m b^n$}. Show the tracing for string aaabbb.	*CO2*	*PO2*	**10**
			OR			
	10	a)	Design a Turing Machine for L= {$0^n1^n2^n$, n>=1}. Demonstrate its correctness by tracing it for the string 001122.	*CO2*	*PO2*	**10**
		b)	Find whether the below lists have a post correspondence solution or not. i. M = (abb, aa, aaa) and N = (bba, aaa, aa) ii. A = (1, 10111, 10) and B = (111, 10, 0)	*CO2*	*PO2*	**10**

****