



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 50017

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024
 Fifth Semester
 Computer Science and Engineering
 U19CS522 – THEORY OF COMPUTATION
 (Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define Deterministic Finite Automaton.	2	K1	CO1
2.	Draw a non deterministic finite automata to accept the string containing the substring 1010.	2	K3	CO1
3.	Write regular expression to recognize the set of strings over {a,b} having odd number of a's and b's and that starts with 'a'.	2	K3	CO2
4.	Write the regular expression for all strings over {a,b}* that contain no more than one occurrence of aa.	2	K3	CO2
5.	Write a Context Free Grammar for the language consisting of equal number of a's and b's.	2	K2	CO3
6.	What are the two normal forms of CFG? Write their productions format.	2	K1	CO3
7.	Does a pushdown Automata has memory? Justify.	2	K2	CO4
8.	When is PDA said to be deterministic?	2	K2	CO4
9.	What are recursive languages ?	2	K1	CO5
10.	Define Turing Machine. Show the instantaneous description with an example of TM .	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Prove that for every L recognized by an NFA, there exists an equivalent DFA accepting the same language L.	13	K2	CO1

		(OR)			
	b)	Determine a DFA from the given NFA: $M = \{ \{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_1\} \}$ $\delta(q_0, 0) = \{q_0, q_1\}, \delta(q_0, 1) = \{q_1\}, \delta(q_1, 0) = \emptyset,$ $\delta(q_1, 1) = \{q_0, q_1\}.$	13	K3	CO1
12.	a)	Prove that the following languages are not regular using pumping lemma. i. All unary strings of length prime. ii. $L = \{uu^k u \in \{0, 1\}^*\}.$	7+6 =13	K3	CO2
		(OR)			
	b)	State and Prove any two closure properties of Regular Languages.	13	K2	CO2
13.	a)	How ϵ -productions are eliminated from a grammar whose language doesn't have empty string? Remove ϵ -productions from the grammar given below: $S \rightarrow a aA B C \quad A \rightarrow aB \epsilon \quad B \rightarrow Aa \quad C \rightarrow aCD \quad D \rightarrow ddd$	13	K3	CO3
		(OR)			
	b)	How a CFG for L is converted into CNF accepting the same language? Convert the following CFG into CNF. $S \rightarrow b A a B \quad A \rightarrow b A A a S a \quad B \rightarrow a B B b S b$	13	K3	CO3
14.	a)	Prove that the languages accepted by PDA using empty stack and final states are equivalent.	13	K2	CO4
		(OR)			
	b)	Design a pushdown automata to recognize the language L, defined by $L = \{wcw^c w \in \{0, 1\}^* \text{ and } w^c \text{ is the one's complement of } w\}.$	13	K3	CO4
15.	a)	Construct a Turing Machine that replace all the occurrence of 111 by 101 from sequence of 0's and 1's.	13	K3	CO5
		(OR)			
	b)	Design a Turing Machine that accepts the language $L = \{ss s \text{ is in } \{a,b\}^* \}$	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16.	a) Prove that Halting problem is undecidable.	15	K2	CO5
	(OR)			
	b) What is a universal Turing Machine? Explain the procedure to construct the universal Turing Machine.	15	K2	CO5