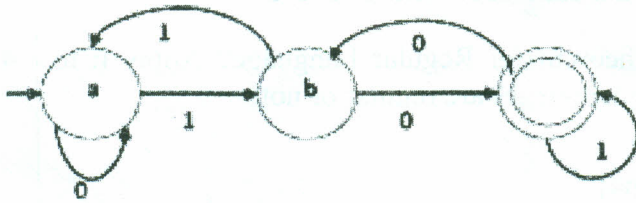# VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (CSE & AIML) V-Semester Main & Backlog Examinations, Jan./Feb.-2024
Automata, Languages and Computation

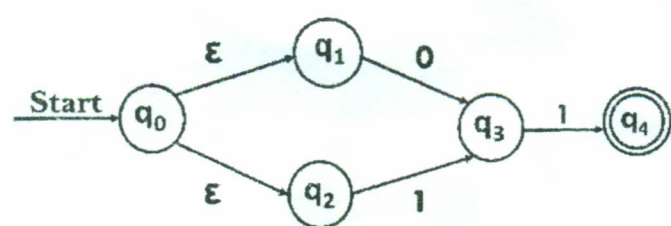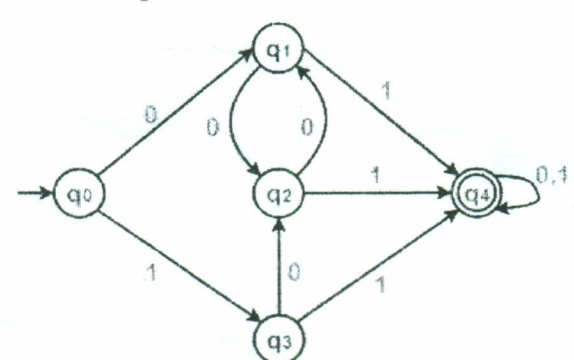Time: **3 hours**   Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define Chomsky Hierarchy? List out Chomsky Hierarchy of Formal Languages.	2	1	1	1
2.	Define Deterministic Finite Automata (DFA) and Identify the Language accepted by the given DFA?	2	2	1	2
3.	Define Emptiness problem in regular language? How do you test it?	2	1	2	1
4.	Determine the regular expression corresponding to the Context Free Grammar (CFG): S → aS | bS | a | b	2	2	2	2
5.	Give the formal definition of Push Down Automata (PDA)? How does it differ from Finite Automata?	2	1	3	1
6.	Convert the following CFG to Chomsky Normal Form (CNF)? S->aAB A->aA|a B->bB|b	2	2	3	2
7.	Differentiate between Linear Bounded Automata (LBA) and Turing Machine (TM)?	2	1	4	1
8.	Identify the language generated by the following Context Sensitive Language (CSG), where S is the start variable. S→XY X→aX|a Y→aYb|∈	2	2	4	2
9.	Define Universal Turing Machine (UTM)? How is it differed from Turing Machine?	2	1	5	1

10.	Differentiate P, NP, and NP complete problem?	2	1	5	1

Part-B (5 × 8 = 40 Marks)

11. a)	Define formal definition of Finite Automata (FA)? Draw State Transition diagram and find the regular expression for the following State Transition Table?	4	2	1	2

Present State	Next state for Input 0	Next State of Input 1
→q0	q0	q1
q1	q2	q1
*q2	q2	q2

b)	Construct a DFA that recognizes the languages defined over Σ= {a, b, c} consisting of all the strings that contain substring "abc".	4	3	1	3
12. a)	Define Pumping Lemma Theorem for Regular Language? Apply it to check whether the following languages are regular or not? i. $L = \{a^n b^n \mid n >= 0\}$ ii. $L = \{a^p \mid p \text{ is prime}\}$	4	3	2	3
b)	Define Ambigous Grammar for regular language? Check whether the following grammar is ambiguous or not for the given string "ibtibtaea". $S \rightarrow iCtS \mid iCtSeS \mid a$ $C \rightarrow b$	4	3	2	3
13. a)	Design a PDA (by default it is non-deterministic) for accepting the language $L = \{0^n 1^m 0^n \mid m, n >= 1\}$, by final state or empty stack or both.	4	3	3	3
b)	List out the steps used to convert from Context Free Grammar (CFG) to Greibach Normal Form (GNF)? Convert following CFG into GNF? $S \rightarrow XB \mid AA$ $A \rightarrow a \mid SA$ $B \rightarrow b$ $X \rightarrow a$	4	3	3	3
14. a)	Give the formal definition of LBA? Design LBA for CSL $L = \{a^{2n} b^n \mid n > 0\}$ and check the input string "aaaabb" is accepted by LBA or not?	4	3	4	3
b)	Design a Turing Machine for language $L = \{0^n 1^n \mid n > 0\}$	4	3	4	3
15. a)	Define Post's correspondence problem (PCP)? How Modified PCP (MPCP) differs from PCP? Determine the solution for the following PCP instance consists of the two pairs? $X = \{01, 1, 1\}$ and $Y = \{01^3, 10, 11\}$	4	3	5	3
b)	State and explain Cook's Theorem with suitable example?	4	1	5	2

			M	L	CO	PO
16.	a)	Construct DFA from given ε-NFA?	4	3	1	3

| | b) | What are the possible methods used to minimize DFA? Apply equivalence theorem or partition method to Minimize following DFA? | 4 | 3 | 2 | 3 |

| 17. | | Answer any *two* of the following: | | | | |

| | a) | Apply CYK algorithm to check whether the string 'abba' is a member of the language defined by following grammar: | 4 | 2 | 3 | 3 |

S→AB

A→a|AA|b

B→b

| | b) | Differentiate Multi-track and Multi-tape Turing Machine? Explain how Multi-tape TM converted in to equivalent single-tape TM? | 4 | 2 | 3 | 2 |

| | c) | Differentiate Disjunctive Normal Form (DNF) and Conjunctive Normal Form (CNF)? Represent function $f(x, y, z) = (\neg x \wedge z) \vee y$ in to DNF and CNF form. | 4 | 2 | 3 | 2 |

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	30%
iii)	Blooms Taxonomy Level – 3 & 4	50%

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