

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**B.Tech. Winter 2023 - 24 Examination**

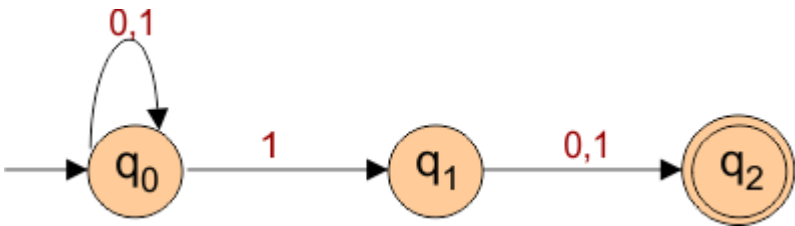
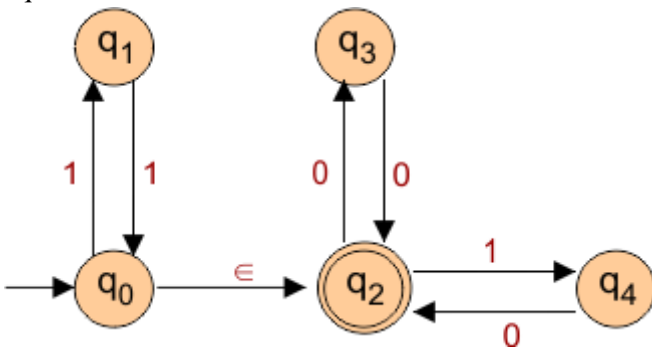
**Semester: 5**  
**Subject Code: 203108301**  
**Subject Name: Theory of Computation**

**Date: 23/11/2023**  
**Time: 02:00 pm to 04:30 pm**  
**Total Marks: 60**

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1	Objective Type Questions - (Each of one mark)	(15)	CO	PO	Bloom's Taxonomy
	1. CFG can be recognized by ____ a) Pushdown Automata b) Finite Automata c) Deterministic Finite Automata d) None of these		4	2	I
	2. Recursively Enumerable Languages are not closed under Complementation. State True or False.		1	1	I
	3. The Ambiguity Problem for CFGs is undecidable. State True or False.		4	4	I
	4. Write the Transition function of DFA.		2	3	II
	5. Define Unreachable States.		2	4	I
	6. Write the Transition function of e-NFA.		2	3	II
	7. Which of the following is not a part of 5-tuple finite automata? a) Input alphabet b) Transition function c) Initial State d) Output Alphabet		2	6	V
	8. The number of elements in the set for the Language $L = \{x \in (\Sigma^r)^* \mid \text{length of } x \text{ is at most } 2\}$ and $\Sigma = \{0,1\}$ is ____		1	1	II
	9. The maximum number of transition which can be performed over a state in a DFA? $\Sigma = \{a, b, c\}$		2	1	IV
	10. Language of finite automata is ____		1	2	I
	11. Regular expression for all strings starts with ab and ends with bba is: ____		1	3	I
	12. The set of all strings over the alphabet $S = \{a, b\}$ (including $\epsilon$ ) is denoted by a) $(a + b)^*$ b) $(a + b)^+$ c) $a+b^+$ d) $a^*b^*$		1	3	I
	13. Which of the following Machine is specific for Context free grammar? a) Finite state automata b) Push down automata c) Linear bounded automata d) Turing Machine		4	5	V

	14. Which of the following is not a component of a formal language? a) Alphabet b) Grammar c) Semantics d) Compiler		1	5	V
	15. A DFA is defined as a 5-tuple, which includes: a) Alphabet, set of states, start state, set of transitions, set of accepting states b) Alphabet, set of states, final state, set of transitions, set of accepting states c) Alphabet, set of states, start state, transition function, set of accepting states d) Alphabet, set of states, start state, transition function, final state		2	3	I
<b>Q.2</b>	<b>Answer the following questions.</b> (Attempt any three)	<b>(15)</b>			
	A) What is Grammar ? Explain Chomsky and Greibach Normal Form.		6	4	II
	B) Convert the given NFA into equivalent DFA 		2	3	VI
	C) Draw DFA and Transition Table for the String that Contains even number of 0's and even number of 1's. Input Symbol is {0,1}		2	3	VI
	D) Explain Chomsky classification of grammar in detail.		6	4	II
<b>Q.3</b>	A) Write down the Steps for Removal of Null Productions. And Remove null production from the following – $S \rightarrow ASA \mid aB \mid b, A \rightarrow B, B \rightarrow b \mid \epsilon$	<b>(07)</b>	4	3	II
	E) Explain Pushdown Automata. Construct a PDA that accepts $L = \{0^n 1^n \mid n \geq 0\}$	<b>(08)</b>	5	3	III
	<b>OR</b>				
	F) State Church Turing thesis. What are Universal Turing machines and what are the concepts used in UTMs ?	<b>(08)</b>	7	4	II
<b>Q.4</b>	A) Define Turing machine. Construct a Turing Machine for $L = \{a^n b^n \mid n \geq 1\}$ .	<b>(07)</b>	7	3	III
	<b>OR</b>				
	A) Explain Epsilon-NFA. Construct the following e-NFA to its equivalent NFA 	<b>(07)</b>	2	3	VI
	B) Find a reduced grammar equivalent to the grammar G, having production rules, P: $S \rightarrow AC \mid B, A \rightarrow a, C \rightarrow c \mid BC, E \rightarrow aA \mid e$	<b>(08)</b>	4	3	VI