

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VI EXAMINATION – WINTER 2025****Subject Code:3164203****Date:21-11-2025****Subject Name:Theory of Computation****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define reflexivity, symmetry, and transitivity properties of relations.	03
	(b) Explain one-to-one, onto and bijection function.	04
	(c) Define NFA- Λ . Explain how to convert NFA- Λ into NFA and FA with suitable example.	07
Q.2	(a) Define class P and class NP in computational complexity theory.	03
	(b) Explain moore machine and mealy machine.	04
	(c) Prove Kleene's theorem Part 1.	07
	OR	
	(c) Prove that, if L is accepted by an NFA with ϵ transitions, then L is accepted by an NFA without ϵ -transitions.	07
Q.3	(a) Explain ambiguity in CGF.	03
	(b) Explain Post's Correspondence Problem.	04
	(c) Given the context-free grammar G, find a CFG G' in Chomsky Normal Form.	07
	$G : S \rightarrow AaA \mid CA \mid BaB$ $A \rightarrow aaBa \mid CDA \mid aa \mid DC$ $B \rightarrow bB \mid bAB \mid bb \mid aS$ $C \rightarrow Ca \mid bC \mid D$ $D \rightarrow bD \mid \epsilon$ $\epsilon \text{ represents null.}$	
	OR	
Q.3	(a) Explain BNF with example.	03
	(b) Explain Recursive Enumerable language.	04
	(c) Define Context Free Grammar. Find context-free grammar for the language: $L = \{a^i b^j \mid i < 2j\}$	07
Q.4	(a) Explain Bounded Minimization.	03
	(b) Show using pumping lemma that the given language is not a CFL. $L = \{a^n b^{2n} a^n \mid n \geq 0\}$	04
	(c) Draw a transition diagram for a Turing machine for the language $L = \{0^n 1^n 2^n\}$ where $n \geq 1$.	07
	OR	
Q.4	(a) Explain Partial Functions with example.	03
	(b) Decide whether the given language is a CFL, and prove your answer. $L = \{xyx \mid x, y \in \{a, b\}^* \text{ and } x \geq 1\}$	04
	(c) Draw a transition diagram for a Turing machine for the language of all palindromes over $\{a, b\}$.	07
Q.5	(a) Explain Universal Turing Machine.	03
	(b) Write a short note on Deterministic PDA.	04
	(c) Explain primitive recursive function by suitable example.	07

OR

Q.5	(a)	Explain church-turing thesis.	03
	(b)	Write a short note on Non-CFL.	04
	(c)	Explain μ -Recursive Functions by suitable example.	07
