

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V EXAMINATION – SUMMER 2025****Subject Code:3151605****Date:15-05-2025****Subject Name:Formal Language and Automata Theory****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) Write down 5-tuple definition for the finite automata. | 03 |
| (b) Write regular expressions (REs) over alphabet {0, 1}:
1. String should contain exactly two 1's
2. Language of all string containing both 11 and 00 as substring | 04 |
| (c) Draw NFA- $\wedge$ for the given regular expression: $(00+1)^*(10)^*$ | 07 |
| Q.2 (a) Explain procedure to minimize Finite Automata. | 03 |
| (b) Draw DFA for the string with number of 0s and number of 1s are odd. | 04 |
| (c) Draw Finite Automata for following languages:
$L1 = \{x/x \text{ 00 is not substring of } x, x \in \{0,1\}^*\}$
$L2 = \{x/x \text{ ends with } 01, x \in \{0,1\}^*\}$
Draw finite Automata for $L1 \cup L2$ and $L1 \cdot L2$ | 07 |
| OR | |
| (c) Convert NFA - $\wedge$ to FA: | 07 |

q	$\delta(q, \wedge)$	$\delta(q, 0)$	$\delta(q, 1)$
A	{B}	{A}	$\emptyset$
B	{D}	{C}	$\emptyset$
C	$\emptyset$	$\emptyset$	{B}
D	$\emptyset$	{D}	$\emptyset$

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|---|-----------|
| Q.3 (a) Define Context free grammar & context free language. | 03 |
| (b) Write CFG for $L = \{ a^i b^j c^k \mid j > i + k \}$. | 04 |
| (c) Convert following CFG to CNF:
$S \rightarrow aX/Yb$
$X \rightarrow S/\wedge$
$Y \rightarrow bY/b$ | 07 |
| OR | |
| Q.3 (a) Explain types of derivation and ambiguity. | 03 |
| (b) Write CFG for $L = \{ a^i b^j c^k \mid i = j \text{ or } j = k \}$. | 04 |
| (c) Convert following CFG to CNF:
$S \rightarrow S(S)/\wedge$ | 07 |
| Q.4 (a) Explain deterministic pushdown automata. | 03 |
| (b) Give the difference between top down and bottom up parsing. | 04 |
| (c) Design and draw PDA to accept string with more a's than b's. | 07 |
| OR | |
| Q.4 (a) What is a pushdown automaton? Explain. | 03 |
| (b) Explain conversion from PDA to CFG. | 04 |

- (c) Design and draw deterministic PDA Accepting “Balance string of brackets”. **07**
- Q.5** (a) Define Chomsky Hierarchy. **03**
- (b) Write a note on Primitive Recursive functions. **04**
- (c) Design a Turing machine to delete a symbol. **07**
- OR**
- Q.5** (a) State the following functions: Partial, Constant and Total. **03**
- (b) Define and explain Bounded Quantification. **04**
- (c) Design a Turing machine to copy a string. **07**
