

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code:2160704****Date:20-05-2024****Subject Name:Theory of Computation****Time:10:30 AM TO 01:00 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.

	<b>Marks</b>
<b>Q.1</b> (a) What are existential quantifiers? If the statement (p) says: “There are some people who work at some place for some time.” How can you write it as a quantified statement?	<b>03</b>
(b) Explain the strong principle of mathematical induction.	<b>04</b>
(c) Write the pumping lemma for regular languages and show how it is used to show that a language is not regular.	<b>07</b>
<b>Q.2</b> (a) Write all the strings with length less than 4 generate by following grammar: $(x + y)^* ab (a + ab)^*$	<b>03</b>
(b) What do we understand by the two different statements: $p \rightarrow q$ and $P \Rightarrow Q$ ? Are they similar or different?	<b>04</b>
(c) Show that for any NFA accepting a language L over $\Sigma^*$ , there is an FA that also accepts L.	<b>07</b>
<b>OR</b>	
(c) Show that any regular language can be accepted by a finite automaton.	<b>07</b>
<b>Q.3</b> (a) Explain the difference between ambiguous grammar and unambiguous grammar.	<b>03</b>
(b) For the given ambiguous grammar, find its equivalent unambiguous grammar: $S \rightarrow ABA$ $A \rightarrow aA   \Lambda$ $B \rightarrow bB   \Lambda$	<b>04</b>
(c) Explain all the closure properties of CFG.	<b>07</b>
<b>OR</b>	
<b>Q.3</b> (a) What is the dangling else problem?	<b>03</b>
(b) Describe the language generated by this grammar: $S \rightarrow aA   bC   b$ $A \rightarrow aS   bB$ $B \rightarrow aC   bA   a$ $C \rightarrow aB   bS$	<b>04</b>
(c) Explain how every regular expression can be converted to its equivalent grammar with an example.	<b>07</b>
<b>Q.4</b> (a) What do we mean by instantaneous description of a PDA?	<b>03</b>
(b) Write the pumping lemma for the context free languages.	<b>04</b>
(c) Construct a DPDA to accept the strings with equal number of 0's and 1's.	<b>07</b>
<b>OR</b>	
<b>Q.4</b> (a) Explain the difference or similarity between language accepted by PDA with empty stack and language accepted by PDA with a state.	<b>03</b>
(b) Define: Top-Down PDA corresponding to a CFG.	<b>04</b>
(c) Construct a Nondeterministic PDA for balanced strings of parenthesis.	<b>07</b>
<b>Q.5</b> (a) Define: “Primitive Recursive Functions”	<b>03</b>

- (b) Explain in short: “Universal Turing Machine.” **04**  
(c) Draw a Turing Machine to accept  $\{ss \mid s \in \{a, b\}^*\}$  **07**

**OR**

- Q.5** (a) Define: “Bounded Quantifications” **03**  
(b) Explain in short, “Multi-tape Turing Machine” **04**  
(c) Draw a Turing Machine to accept palindromes over  $\{a,b\}^*$  **07**

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