Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3151605 Date:04/06/2022

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)**	Define DFA. Give Difference between DFA and NFA	**03**
	(b)	Write down Regular Expressions (R.E.) for the following languages over the $\sum = \{0,1\}$ 1) The language of the strings ends with 0 and starts with 1 2) The language of the strings begins with 00 or 11	**04**
	(c)	Draw DFA for the R.E.= (1+0) * 10 (1+0) * 01 (1+0) * where $\sum = \{0,1\}$	**07**
Q.2	**(a)**	Give recursive definition of the extended transition function, δ^* for DFA and NFA	**03**
	(b)	Compare DFA, NFA and NFA – Λ	**04**
	(c)	Draw NFA for the languages of all Strings that do not end with 01 where $\sum = \{0,1\}$. Also convert it to DFA	**07**
		OR	
	(c)	Draw NFA Λ for R.E. = (11+110) * 0 where $\sum = \{0,1\}$. Also Convert it to NFA.	**07**
Q.3	**(a)**	Define CFG and Ambiguous CFG	**03**
	(b)	Explain Kleene's Theorem part-I	**04**
	(c)	Design PDA for the language L = { XCX^r | X ∈ {a,b}* }	**07**
		OR	
Q.3	**(a)**	Define Pumping lemma for CFL	**03**
	(b)	Explain Kleene's Theorem part-II	**04**
	(c)	Design PDA for the language L = {XX^r | X ∈ {a,b}* }	**07**
Q.4	**(a)**	Find the CFG for the R.E. = (011 + 1) * (01) *	**03**
	(b)	Give CFG for the language L = {{$a^i b^j c^k$ | i = j + k}}	**04**
	(c)	Given the Context Free Grammar G, find a CFG G' in Chomsky Normal Form generating L(G) – {} S → aY | Ybb | Y X → Λ | a Y → aXY | bb | XXa	**07**
		OR	
Q.4	**(a)**	Design a CFG for the following language. L = {x ∈ (0,1) * | $n_0(x) = n_1(x)$}	**03**
	(b)	Use Pumping Lemma to show that L = {x ∈ {0,1} * | x is a palindrome} is not a regular language	**04**

	(c)	Consider following grammar: S → A1B A → 0A | Λ B → 0B | 1B | Λ Give leftmost and rightmost derivations of the string 00101. Also draw the parse tree corresponding to this string	**07**
Q.5	**(a)**	Define Turing machine	**03**
	(b)	Explain Recursive functions with example	**04**
	(c)	Design a Turing machine for deleting nth symbol from a string w from the alphabet ∑ = {0,1}	**07**

OR

Q.5	**(a)**	Explain Universal Turing Machine	**03**
	(b)	Define - Primitive recursive functions and also give complete primitive recursive derivations for the function, f : N → N defined by Add (x, y) = x + y	**04**
	(c)	Draw a Turing Machine that accepts the language L = { XX | X ∈ {a, b}*}	**07**

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