Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021

Subject Code:2160704 Date:30/11/2021

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.**

Q.1	**(a)**	Explain on to, one to one, and Bijection Function with suitable example.	**03**
	(b)	Explain reflexivity, symmetry, and transitivity properties of relations.	**04**
	(c)	What is PMI? Prove 7+ 13+19+…..+(6n+1)= n(3n+4) using PMI.	**07**
Q.2	**(a)**	Find regular expression for following I. Language of all strings containing exactly two 0's. II. Language of all strings that begins or ends with 00 or 11.	**03**
	(b)	Compare FA, NFA and NFA-^.	**04**
	(c)	Draw Finite Automata (FA) for following languages: L1 = {x / 00 is not a substring of x } L2 = {x / x ends with 01 } Find FA accepting languages (i) L1 ∩ L2 and (ii) L2 – L1	**07**
		OR	
	(c)	Define NFA – Λ. Explain how to convert NFA – Λ into NFA and FA with suitable example.	**07**
Q.3	**(a)**	Draw FA for each of the following RE. (a+b)*baaa	**03**
	(b)	Define pumping lemma and its application.	**04**
	(c)	For the following CFG, Find Chomsky normal form S→AACD A→aAb|ʌ C→ aC|a D→aDa|bDb|ʌ	**07**
		OR	
Q.3	**(a)**	Consider the grammar: S→aAS | a	**03**

A→ SbA | SS | ba

Derive left most and right most derivation of string aabbaa using given grammar.

	(b)	Define CFG. Create CFG for (011+1)*(01)*	**04**
	(c)	Design a TM for accepting Palindromes for odd and even length.	**07**
Q.4	**(a)**	What is Turing Machine? Write advantages of TM over FSM.	**03**
	(b)	Explain Ambiguous Grammar and remove ambiguity with suitable example.	**04**
	(c)	Design PDA for $L=\{x \in x^r / x \in \{a,b\}^*\}$. The string in L are odd length palindromes over {a,b}.	**07**

OR

Q.4	**(a)**	Define Constant functions, Successor functions and Projection function.	**03**
	(b)	Write a note on DPDA and NPDA	**04**
	(c)	Design a deterministic PDA Accepting "Balance string of brackets".	**07**
Q.5	**(a)**	Enlist limitations of Turing machines.	**03**
	(b)	Explain moore machine and mealy machine.	**04**
	(c)	Discuss Universal Turing Machine with suitable example.	**07**

OR

Q.5	**(a)**	Write Short note on Church-Turing Thesis.	**03**
	(b)	Define P, NP, NP-Hard and NP-Complete problem?	**04**
	(c)	Explain Halting Problem with suitable example.	**07**

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