Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2160704 **Date:16/05/2019**

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.**

			MARKS
Q.1	**(a)**	Define 1) Parse tree 2) Ambiguous grammar	**03**
	(b)	Prove by mathematical induction: for every n>=1, $1 + 3 + 5 + \ldots + (2n - 1) = n^2$	**04**
	(c)	Consider the grammar: S→ABA, A→aA | ∈, B→bB | ∈ Is given grammar ambiguous? If so then remove ambiguity	**07**
Q.2	**(a)**	Design Moore machine to generate 1's complement of binary number.	**03**
	(b)	Write Regular Expression over the alphabets {a, b} consisting strings: • Second last character as *'a'* • Starting with *'a'* and ending with *'b'*	**04**
	(c)	Find context free grammar for the following language. $L_1=\{a^i b^j c^k \mid i = j + k\}$, L_2= (011+1)* (01)*, L_3=(0+1)1*(1+(01)*)	**07**
		OR	
	(c)	Draw FA for following languages: • L1 = {w | 00 is not substring of w} • L2 = {w | w ends in 01} Find FA accepting languages (i). L1 ∪ L2 and (ii). L1 ∩ L2	**07**
Q.3	**(a)**	Give the left linear grammar for RE $(10)^*1$	**03**
	(b)	Minimize the given DFA:	**04**

State / Transition	a	b
→ (1)	{3}	{2}
2	{4}	{1}
3	{5}	{4}
4	{4}	{4}
5	{3}	{2}

	(c)	Eliminate useless symbols, ∈-productions and unit productions for the following grammar: S→0A0 | 1B1 | BB, A→C, B→S | A, C→S | ∈	**07**
		OR	
Q.3	**(a)**	Consider the grammar: S → aAS | a A → SbA | SS | ba Derive left most and right most derivation of string *aabbaa* using given grammar.	**03**
	(b)	Give CFG for following languages: 1). L = a*b* 2). $L = \{a^{n+2} b^n \mid n >= 0\}$	**04**
	(c)	Construct finite automata for following left linear grammar: S → X0 | Y1	**07**

X → Y1
Y → Y0 | 1

Q.4	**(a)**	Compare PDA with FSM	**03**
	(b)	Write a note on DPDA and NPDA	**04**
	(c)	Design a pushdown automata to check well-formed parenthesis.	**07**

OR

Q.4	**(a)**	Give the formal definition of Turing machine. Also compare the power of DFA, NFA, DPDA, NDPA and TM	**03**
	(b)	Write a note on post machines.	**04**
	(c)	Design a Turing machine to reverse the string over alphabet {0, 1}	**07**
Q.5	**(a)**	Compare and contrast push down automata and Turing machine.	**03**
	(b)	Enlist limitations of Turing machines.	**04**
	(c)	Design a Turing machine which accepts the language consisting string which contain aba as a substring over alphabets {a, b}	**07**

OR

Q.5	**(a)**	Discuss universal Turing machine	**03**
	(b)	Write a short note on Halting problem	**04**
	(c)	What is decidability? How to prove that the given language is undecidable? List some undecidable problems.	**07**

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