

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 $n \geq 1$, $1 + 3 + 5 + \dots + (2n - 1) = n^2$ **04**
- (c) Consider the grammar: $S \rightarrow ABA$, $A \rightarrow aA \mid \epsilon$, $B \rightarrow bB \mid \epsilon$ **07**
Is given grammar ambiguous? If so then remove ambiguity

- 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: **04**
- Second last character as 'a'
 - Starting with 'a' and ending with 'b'
- (c) Find context free grammar for the following language. **07**
 $L_1 = \{a^i b^j c^k \mid i = j + k\}$, $L_2 = (011+1)^* (01)^*$, $L_3 = (0+1)^* 1^* (1+(01)^*)$

OR

- (c) Draw FA for following languages: **07**
- $L_1 = \{w \mid 00 \text{ is not substring of } w\}$
 - $L_2 = \{w \mid w \text{ ends in } 01\}$
- Find FA accepting languages (i). $L_1 \cup L_2$ and (ii). $L_1 \cap L_2$
- Q.3**
- (a) Give the left linear grammar for RE $(10)^* 1$ **03**
- (b) Minimize the given DFA: **04**

State / Transition	a	b
$\rightarrow \textcircled{1}$	{3}	{2}
2	{4}	{1}
3	{5}	{4}
4	{4}	{4}
5	{3}	{2}

- (c) Eliminate useless symbols, ϵ -productions and unit productions for the following grammar: **07**
 $S \rightarrow 0A0 \mid 1B1 \mid BB$, $A \rightarrow C$, $B \rightarrow S \mid A$, $C \rightarrow S \mid \epsilon$

OR

- Q.3**
- (a) Consider the grammar: **03**
 $S \rightarrow aAS \mid a$
 $A \rightarrow SbA \mid SS \mid ba$
Derive left most and right most derivation of string *aabbbaa* using given grammar.
- (b) Give CFG for following languages: **04**
1). $L = a^* b^*$ 2). $L = \{a^{n+2} b^n \mid n \geq 0\}$
- (c) Construct finite automata for following left linear grammar: **07**
 $S \rightarrow X0 \mid Y1$

$X \rightarrow Y1$

$Y \rightarrow Y0 \mid 1$

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|------------|------------|--|-----------|
| 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

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|------------|------------|---|-----------|
| 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 |

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|------------|------------|---|-----------|
| 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

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|------------|------------|--|-----------|
| 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 |
