Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2160704 **Date:11/05/2016**

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.**

Q.1 **(a)** Define One-to-one and Onto Functions. Also explain Compositions and Inverse of functions. **07**

(b) Define NFA – Λ. Explain how to convert NFA – Λ into NFA and FA with suitable example. **07**

Q.2 **(a)** Define Mathematical Induction Principle and Prove that for every $n \geq 1$, **07**

$$\sum_{i=1}^{n} i^2 = n(n+1)(2n+1)/6$$

(b) Write Regular Expressions corresponding to each of the following subsets of {0,1}* **07**

(i) The language of all strings in {0,1}* that containing at least two 0's.

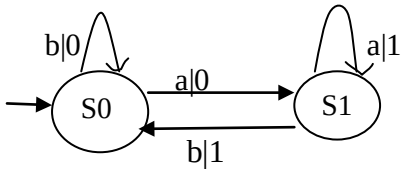
(ii) The language of all strings containing both 101 and 010 as substrings.

(iii) The language of all strings that do not end with 01.

OR

(b) Prove the formula (00*1)*1 = 1+0(0+10)*11 **07**

Q.3 **(a)** Convert the Mealy machine shown in given figure into Moore machine. **07**



(b) Check whether the given grammar is in CNF **07**

S-> bA|aB

A-> bAA|aS|a

B-> aBB|bS|b

If it is not in CNF, Find the equivalent CNF.

OR

Q.3 **(a)** Draw FA for accepting: **07**

(i)The string in {0,1}* ending in 1 and not containing substring 00.

(ii)The strings with odd no of 1's and odd no of 0's.

(b) Give the context free grammar for the following languages. **07**

(011 +1)* (01)*

Q.4 **(a)** Explain Pumping Lemma and its applications. **07**

(b) Define Push Down Automata (PDA). Design and draw a deterministic PDA accepting strings with more a's than b's. Trace it for the string "abbabaa". **07**

OR

Q.4 **(a)** Prove Kleene's Theorem Part 1 with illustration. **07**

(b) Write PDA for following languages: **07**

$\{ a^i b^j c^k \mid i, j, k >= 0 \text{ and } j = i \text{ or } j = k\}$.

Q.5	**(a)**	Draw the TM which recognize words of the form $\{ a^n b^n c^n \mid n>=1\}$.	**07**
	(b)	Explain Universal Turing Machine and Church Turing Hypothesis.	**07**

OR

Q.5	**(a)**	Design Turing Machine(TM) to accept Palindrome over {a,b}, even as well as odd.	**07**
	(b)	Write Short note on Following: (i) Halting Problem (ii) Primitive Recursive Function.	**07**

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