Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

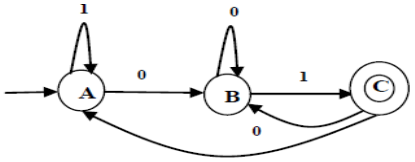
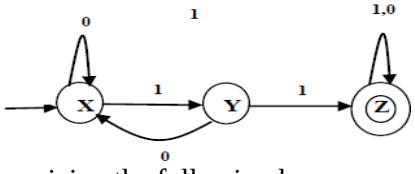
Subject Code:3160704 Date:24/11/2021

Subject Name:Theory of Computation

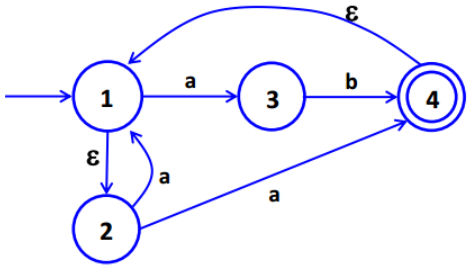
Time:10:30 AM TO 01:00 PM Total Marks: 70

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.**

			MARKS
Q.1	**(a)**	Define one-to-one, onto and bijection function	**03**
	(b)	The given relation R on set A= {1,2,3} determine whether the Relation is reflexive, symmetric or transitive, give reason. R ={(1,1), (1,2), (1, 3),(2,1), (2, 2), (3, 1),(3,3)}	**04**
	(c)	Write Principle of Mathematical Induction. Prove that for every $n \geq 1$, $1 + 3 + 5 + \ldots + (2n - 1) = n^2$	**07**
Q.2	**(a)**	Define FA and Write recursive definition of NFA	**03**
	(b)	Find a regular expression of following subsets of {0, 1}* 1. The language of all strings that begin or end with 00 or 11. 2. The language of all strings ending with 1 and not containing 00.	**04**
	(c)	Draw Finite Automata to accept following over input alphabets Σ ={0, 1} (i) The language accepting strings not ending with ’01’ . (ii)The language accepting strings next to last symbol ‘0’	**07**
		OR	
	(c)	Let M1 and M2 be the FAs pictured in Figure, recognizing languages L1 and L2 respectively. M_1 =  M_2 =  Draw FAs recognizing the following languages. a. L1 U L2 b. L1 - L2	**07**
Q.3	**(a)**	Give the difference between moore machine and mealy machine.	**03**
	(b)	Define Context Free Grammar. Find context-free grammar for the language: L= $\{a^i b^j c^k \mid j=i+k\}$	**04**

(c) Convert NFA- Λ to FA for following figure. **07**

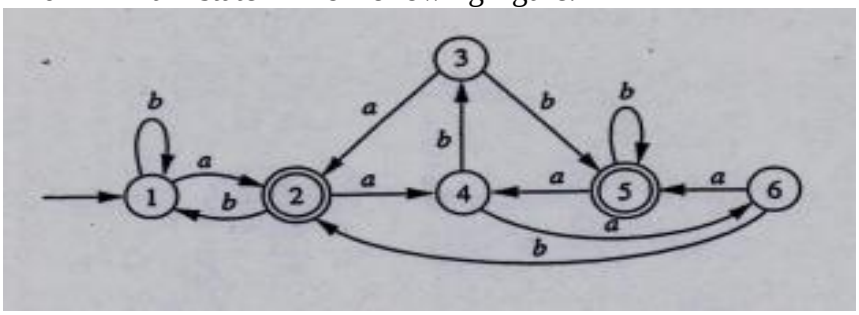


OR

Q.3 **(a)** Define Ambiguous grammar. for following grammar say whether the grammar is ambiguous or not. give reason **03**
S→ABA, A→aA | Λ , B→bB | Λ

(b) Design and mealy machine that gives output 1 if input of sequence abb comes, other wise 0. **04**

(c) Find minimum state FA for following figure. **07**



Q.4 **(a)** State pumping lemma for regular languages. **03**
(b) Give an unambiguous grammar for SIMPLE CALCULATOR contain +, -, *, /,(,) operator for terminal 'id'. And draw a parse tree for (id+id)*id-id **04**
(c) Write Kleen's Theorem part -1. **07**

OR

Q.4 **(a)** Find the CFG for the regular expression : (01*1 + 1)* (01)* **03**
(b) Using kleene's Theorem Draw NFA-Λ for ((0+1)*10 + (00)*)* **04**
(c) Given the context-free grammar G, find a CFG G' in Chomsky Normal Form. **07**

S -> AaA | CA | BaB
A -> aaBa | DC
B -> bb | aS
C -> Ca | bC | D
D -> bD | Λ

Q.5 **(a)** Define Pushdown Automata **03**
(b) Design a PDA to accept L = {xcy | x, y∈ (a,b)* and |x| = |y|}. **04**
(c) Develop a Turing Machine to accept palindromes over {a,b}* **07**

OR

Q.5 **(a)** Define grammar and Chomsky hierarchy. **03**
(b) Design a PDA to accept L = $\{a^n b^n \mid n>=0\}$. **04**
(c) Develop a Turing Machine to accept the language L = $\{X / N_a(X)=N_b(X)$, $X \in \{a,b\}^*\}$ **07**

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