Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3151605 Date:01/01/2022

Subject Name:Formal Language and Automata Theory

Time:02:30 PM TO 05:00 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)**	Justify the need of different automata in theory of computation.	**03**
	(b)	Discuss the equivalence between ε-NFA and NFA with example.	**04**
	(c)	List out the steps involved in pumping lemma for regular language. Prove that L= {a^nb^n, n>=0} is a non-regular language using pumping lemma.	**07**
Q.2	**(a)**	Discuss undecidable problems with respect to turing machine.	**03**
	(b)	Construct the minimal DFA which accepts all the binary strings which integer values is divisible by 3.	**04**
	(c)	Construct the minimal FA that accept the language over alphabet Σ={a,b}, 1. Every string ends with aa. 2. Every string has odd occurrences of ab. 3. Every string is divisible by 4.	**07**
		OR	
	(c)	Construct the NFA that accept the language over alphabet Σ={a,b}, 1. Every string ends contains substring ab. 2. Every string starts and ends with different symbol 3. Every string starts and ends with same symbol	**07**
Q.3	**(a)**	Define Context Free Language (CFL) and prove that every RL is CFL.	**03**
	(b)	Write the correct regular expressions for the following languages over alphabet Σ={a,b}, 1. Every string contains substring ‘ab’. 2. Every string contains atmost 2 a’s. 3. 6^{th} symbol from the RHS is always b. 4. Length of the string is odd	**04**
	(c)	Describe useless symbol, unit-production and null-production with example for the simplification of CFG.	**07**

OR

Q.3	**(a)**	Define Context Free Grammar (CFG) with example..	**03**
	(b)	Write the correct regular expressions for the following languages over alphabet Σ={a,b}, 1. Every string contains even no. of a's. 2. Every string contains atleast 2 b's. 3. 4th symbol from the LHS is always a. 4. Length of the string is congruent ≅ 2 mode 5.	**04**
	(c)	List out the steps involved in CFG to PDA conversion. Generate the CFG for the language L={a^mb^n, m<n, m,n>=1} and convert it into PDA.	**07**
Q.4	**(a)**	Explain recursive enumerable language with example.	**03**
	(b)	Explain Chomsky Normal Form (CNF) with example.	**04**
	(c)	List out the operations performed on Push Down Automata (PDA). Construct the PDA over alphabet Σ={a,b} for the language L= {a^nb^n/n>=1}. Justify your answer.	**07**

OR

Q.4	**(a)**	Explain context sensitive language with example.	**03**
	(b)	Explain BacosNaur Form (BNF) with example.	**04**
	(c)	What is Instantaneous Identification (ID) in Push Down Automata (PDA)? Construct the PDA over alphabet Σ={a,b,c} for the language L= {a^ncb^n/n>=1}. Justify your answer.	**07**
Q.5	**(a)**	What is Bounded Mineralization? Discuss it in detail.	**03**
	(b)	Explain primitive recursion function with example.	**04**
	(c)	Define Turing machine. Construct the turing machine for the language L= {a^nb^nc^n, n>=1}.	**07**

OR

Q.5	**(a)**	Explain partial function with example.	**03**
	(b)	Construct the turing machine for the language L of all the strings of a's and b's where no. of a is even	**04**
	(c)	How turing machine works as language acceptor and as a transducer? Construct the turing machine as a transducer for the f(m,n)= m+n.	**07**