Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V EXAMINATION – WINTER 2025

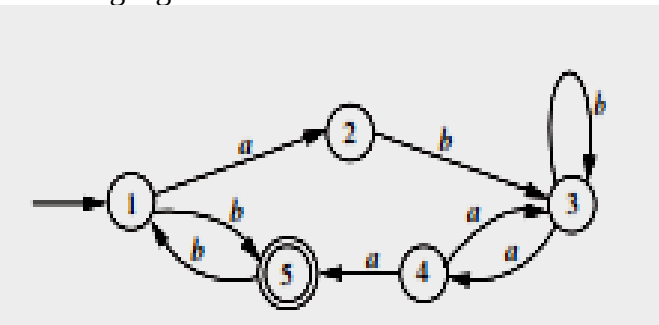
Subject Code:3151605 Date:19-11-2025

Subject Name:Formal Language and Automata Theory

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 following terms i) Regular Expression ii) Regular Grammar	**03**
	(b)	Write difference between NFA and DFA.	**04**
	(c)	Draw DFA for RE : **(0+1)* (01+110)**	**07**
Q.2	**(a)**	Define NFA-Λ.	**03**
	(b)	Write regular expression for the following (i)The language of all strings over {0,1} containing substring 0101. (ii) The language of all strings over {0,1} containing minimum two 0's..	**04**
	(c)	Draw an NFA-Λ for the given regular expression without using Kleene's Theorem : **(0+1)*(011+01010)(0+1)***	**07**
		OR	
	(c)	Using subset construction, convert the given NFA to FA accepting the same language. 	**07**
Q.3	**(a)**	What language is generated by the given Context free grammar : **i) S → aSa | bSb | Λ** ii) **S → aSa | bSb | a | b**	**03**
	(b)	Define Context Free Language (CFL) and prove that every RL is CFL.	**04**
	(c)	Convert the given CFG into Chomsky normal form. **S →A | B | C** **A → aAa | B** **B → bB | bb** **C → aCaa | D** **D → baD | abD |aa**	**07**
		OR	

Q.3	**(a)**	What is ambiguous grammar? Explain with suitable example.	**03**
	(b)	Explain BacosNaur Form (BNF) with example	**04**
	(c)	Find context free grammar for the following language **i)** **$L = \{a^i b^j c^k \mid i = j + k\}$** ii) **$L = \{ a^i b^j c^k \mid i = j \text{ or } i = k\}$**	**07**
Q.4	**(a)**	Define Pumping Lemma for context free languages.	**03**
	(b)	Show that the given language is not a CFL using pumping lemma. **$L = \{ a^i b^j c^k \mid i < j < k \}$**	**04**
	(c)	Construct transition table and diagram for PDA recognizing following language : **$L = \{ xcx^r \mid x \in \{a,b\}^* \}$**	**07**
		OR	
Q.4	**(a)**	State true or false and justify the same: "Non-deterministic PDA is more powerful than deterministic PDA".	**03**
	(b)	Consider the following CFG: **$S \rightarrow AB \mid \Lambda$** **$A \rightarrow aASb \mid a$** **$B \rightarrow bS$** Give rightmost and leftmost derivation for the string "aaabbb". Also draw parse tree for the same.	**04**
	(c)	Construct transition table and diagram for DPDA recognizing following language : $L = \{ x \in \{a,b\}^* \mid n_a(x) > n_b(x) \}$	**07**
Q.5	**(a)**	What is Initial Functions?	**03**
	(b)	What is Bounded Mineralization? Discuss it in detail.	**04**
	(c)	Write a short note on Universal Turing Machine.	**07**
		OR	
Q.5	**(a)**	Explain primitive recursion function with example	**03**
	(b)	Discuss undecidable problems with respect to turing machine	**04**
	(c)	Construct a Turing Machine to accept the language of palindromes over {a, b}.	**07**

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