

**K. J. Somaiya Institute of Technology, Sion, Mumbai-22  
(Autonomous College Affiliated to University of Mumbai)**

<b>April - May 2023</b>		
(B.Tech) Program: Information Technology	Scheme- II	
Examination: SY Semester: IV		
Course Code: ITC404 and Course Name: Automata Theory		
Date of Exam: 20-05-2023	Duration: 2.5 Hours	Max. Marks: 60

**Instructions:**  
 (1) All questions are compulsory.  
 (2) Draw neat diagrams wherever applicable.  
 (3) Assume suitable data, if necessary and state it clearly.  
 (4) All questions are carefully designed, so in case of doubts, re-read the question again.

	Question	Max. Marks	CO	BT Level
Qu-1	Solve any <b>SIX</b> questions out of <b>EIGHT</b> .	<b>12</b>		
i)	<b>What are the types of Turing machines? Define the Transition Function for Turing Machine.</b>	<b>2</b>	CO5	1
ii)	<b>What is an offline and multi-tape Turing machine?</b>	<b>2</b>	CO5	1
iii)	<b>What are the languages the Chomsky Hierarchy describes?</b>	<b>2</b>	CO4	1
iv)	<b>Define the 'Empty string' and 'Reverse string' with respect of languages.</b>	<b>2</b>	CO1	1
v)	<b>Define "Kleene Star" with an example.</b>	<b>2</b>	CO1	1
vi)	<b>What do you mean by Grammar?</b>	<b>2</b>	CO3	1
vii)	<b>What is an automaton? What are the types of Automaton?</b>	<b>2</b>	CO2	2
viii)	<b>Explain the Lexical analysis of following statement: NewValue = OldValue + 50;</b>	<b>2</b>	CO6	2
Qu-2	Solve any <b>FOUR</b> questions out of <b>SIX</b> .	<b>16</b>		
i)	<b>Explain the Moore Machine with suitable example.</b>	<b>4</b>	CO2	2
ii)	<b>What are derivation trees? Sketch the derivation tree for the CFG given by:  <math>S \rightarrow aA</math> -- (1)  <math>A \rightarrow aB</math> -- (2)  <math>B \rightarrow bB</math> -- (3)  <math>B \rightarrow a</math> -- (4)</b>	<b>4</b>	CO3	3
iii)	<b>What do you mean by the Halting problem? Explain the implications of Halting problem.</b>	<b>4</b>	CO5	2



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iv)	Explain the Closure Properties of Regular Languages.	4	CO1	2
v)	Write a short note on "Compiler & Its phases".	4	CO6	2
vi)	Write a short note on "Equivalence between PDA and CFG".	4	CO4	2
Qu-3	Solve any TWO questions out of THREE.	16		
i)	Design the DFA that accepts/recognizes the language $L(M) = \{w \mid w \in \{a, b, c\}^* \text{ and } w \text{ contains the pattern } abac\}$ .	8	CO2	6
ii)	Construct a PDA accepting $\{a^n b^m a^n \mid m, n \geq 1\}$ by final state.	8	CO4	6
iii)	Design a Turing Machine to accept the language of all strings in $\{a, b\}^*$ that either contain the substring $ab$ or end with $ba$ .	8	CO5	6
Qu-4	Solve any TWO questions out of THREE.	16		
i)	Design a Finite Automata accepting binary representations of integers divisible by 3.	8	CO2	6
ii)	What is regular expression? Give the regular expression for: a) representing the set L of strings in which every 0 is immediately followed by at least two 1's. b) representing the set of strings $L = \{a^2, a^5, a^8, \dots\}$	8	CO1	3
iii)	Construct a grammar in Greibach Normal Form equivalent to the grammar: $S \rightarrow AA \mid a$ $A \rightarrow SS \mid b$	8	CO3	

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