

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

May-June 2025/ Nov – Dec 20__ July-Aug 20__ / Feb– March 20__

B. Tech Program: Information Technology Scheme : III

Regular/Supplementary Examination: SY Semester: IV

Course Code: ITC404 and Course Name: Automata Theory

Date of Exam: 26-05-2025

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.

Qu. No.	Question	Max. Marks	CO	BT level
Qu-1	Solve any TWO questions out of three: (05 marks each)	10		
a)	Write a short note on phases of the compiler.	5	CO6	2
b)	Explain the Chomsky hierarchy for languages.	5	CO3	2
c)	Write regular expression to each following subsets of {a, b} i. The set of all strings containing at least 2a. ii. The set of all strings containing exactly 2a.	5	CO1	3
Qu-2	Solve any TWO questions out of three: (05 marks each)	10		
a)	Design a DFA to accept strings of a's and b's starting with the string ab.	5	CO2	6
b)	Construct PDA for following languages: $L = \{ w \in \{ a, b \}^* \mid w \text{ has the equal number of a's and b's} \}$	5	CO4	6
c)	Construct a Turing machine that accept $L = \{ 0^n 1^n \mid n \geq 0 \}$.	5	CO5	6
Qu-3	Solve any TWO questions out of three. (10 marks each)	20		
a)	i) Design the grammars for the languages $L = \{ w \mid (w \mid \text{mod } 3 = 0) \}$ on $\Sigma = \{ a \}$ and use it to derive any valid string.	4	CO1	6
	ii) Let G be the grammar $S \rightarrow aB \mid bA$ $A \rightarrow a \mid aS \mid bAA$ $B \rightarrow b \mid bS \mid aBB$ For the string 'aaabbabba' find i) Left most derivation ii) Rightmost derivation iii) Parse tree	6	CO3	3
b)	Let the PDA: $M = (\{ q_0, q_1 \}, \{ 0, 1 \}, \{ X, Z_0 \}, \delta, q_0, Z_0, F)$ with transition function δ :	10	CO4	6

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	$\delta(q_0, 0, Z_0) = (q_0, XZ_0)$ $\delta(q_0, 0, X) = (q_0, XX)$ $\delta(q_0, 1, X) = (q_1, \epsilon)$ $\delta(q_1, 1, X) = (q_1, \epsilon)$ $\delta(q_1, \epsilon, X) = (q_1, \epsilon)$ $\delta(q_1, \epsilon, Z_0) = (q_1, \epsilon)$ Construct the equivalent context-free grammar (CFG) from the given PDA.			
c)	Construct the minimum state automata equivalent to transition diagram.	10	CO2	6
Qu-4	Solve any TWO questions out of three. (10 marks each)	20		
a)	i) Construct a mealy machine for regular expression: $(0+1)^*(00+11)$. ii) Differentiate between Moore Machine and Mealy machine.	5 5	CO2	6 4
b)	i) Reduce the following grammar to CNF: $S \rightarrow 1A \mid 0B$ $A \rightarrow 1AA \mid 0S \mid 0$ $B \rightarrow 0BB \mid 1S \mid 1$	6	CO3	3
	ii) Explain the closure properties of regular language with example.	4	CO1	2
c)	Design a Turing machine for set of string with equal number of 0's and 1 's over $\{0, 1\}^*$.	10	CO5	6
