K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code:INT	Pattern:2022
Name of Course:Theory of Computation	Course Code:INT223001
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	CO
Question No. 1			
a)	Design a deterministic finite automaton to accept all strings consisting of a substring "aba" over Σ = {a, b}.	(6)	CO1
Question No. 2			
b)	Draw finite automata for regular expression: (111+100)*0.	(6)	CO2
Question No. 3			
a)	Construct a derivation tree for a string "aabbabba" from the given context free grammar: S → aB | bA A → a | aS | bAA B → b | bS | aBB	(5)	CO3
	OR		
b)	Recognize the language L from CFG: G = [{S}, {a, b}, P, {S}] where P = S → aSB; S → ab	(5)	CO3
c)	Construct context free grammar which consists of all the strings having at least one occurrence of '000' over Σ = {0, 1}.	(5)	CO3
	OR		
d)	Construct context free grammar for the language in which there are no consecutive b's, the strings may or may not have consecutive a's.	(5)	CO3
e)	Convert the given context free grammar to Chomsky Normal Form. G = S → aSa | bSb | a | b | aa | bb	(6)	CO3
	OR		
f)	Convert the following grammar to Greibach Normal Form.	(6)	CO3

$G = S \rightarrow abSb \mid aa$

Question No. 4

a) Define Push Down Automata (PDA) through final state and through empty stack. Enlist the differences between push down automata and finite state machine. (8) CO4

OR

b) Define Post Machine (PM). State and explain the closure properties of context free languages. (8) CO4

c) Design push down automata accepting $\{a^n b^m a^n \mid m, n \geq 1\}$. Simulate a push down automata for a string "aabaa". (8) CO4

OR

d) Design post machine to accept a language $L = \{a^n b^n c^n \mid n \geq 0\}$. (8) CO4

Question No. 5

a) Construct a Turing machine to replace the string '110' by '101' in binary input string. (8) CO5

OR

b) Construct a Turing machine for the language of even number of 1's and even number of 0's over $\Sigma = \{0, 1\}$. (8) CO5

c) Show that the following problems are undecidable: (8) CO5

i) Given two CFGs G1 and G2, $L(G1) \cap L(G2) = \Phi$

ii) Whether a CFG is ambiguous or not

OR

d) Compare finite state machine, push down automata, post machine and Turing machine with respect to language, grammar, powerfulness and examples. (8) CO5

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