

B.E. /B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
 Third Semester
Computer Science and Business Systems
24CBPC301 - FORMAL LANGUAGE AND AUTOMATA THEORY
 Regulations - 2024

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
 Answer ALL Questions

	Marks	K- Level	CO
1. Regular expression are _____ (a) Type 0 language (b) Type 1 language (c) Type 2 language (d) Type 3 language	1	K1	CO1
2. The complement of a language will only be defined when and only when the _____ over the language is defined. (a) String (b) Word (c) Alphabet (d) Grammar	1	K1	CO1
3. The set of strings that a DFA recognizes is known as the _____. (a) Input alphabet (b) Transition set (c) Accepted language (d) Final state set	1	K1	CO2
4. Which of the following option is correct with respect to Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA) ? (a) NFA is slower to process and its representation uses more memory than DFA (b) DFA is faster to process and its representation uses less memory than NFA (c) NFA is slower to process and its representation uses less memory than DFA (d) DFA is slower to process and its representation uses less memory than NFA	1	K1	CO2
5. The format: A->aB refers to which of the following? (a) Chomsky Normal Form (b) Greibach Normal Form (c) Backus Naur Form (d) None of the mentioned	1	K1	CO3
6. Choose the correct option: Statement 1: Recursive Inference, using productions from head to body. Statement 2: Derivations, using productions from body to head. (a) Statement 1 is true and Statement 2 is true (b) Statement 1 and Statement 2, both are false (c) Statement 1 is true and Statement 2 is false (d) Statement 2 is true and Statement 1 is true	1	K1	CO3
7. A deterministic linear bounded automaton is always (a) Regular (b) Context free (c) Context Sensitive (d) Recursively Enumerable	1	K1	CO4
8. If L1 and L2 are context free languages, L1-L2 are context free: (a) always (b) sometimes (c) never (d) none of the mentioned	1	K1	CO4
9. An instantaneous description of Turing machine consists of (a) Present state and input to be processed (b) Present state and entire input to be processed (c) Present input only (d) None of the mentioned	1	K1	CO5
10. What role does diagonalization play in demonstrating undecidability? (a) It proves the existence of polynomial-time algorithms (b) It constructs languages that are provably undecidable (c) It simplifies complexity analysis of algorithms (d) It optimizes resource allocation in computational systems	1	K1	CO6

PART - B (12 × 2 = 24 Marks)
 Answer ALL Questions

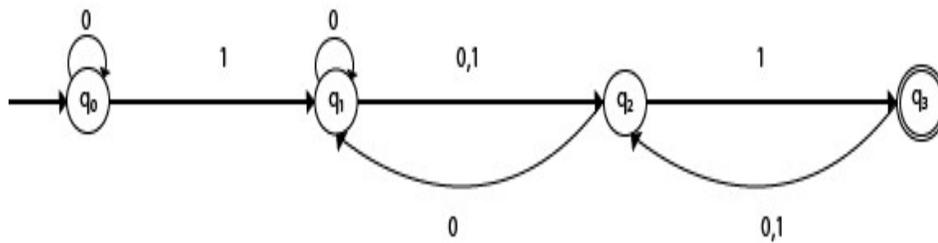
11. Define Grammar.	2	K1	CO1
12. Demonstrate a regular expression for a language that accepts all strings which start with 'a' but do not contain consecutive b's.	2	K2	CO1

13. Define Equivalent States.

2 K1 CO2

14.

2 K2 CO2



Draw the transition table for the given diagram.

15. Compute LMD & RMD for the following grammar.

2 K2 CO3

$w = 00110101S \Rightarrow 0B / 1A$ $A \Rightarrow 0/0S/1AA$ $B \Rightarrow 1/1S/0BB$

16. How ambiguity is removed from the Grammar?

2 K1 CO3

17. When pushdown automata is said to be deterministic?

2 K1 CO4

18. Compare CFG and CSG.

2 K2 CO4

19. Define Turing machine.

2 K1 CO5

20. Illustrate a Turing Machine which accepts the string $W = aba$ over the input symbol $\{a,b\}$.

2 K2 CO5

21. What are undecidable problems? Give some examples.

2 K1 CO6

22. What is universal Language L_u ?

2 K1 CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Explain in detail about Chomsky Hierarchy Model.

11 K2 CO1

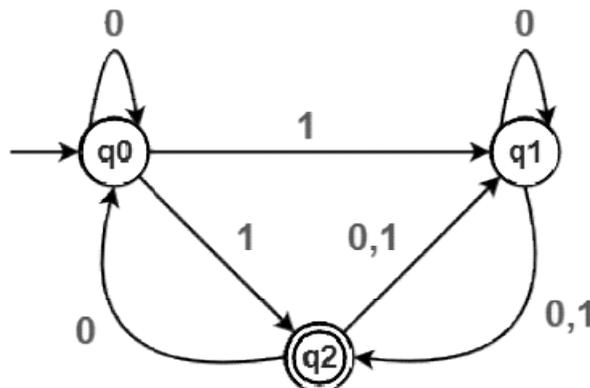
OR

b) Illustrate productions and derivations in detail.

11 K2 CO1

24. a) Construct Deterministic Finite Automata (DFA) for the given Non-Deterministic Finite Automata (NFA) diagram.

11 K3 CO2



OR

b) Make use of Pumping Lemma, to prove that the language $A = \{a^n b^n \mid n \geq 0\}$ is Not Regular.

11 K3 CO2

25. a) Apply the procedure for converting a context-free grammar into Chomsky Normal Form (CNF) to the given grammar.

11 K3 CO3

$A \rightarrow BCD \mid b$
 $B \rightarrow Yc \mid d$
 $C \rightarrow gA \mid c$
 $D \rightarrow dB \mid a$
 $Y \rightarrow f$

OR

- b) Consider the grammar 11 K3 CO3
 $S \rightarrow AS | \xi$
 $A \rightarrow aa | ab | ba | bb$
Construct LMD & RMD for the following grammar which consists of all strings of even length.
(i) aabbba
(ii) baabab
(iii) aaabbb

26. a) Explain the working of Linear Bounded Automata with example. 11 K2 CO4

OR

- b) Demonstrate the Pushdown Automata for the following language 11 K2 CO4
 $L = \{0^n 1^m 2^m 3^n \mid n \geq 1, m \geq 1\}$ Explain with steps.

27. a) Construct a Turing Machine that accepts Even Palindrome over the alphabet 11 K3 CO5
 $\Sigma = \{a, b\}$.

OR

- b) Apply the concept of recursive languages to show that the union and intersection of 11 K3 CO5
two recursive languages L_1 and L_2 are also recursive.

28. a) Explain undecidability of PCP in detail. 11 K2 CO6

OR

- b) Illustrate the concepts of Class P and Class NP problems with suitable examples, 11 K2 CO6
and describe their relationship to NP-complete problems.