

4E1306

Roll No. \_\_\_\_\_

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**B. Tech. IV - Sem. (Main / Back) Exam., - 2025**  
**Artificial Intelligence and Data Science**  
**4AID4-06 Theory of Computation**  
**CS, IT, AID, CAI, CCS, CDS, CIT**

**Time: 3 Hours**

**Maximum Marks: 70**

*Instructions to Candidates:*

*Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL

2. NIL

**PART - A**

**[10×2=20]**

**(Answer should be given up to 25 words only)**

**All questions are compulsory**

- Q.1 What are acceptors and transducer in context of Turing machine?
- Q.2 Define a Finite Automata.
- Q.3 Write applications of Mealy and Moore machines.
- Q.4 What are the computable functions?
- Q.5 Define any one closure property of regular sets.

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- Q.6 Show that the grammar  $S \rightarrow aB \mid ab$ ,  $A \rightarrow aAB \mid a$ ,  $B \rightarrow Abb \mid b$  is ambiguous.
- Q.7 Describe the Context-sensitive grammar (CSG).
- Q.8 What is NP complete and NP hard problem?
- Q.9 What is the use of Null Production and Unit Production?
- Q.10 What is recursively enumerable language?

## **PART – B**

[5x4]

### **(Analytical/Problem solving questions)**

#### **Attempt any five questions**

- Q.1 Describe the terms tractable problem, intractable problem and undecidability problem in context of computation.
- Q.2 Discuss Turing machine as language acceptors and transducers. Construct Turing machine for language  $L = \{a^n b^n c^n \mid n \geq 1\}$ .
- Q.3 What is the role of CFG for PDA? Construct the PDA for language  $L = \{a^n b^{2n} \mid n \geq 1\}$ .
- Q.4 Distinguish CNF and GNF with examples. Also explain problem related to them.
- Q.5 Explain the Chomsky classification with the suitable example of each grammar.
- Q.6 Discuss the equivalence of DFA and N DFA.
- Q.7 Construct the CSG for the language  $L = \{a^n b^n c^n \mid n \geq 1\}$ .

## PART - C

[3×10=30]

### (Descriptive/Analytical/Problem Solving/Design Questions)

#### Attempt any three questions

- Q.1 Elaborate pumping lemma for regular language. Show that the language  $L = \{a^n b^n \mid n > 0\}$  is not regular by using pumping lemma.
- Q.2 Deduce Myhill-Nerode theorem and prove that following language is regular:  $L = \{w \in \{a, b\}^* \mid w \text{ having even number of a's}\}$ .
- Q.3 Explain conversion of Finite automata to regular expression and vice versa. Prove that the strings recognized by the following finite automata are:  $(a + a(b + aa)^* b)^* a(b + aa)^* a$ . Where P is the initial state and R is the final state.

Current State	Current Input: a	Current Input: b
P	P, Q	
Q	R	P, Q
R	Q	

- Q.4 Discuss the solution of travelling salesman problem with a real-world example.
- Q.5 Explain the following terms with examples -
- (1) Universal Turing Machine
  - (2) Multitrack Turing Machine
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