(T) Roll No. .....

PAPER ID—11160

B. Tech. EXAMINATION, 2025

(Fifth Semester)

FORMAL LANGUAGES AND AUTOMATA

(THEORY)

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Define a power set with an example.

(b) Draw the transition diagram of an NFA that accepts strings ending with '01'.

(c) State Arden's Lemma.

(d) Is the language $L = \{0^n 1^n \mid n \geq 0\}$ regular ? Justify with pumping lemma.

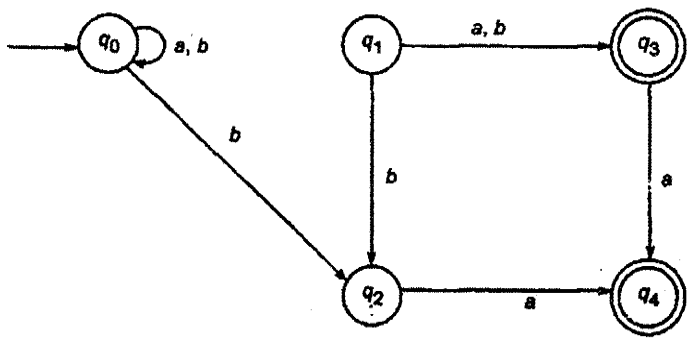
(e) Define Griebach Normal Form.

(f) Explain the Halting Problem in brief.

(g) Write the transition function for a PDA accepting $a^n b^n$. **7×2=14**

Unit I

2. (a) Explain the procedure for converting an NFA to a DFA for the following transition graph : 7



(b) Discuss the minimization of finite automata using an example. 7

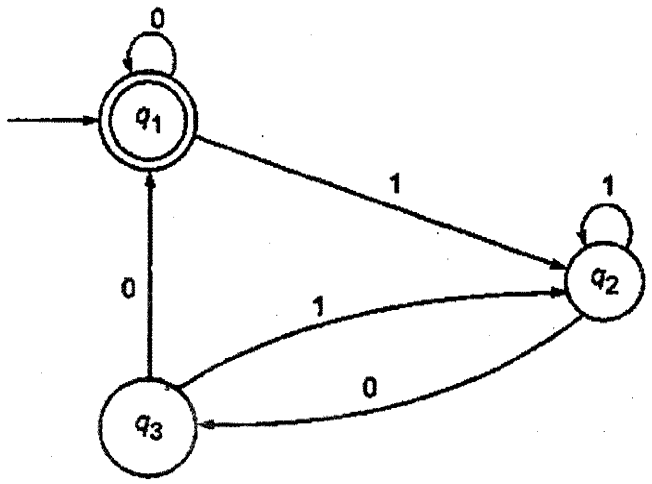
3. (a) What are Mealy and Moore machines ? 7

(b) Compare their equivalence and provide the differences between them using an example. 7

Unit II

4. (a) State and prove Arden's method with an example. 7

(b) Construct a regular expression for the given Finite Automata : 7



5. (a) Define the pumping lemma for regular languages and illustrate its use in proving non-regularity. 7

(b) Discuss any *two* applications of regular languages. 7

Unit III

6. (a) Explain the Chomsky hierarchy of grammars, with examples for each type. 7

(b) Describe the steps for removing ambiguity in context-free grammars. 7

7. (a) Define a Pushdown Automaton (PDA). 7

(b) Design a PDA for the language $L = \{a^n b^n \mid n \geq 0\}$ and explain the acceptability of a string. 7

Unit IV

8. (a) Provide a model for a basic Turing machine and design a Turing machine that increments a binary number by 1. 7

(b) Explain the concept of a Universal Turing Machine. 7

9. (a) Discuss the significance of the Church-Turing thesis. 7

(b) What is Rice's Theorem ? State and prove it. Also, mention its applications in undecidability. 7

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