Code No: 124AG **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, December – 2024/January - 2025
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) Define Finite State Machine(FSM). [2]
b) Construct the language generated by the grammar: S→aSb | Ɛ. [3]
c) What is meant by Context Free Grammar (CFG)? [2]
d) Write down the applications of Pumping Lemma. [3]
e) What do you mean by Greiback Normal Form? [2]
f) What are the application of Push Down Automata(PDA)? [3]
g) What do you mean by Multitape Turing Machine? [2]
h) Define a Turing Machine and list its components. [3]
i) Define the classes P and NP in computational theory. [2]
j) What are the four types of languages in the Chomsky hierarchy? [3]

PART - B

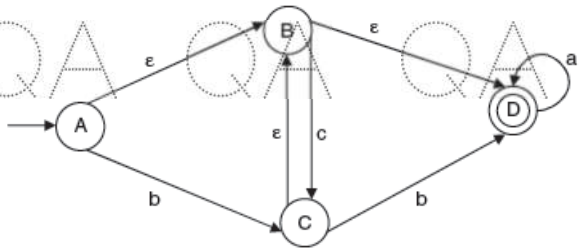
(50 Marks)

2.a) Design a DFA to accept the language L = {w | w has both an even number of 0's and an even number of 1's}.
b) Construct a DFA for the given NFA: [5+5]

Present State	Next State	
	0	1
→Q_0	Q_0, Q_1	Q_2
Q_1	Q_0	Q_1
(Q_2)	-	Q_0, Q_1

OR

3.a) Convert the following NFA with Ɛ moves to an equivalent DFA without Ɛ move:



b) Design a Moore machine which determines the residue mod-3 for each binary string treated as a binary integer. [5+5]

4.a) Write the regular expressions for the following languages:]
i) The set of strings consisting of alternative 0's and 1's over {0,1}.
ii) The set of strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.

b) Consider the transition table for a DFA:

	0	1
$\rightarrow Q_1$	Q_2	Q_1
Q_2	Q_3	Q_1
$*Q_3$	Q_3	Q_2

i) Give the regular expression for the language of the automaton.
ii) Construct the transition diagram for the DFA and give a regular expression for its language by eliminating state Q_2. [5+5]

OR

5.a) Prove that "Every language defined by a regular expression is also defined by a finite automaton".

b) Explain the strategy for constructing a regular expression from a finite automaton. [5+5]

6.a) Convert the following CFG to GNF:

S→AB | BC A→aB | bA | a B→bB | cC | b C→c.

b) Discuss the closure properties of the Context-Free Languages. [5+5]

OR

7. Construct a PDA to accept a given language L by both the empty stack and the final state where L = $\{a^n b^n$, where $n \geq 1\}$. [10]

8.a) Design a Turing Machine that accepts strings of the form $0^n 1^n$.

b) Give brief descriptions of various types of Turing Machines with necessary examples. [5+5]

OR

9.a) Construct a linear-bounded automata for the following context-sensitive language:

$L = \{a^n b^n c^n \mid n \geq 0\}$.

b) Discuss briefly about Church's hypothesis. [5+5]

10. Describe in detail about post correspondence problem. [10]

OR

11. Discuss the significance of the Universal Turing Machine in proving the computational universality of Turing Machines. Why is it important in computability theory? [10]

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