Code No: 154CK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, September/October - 2023
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering (Artificial Intelligence and Machine Learning))

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

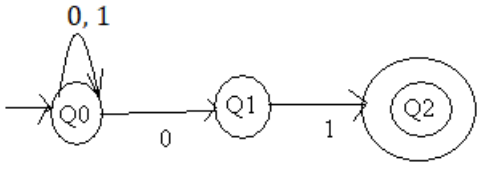
(25 Marks)

1.a)	Write applications of finite automata.	[2]
b)	Define NDFA.	[3]
c)	Simplify regular expression: a(ab + ab)* + b(ab + ab)*.	[2]
d)	Give Recursive definition for Regular Expression.	[3]
e)	How is a pushdown automaton different from finite automaton?	[2]
f)	Define CFG.	[3]
g)	What do you mean by Unit Production?	[2]
h)	When will you say that a symbol in a grammar is Useless?	[3]
i)	Define undecidable problem.	[2]
j)	State Rice's theorem.	[3]

PART – B

(50 Marks)

2.a) Design a DFA to accept set of all strings ending with 010.
b) Construct DFA for given NFA. [5+5]



OR

3.a) Design a Moore Machine to count number of substrings ***101*** in a given string over alphabet Σ = {0, 1}.
b) Let L be a set accepted by a NFA. Then show that there exists a DFA that accepts L? [5+5]

4. Construct an FA recognizing the corresponding language.
(1+110)*0 [10]

OR

5. Find a Regular expression corresponding to each of the following subsets over {0,1}*
a) The set of all strings containing even number of 1's including empty string?
b) The set of all strings containing at least two consecutive 0's or 1's?
c) The set of all strings not ending in 10? [10]

6.a) Show that the following grammar is ambiguous.
E →E + T / T
T→ T*F / F
F→(E) / id

b) Consider the following grammar G = ({S,A}{a,b},P,S) Where P consists of S→ aAS |a, A→ SbA | SS | ba. For the string **aabbaa** show i) Left most derivation (ii) Right most derivation. [5+5]

OR

7. Design a PDA for the language $L = \{a^n b^m a^n \mid m, n \geq 1\}$. [10]

8. Design Turing Machine which recognizes the words of the form
L = { 0^n1^n | n>=1}. [10]

OR

9. Convert the following Context Free Grammar to Greibach Normal Form
G={({S,A,B},{a,b},P,S)} Where P is
S→AB
A→BS / a
B→SA / b [10]

10. Write about
a) Universal Turing Machine
b) Halting Problem of a Turing Machine. [5+5]

OR

11.a) List and explain properties of recursively enumerable languages.
b) What do you mean by Counter Machine? Discuss in brief. [6+4]

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