NARULA INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT

B.Tech./IT/ODD/3RD SEM/R_21/IT 305/2022-2023
YEAR: 2022

FORMAL LANGUAGE AND AUTOMATA THEORY IT 305

TIME ALLOTTED: 3 HOURS FULL MARKS: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

1. Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

SL	Question	Marks	Co	Blooms Taxonomy Level
(i)	The production of the form A->B, where A and B are non-terminals is called a) Null production b) Unit production c) Greibach Normal Form d) Chomsky Normal Form	1	CO1, CO3	Knowledge, Comprehension
(ii)	Which of the production rule can be accepted by Chomsky grammar? a) A->BC b) A->a c) S->e d) All of these	1	CO1, CO3	Knowledge, Comprehension
(iii)	A Language for which no DFA exist is a________ a) Regular Language b) Non-Regular Language c) May be Regular d) none of these	1	CO1, CO3	Knowledge, Comprehension
(iv)	A context free grammar can be recognized by a) Push down automata b) 2 way linearly bounded automata c) Turing Machine d) Finite Automata	1	CO3	Application
(v)	Given: L1= {xϵ $\sum$*|x contains even no's of 0's} L2= {xϵ $\sum$*|x contains odd no's of 1's} No of final states in Language L1 U L2? a) 1 b) 2 c) 3 d) 4	1	CO3	Comprehension

(vi)	Regular expression for all strings starts with ab and ends with bba is. a) aba*b*bba b) ab(ab)*bba c) ab(a+b)*bba d) All of the mentioned	1	CO3	Comprehension
(vii)	RR* can be expressed in which of the forms: a) R+ b) R- c) R+ U R- d) R	1	CO3	Comprehension
(viii)	A turing machine operates over: a) finite memory tape b) infinite memory tape c) depends on the algorithm d) none of the mentioned	1	CO3	Application
(ix)	Push down automata accepts _________ languages. a) Type 3 b) Type 2 c) Type 1 d) Type 0	1	CO3	Application
(x)	Which among the following looks similar to the given expression? ((0+1). (0+1)) * a) {xϵ {0,1} *|x is all binary number with even length} b) {xϵ {0,1} |x is all binary number with even length} c) {xϵ {0,1} *|x is all binary number with odd length} d) {xϵ {0,1} |x is all binary number with odd length}	1	CO1, CO3	Knowledge, Comprehension
(xi)	Simplify the following regular expression: ε+1*(011) *(1*(011) *) * a) (1+011) * b) (1*(011) *) c) (1+(011) *) * d) (1011) *	1	CO3	Comprehension
(xii)	In Moore machine, output is produced over the change of: a) transitions b) states c) inputs d) none of these	1	CO1, CO2	Knowledge

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GROUP – B

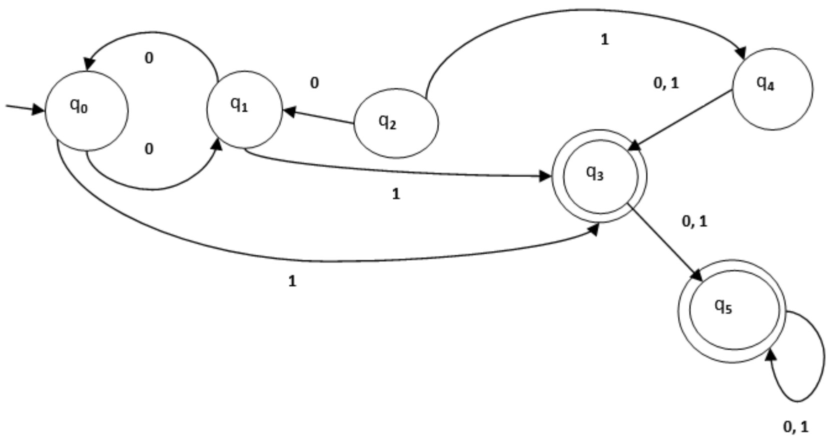
(Short Answer Type Questions)

(Answer any three of the following) 3 x 5 = 15

SL	Question	Marks	Co	Blooms Taxonomy Level
2.	Define Left factoring & Left recursion with proper example.	5	CO3	Knowledge, Comprehension
3.	Construct a minimum state automaton equivalent to the finite automaton given in the table below.	5	CO3	Knowledge, Comprehension

State / Σ	0	1
→ q0	q1	q5
q1	q6	q2
q2	q0	q2
q3	q2	q6
q4	q7	q5
q5	q2	q6
q6	q6	q4
q7	q6	q2

SL	Question	Marks	Co	Blooms Taxonomy Level
4.	Consider G whose productions are: S -> aAS | a, A -> SbA| SS| ba For the string aabbaa, find leftmost derivation, rightmost derivation and derivation tree.	5	CO3	Knowledge, Comprehension, Application
5.	Minimize the states in the DFA depicted in the following diagram:	5	CO3	Knowledge, Comprehension



SL	Question	Marks	Co	Blooms Taxonomy Level
6.	Explain classification of languages and their relations	5	CO3	Knowledge, Comprehension

GROUP – C
(Long Answer Type Questions)
(Answer any three of the following) 3 x 15 = 45

SL		Question	Marks	Co	Blooms Taxonomy Level
7.	(i)	State & Prove Arden's Theorem.	5	CO2	Comprehension
	(ii)	What is *ambiguous grammar*? Comment on the ambiguity of the following grammar. Justify your answer with an example. $S \rightarrow SS$, $S \rightarrow a$, where $S \in N$, $a \in T$ $L(G) = \{a^n \mid n \geq 1\}$	2 + 3	CO2, CO3, CO5	Knowledge, Application
	(iii)	Convert the following Moore machine into Mealy machine:	5	CO1, CO3	Knowledge, Application

PRESENT STATE	NEXT STATE		OUTPUT
	a = 0	a = 1	
$\rightarrow q_1$	q_1	q_2	0
q_2	q_1	q_3	0
q_3	q_1	q_3	1

SL		Question	Marks	Co	Blooms Taxonomy Level
8.	(i)	Explain Chomsky Normal Form or CNF of grammar with an example.	3	CO1, CO3	Knowledge, Application
	(ii)	Convert the following grammar into CNF – S -> aAD, A -> aB | bAB, B -> b, D -> d	4	CO1, CO3	Knowledge, Application
	(iii)	Find the equivalence class partition of the machine shown below:	8	CO1, CO3	Knowledge, Application

PRESENT STATE	NEXT STATE, z	
	x=0	x=1
A	E,0	D,1
B	F,0	D,0
C	E,0	B,1
D	F,0	B,0
E	C,0	F,1
F	B,0	C,0

SL		Question	Marks	Co	Blooms Taxonomy Level
9.	(i)	Construct a DFA equivalent to the NDFA given in the table below.	6	CO2, CO3	Knowledge, Comprehension

State / Σ	a	b
→ q0	q0, q1	q0
q1	q2	q1
q2	q3	q3
q3		q2

SL		Question	Marks	Co	Blooms Taxonomy Level
	(ii)	Simplify the given grammar: S -> aXb	5	CO3	Application

		X -> aXb | e			
	(iii)	What do you mean by unit production? Explain with an example.	4	CO1, CO2	Knowledge, Comprehension
10.	(i)	Prove that (1+00*1) + (1+00*1) (0+10*1)* (0+10*1) = 0*1(0+10*1)*	3	CO2, CO3	Knowledge, Comprehension
	(ii)	Explain Merger Graph with example	4	CO3	Knowledge, Comprehension, Application
	(iii)	Convert the following grammar into GNF - S -> AB, A -> BS | b, B -> SA | a	8	CO3	Application
11.	(i)	Define Push Down Automata.	2	CO2	Knowledge
	(ii)	Construct a push down automata for the language L= {wwR | w ϵ {a,b}*}	6	CO3, CO4	Application
	(iii)	What is derivation tree?	2	CO2, CO3	Knowledge
	(iv)	Convert the following grammar into CNF - S -> aAD, A -> aB | bAB, B -> b, D -> d	5	CO1, CO3	Knowledge, Comprehension
12.	(i)	Using Pumping Lemma check whether L= $\{a^n b^n \mid n \geq 1\}$ is regular or not.	5	CO3	Knowledge, Application
	(ii)	Construct a PDA accepting the set of all strings over {a,b} with equal number of a's followed by equal number of b's.	5	CO3, CO4	Application
	(iii)	Find the highest type number of the following production rules - S→ASB | d, A→aA, S→aA | c, A→ac, aAbcD→abcDbcD	5	CO1, CO3	Application