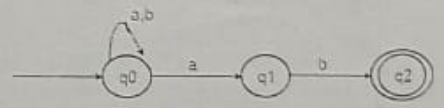
Name: Student University Roll No.:	Printed Pages: 02
School of Engineering SecondSessional Examination, Odd Semester (AS: 2023-24) B. Tech: CSE/AI/CCML [Year: III][Semester: V]	
Course Title: Automata Theory Course Code: BCS3504	Max Marks: 60 Time: 3*hrs*

Instructions if any: Read the question Carefully.

	SECTION 'A' **Q.N.1. Attempt all parts of the following:**	Course Objective	Marks
a)	A pushdown automata can be defined as: (Q, ∑, G, q0, z0, A, d) What does the symbol z0 represents	CO4	1
b)	Differentiate between NFA with ε moves and NFA without ε moves.	CO2	1
c)	The production of the form A->B , where A and B are non terminals is called.....	CO1	1
d)	Let ∑={0,1}* and the grammar G be: S->ε S->SS S->0S1|1S0. What is the language generated by this grammar?	CO1	1
e)	A Language for which no DFA exist is a	CO2	1
f)	What is an ambiguous grammar.	CO1	1
g)	Differentiate Kleene Closure and Positive Closure.	CO2	1
h)	What is the difference between general turing machine and total turing machine?	CO5	1
	SECTION 'B' **Q.N.2. Attempt any two parts of the following:**	Course Objective	Marks
a)	Prove that L = { $a^n b^n c^n$ | N>=1} is not regular.	CO3	6
b)	Let ∑= {a,b}. For each of the following languages over ∑, find the regular expression representing it: i) L= {w: |w| mod 3 = 0, w∈{a,b}*} ii) All strings start and end with different alphabet. iii) Length of each string is zero or exactly three. iv) L = { $a^{2n} b^{2m}$: n>=1, m>=0}	CO3	6
c)	Construct CFG and then find equivalent NPDA: L={set of palindrome over ∑={a,b}* U {$a^n b^m a^n$; n>=1, m>=1}. Also write ID's for ababa	CO4	6
d)	Convert the grammar with production: S -> AABC A -> bAa | ε B -> ab | b C -> aCa | bCb | ε into CNF.	CO1	6
	SECTION 'C'	Course Objective	Marks
	Q.N.3. Attempt any two parts of the following:		
a)	Convert the following NFA to DFA.  Figure 1	CO2	5
b)	Find the parse tree for the expression abbcde considering the productions: S -> aAcBe A -> Ab A -> b B-> d Also write the Left Most Derivation and Right Most Derivation.	CO1	5

c)	Define the following: i)Alphabet ii)Word iii)Language iv)Length of word	CO2	5
Q.N.4. Attempt any two parts of the following:			
a)	Design Moore Machine for $L = \{ w: n_a(w) \bmod 5: w \in \{a,b\}^*\}$ and find its equivalent Mealy Machine.	CO2	5
b)	Construct Turing Machine for copy of string on Turing Tape and also write the ID for the possible string.	CO5	5
c)	What is CHOMSKY Classification? Explain in detail with suitable example.	CO2	5
Q.N.5. Attempt any two parts of the following:			
a)	Minimize the following DFA: δ | a | b ->A | A | D B | C | F C | D | E D | A | F E | A | G F | B | E .G | B | D	CO2	5
b)	What is Universal Turing Machine? Explain the modification of basic model of turing machine.	CO5	5
c)	Show the equivalence of the following regular expression: $(1+00^*1)+(1+00^*1)(0+10^*1) = 0^*1(0+10^*1)$	CO3	5
Q.N.6. Attempt any two parts of the following:			
a)	Construct a grammar generating $L = \{ wcw^T \mid w \in \{a,b\}^*\}$	CO4	5

b)	Prove or disprove the following: i) Complement of a recursively enumerable language is recursively enumerable. ii)Union of recursively enumerable languages is recursively enumerable.	CO5	5
c)	Construct PDA equivalent to the following context free grammar S -> 0BB B-> 0S | 1S | 0 Test whether 010^4 is in N(A)	CO4	5

Table 1: Mapping between COs and questions
(Number of COs may vary from course to course)

COs	Questions Numbers	Total Marks
CO1	1(c),1(d),1(f),2(d),3(b)	14
CO2	1(b),1(e),1(g),3(a),3(c),4(a),4(c),5(a),	28
CO3	2(a),2(b),5(c)	17
CO4	1(a),2(c),6(a),6(c)	17
CO5	1(h),4(b),5(b),6(b)	16