Reg. No.

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Fifth Semester

CS18503 –THEORY OF COMPUTATION

(Computer Science and Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	The student will be able to design and build Finite Automata.	2
CO 2	The student will be able to skillfully demonstrate and solve problems on regular expressions and regular languages.	3
CO 3	The student can formulate and design Pushdown Automata for the given context free languages and context free grammars.	3
CO 4	The student can design and construct the Turing machine for pattern matching and computation of basic integer functions.	4
CO 5	The students will be able to infer the limitations of computers, interpret the answer to what kind of problems can be computed and what cannot be computed by a computer.	5

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Explain Formal Notation of ε-NFA.	1	2
2.	Differentiate between proof by contradiction and proof by contrapositive.	1	4
3.	Explain the Regular Expression and its applications.	2	2
4.	Construct a Regular Expression for set of strings ending with 01.	2	3
5.	Construct the CFG for the language L={a^n b^{2n}}where n ≥ 1.	3	3
6.	Explain the components of Push Down automata.	3	2
7.	Choose the methods to Simplify the Context Free Grammar.	4	3
8.	Illustrate the term Non-Deterministic Turing Machine with example.	4	2
9.	Explain the formal parameters of Linden Mayer system.	5	2
10.	When a recursive enumerable language is said to be recursive?	5	3

PART- B (5 x 14 = 70 Marks)

Marks CO RBT LEVEL

11. (a) **(i)** Prove that a language L is accepted by some DFA if and only if L is accepted by some NFA. **(7)** 1 4

(ii) Construct the DFA from the given NFA. **(7)** 1 4

States	0	1
→ q_0	{ q_0, q_1}	{ q_0}
q_1	∅	{ q_2}
* q_2	∅	∅

(OR)

(b) **(i)** Prove that a language L is accepted by some ε-NFA if and only if L is accepted by some DFA. **(7)** 1 4

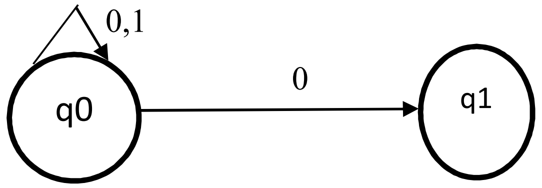
(ii) Construct the DFA equivalent to the NFA. **(7)** 1 4

States	0	1
→ p	{p,q}	{p}
q	{r}	{r}
r	{s}	∅
* s	{s}	{s]

12. (a) **(i)** Construct a ε-NFA for the following Regular Expression **(6)** 2 3

R= $(0+1)^*00(0+1)^*$

(ii) Construct the Regular Expression from the given DFA. **(8)** 2 3



(OR)

(b) **(i)** Construct a ε-NFA for the following Regular Expression **(6)** 2 3

R=$(0+1)^*(00+11)(0+1)^*$

(ii) Construct the regular expression from the given DFA using State Elimination method. **(8)** 2 3

δ	0	1
→ *p	s	p
q	p	s
r	r	q
s	q	r

13. (a) **(i)** Consider the CFG with Productions S->aB | bA ,A->a| aS | bAA, B->bS|aBB|b. Generate the string aaabbabbba. Compute the following **(10) 3 2**

a) Left Most Derivation.

b) Right Most Derivation

c) Parse Tree

d) Check whether the given grammar is ambiguous or not.

(ii) Explain the applications of Context Free Grammar. **(4) 3 2**

(OR)

(b) **(i)** State Pumping Lemma for Context Free Languages. Justify the need for pumping lemma for Context Free Languages. **(4) 3 2**

(ii) Determine a PDA for the language containing strings with equal number of a's and b's. **(10) 3 2**

14. (a) Convert the given CFG G={S,A,B},{0,1},P,S)into CNF where P is given by S→0B|1A, A→0|0S|1AA,B→1|1S|0BB. **(14) 4 3**

(OR)

(b) Construct the Turing Machine for the language $L=\{a^n b^n|n\geq 1\}$ **(14) 4 3**

15. (a) Construct the TM M=({q1,q2,q3},{0,1},{0,1,B},δ,q1,B,{q3}) where δ is given by **(14) 5 4**

q_i	$\delta(q_i,0)$	$\delta(q_i,1)$	$\delta(q_i,B)$
q_1	$(q_2,1, R)$	$(q_2,0, L)$	$(q_2,1, L)$
q_2	$(q_3,0, L)$	$(q_1,0, R)$	$(q_2,0, R)$
q_3	------	------	-----------

And input string w=01 to an instance of MPCP.

(OR)

(b) Explain P and NP problems with necessary examples. **(14) 5 4**

<u>PART- C (1 x 10 = 10 Marks)</u>

(Q.No.16 is compulsory)

Marks CO RBT LEVEL

16. Construct the following Grammar to Greibach Normal Form (GNF). **(10) 3 5**

S->AA|0

A->SS|1

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