B.Tech (Fourth Semester Computer Science & Engineering (C.B.C.S))
End Semester Examination Summer – 2023
Course Name: Theoretical Foundation of Computer Science

Course Code: **BCS2405** ADS/ EFV5738I/3101

Time: 3 Hours] [Max.Marks: 60

Instructions to Candidates:

1. *All questions carry marks as indicated.*
2. *All the sub- questions (a, b, c, d, and e) ofQue.1 in Section A are compulsory.*
3. *Solve any two sub-questions in Que. 2 to Que.6 in Section B.*
4. *Assume suitable data wherever necessary.*
5. *Use of non-programmable calculator is permitted.*

Section – A

Que.1

a) Describe Pigeon Hole Principle. 2 (CO1)

b) Discuss the purpose of pumping lemma? Explain it with example. 2 (CO2)

c) Show that the context free languages are closed under the property of closureand union. 2 (CO3)

d) Write a short note on universal Turing machine. 2 (CO4)

e) Write short note on undecidability. 2 (CO5)

Section – B

Que.2

a) Explain Proof by Induction and Contradiction with example. 5 (CO1)

b) Give Mathematical definition of Finite Automata. 5 (CO1)

c) Construct DFA for L= {x ϵ {a, b}*: $|x|_a$ = odd and $|x|_b$ = even}. 5 (CO1)

Que.3

a) Construct Moore Machine to determine residue mod 4 for each binary stringtreated as binary integer. 5 (CO2)

b) Construct DFA for given Regular Expression, RE=(0+1)(01+10)0*. 5 (CO2)

c) Find regular grammar that generate the following languageL(aa*(ab+a)*). 5 (CO2)

Que.4

a) Let G be the grammar whose productions are 5 (CO3)

S —> aB | bA A —> a | aS | bAA B —> b | bS | Abb

Find LMD, RMD and Parse Tree for the string "aaabbabbba".

b) Eliminate epsilon production from the given grammar 5 (CO3)

S → aSB| aA| bB; A → aA| ϵ; B → bB| ϵ

c) Give formal definition of PDA with block diagram. Explain it. 5 (CO3)

Que.5

a)	Design T.M. for language to find 2's complement of a binary number.	5 (CO4)
b)	List and explain the variants of a Turing machine.	5 (CO4)
c)	Design a Turing Machine for following language. $L = \{ a^n b^n c^n \mid n>=1\}$	5 (CO4)

Que.6

a)	Give Ackermann's function and obtain solution for A (2, 5) and A (3,3).	5 (CO5)
b)	Explain the properties of recursive enumerable language.	5 (CO5)
c)	Describe is PCP and modified PCP.	5 (CO5)

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