Code No: R2022053 **R20** **SET - 1**

II B. Tech II Semester Regular/Supplementary Examinations, July- 2023

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE, CST, CSE(AIML), CSE(AI), CSE(DS), CSE(AIDS), CSE(CS), CSE(IOTCSIBCT), CSE(IOT), AIML, CS, AIDS, CS& AIML)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Construct DFA equivalent to the given NFA [7M]

	0	1
→A	{A,B}	A
B	C	C
C	D	Φ
ⓓ	D	D

b) Construct a DFA accepting the set of all strings ending with 'bb' over Σ={a,b}. [7M]

Or

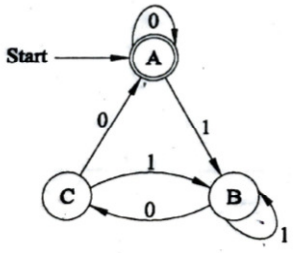
2 a) Draw the transition diagram of a FA which accepts all strings of 0's and 1's in which the number of 0's are odd and 1's are even. [7M]

b) Construct the moore machine to determine residue mod 3 . [7M]

UNIT-II

3 a) Apply pumping lemma for the language L={a^n/n is prime} and prove that it is not regular. [7M]

b) Write equivalent regular expression for the following DFA. [7M]



Or

4 a) Give regular expression for representing the set L of strings in which every 0 is immediately followed by at least two 1's . [7M]

b) Construct the left linear grammar for the language (0+1)*00(0+1)* [7M]

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UNIT-III

5 a) Write CFG for the language $L=\{0^n1^n|n\geq1\}$ i.e. the set of all strings of one or more 0's followed by an equal number of 1's. [7M]

b) Eliminate NULL productions for the grammar [7M]

S→ABC|BaB
A→aA|BaC|aaa
B→bbb|a|D
C→CA|AC
d→ε

Or

6 a) Prove that the following grammar is ambiguous on the string 'aab' [7M]
S→aS|aSbS|ε

b) Find the GNF equivalent to the following [7M]

S → AA | 0
A → SS | 1

UNIT-IV

7 a) Design Push Down Automata for $L = \{a^{2n}b^n \mid n \geq 1\}$ [7M]

b) Convert the following Context Free Grammar to Push Down Automata [7M]

S→aA | bB
A→aB | a
B→b

Or

8 Construct the equivalent grammar for the PDA [14M]
$M=(\{q_0,q_1\}, \{0,1\}, \{R,Z_0\}, \delta, q_0, Z_0, \Phi)$ and δ is given by

$\delta(q_0,0,Z_0)=(q_0,RZ_0)$
$\delta(q_0,0,R)=(q_0,RR)$
$\delta(q_0,1,R)=(q_1,R)$
$\delta(q_1,1,R)=(q_1,R)$
$\delta(q_1,0,R)=(q_1,\varepsilon)$
$\delta(q_1,\varepsilon,Z0)=(q_1,\varepsilon)$

UNIT-V

9 a) Design a Turing Machine to accept $L=\{WW^R \mid W \text{ is in } (a+b)^*\}$ [7M]

b) Construct Turing Machine to compute the function $\log_2{}^n$ [7M]

Or

10 a) Write short note on NP- hard and NP- complete problem. [7M]

b) Check whether the following post correspondence problem has a solution or not. [7M]

I	List A	List B
1	10	11
2	1001	001
3	100	101

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Code No: R2022053 **R20** **SET - 2**

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FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE, CST, CSE(AIML), CSE(AI), CSE(DS), CSE(AIDS), CSE(CS), CSE(IOTCSIBCT), CSE(IOT), AIML, CS, AIDS, CS& AIML)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Design NFA accepting string with a's and b's such that string containing two consecutive a's or two consecutive b's. [7M]

b) Briefly discuss about Finite Automata with Epsilon- Transition. [7M]

Or

2 a) Check whether the following two FSM's are equivalent or not. [7M]

M1	0	1
→A	B	D
Ⓑ	A	C
C	D	B
Ⓓ	C	A

M2	0	1
→P	R	R
Q	R	P
Ⓡ	P	Q

b) Draw the transition diagram of a FA which accepts all strings of 0's and 1's in which the number of 0's are even and 1's are odd. [7M]

UNIT-II

3 a) Write a R.E. for the following DFA. [7M]

	a	b
→P	Q	P
Ⓠ	Q	P

b) Construct a Regular grammar G generating the regular set represented by a*b(a+b)* [7M]

Or

4 a) Construct NFA with ε transition for the following expression 0* + 11 [7M]

b) Construct the right linear grammar for the language (01)*0 [7M]

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Code No: R2022053 **R20** **SET - 2**

UNIT-III

5 a) Define Context free grammar and write context free grammar for the language $L=\{a^ib^jc^k \mid i+j=k, i\geq 0, j\geq 0\}$ [7M]

b) Eliminate Null, unit and useless production from the following grammar [7M]

$S\rightarrow AaA|CA|BaB$
$A\rightarrow aaBa|CDA|aa|DC$
$B\rightarrow bB|bAB|bb|aS$
$C\rightarrow Ca|bC|D$
$D\rightarrow bD|\varepsilon$

Or

6 a) Define ambiguous Grammar. Prove that the following grammar is Ambiguous. [7M]
$S\rightarrow aS|aSbS|\varepsilon$

b) Convert the following CFG to CNF [7M]

$S\rightarrow ASB|\varepsilon$
$A\rightarrow aAS|a$
$B\rightarrow SbS|A|bb$

UNIT-IV

7 a) Construct PDA for the language $L=\{ a^mb^mc^n \mid m,n \geq 1 \}$ [7M]

b) Construct PDA equivalent to the following CFG [7M]

$S \rightarrow 0A$
$A \rightarrow 0ABC \mid 1B \mid 0$
$B \rightarrow 1$
$C \rightarrow 2$

Or

8 Construct the CFG for the PDA [14M]
$M=(\{q_0,q_1\}, \{0,1\}, \{R,Z_0\}, \delta, q_0, Z_0, \Phi)$ and δ is given by

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q_0, Z_0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$

UNIT-V

9 a) Design a TM to recognize the language $L=\{ 1^n2^n3^n \mid n\geq 1 \}$ [7M]

b) Design TM which will recognize strings containing equal number of a's and b's [7M]

Or

10 a) Describe various ways of representing Turing machines with suitable examples. [7M]

b) What is meant by Turing Reducibility? Explain. [7M]

Code No: R2022053 **R20** **SET - 3**

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Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Construct NFA with ε which accepts a language consisting the strings of any no. of 0's followed by any no. of 1's followed by any no. of 2's.And also convert into NFA without ε [7M]

b) Draw the transition diagram of a FA which accepts all strings of 0's and 1's in which the number of 0's are even and 1's are even. [7M]

Or

2 a) Design a Mealy machine which can output symbols 'E' or 'O' according to the total number of 1's encountered is even or odd. The input symbols are 0 and 1. [7M]

b) Construct the minimum state equivalent DFA [7M]

	0	1
→A	B	A
B	A	C
C	D	B
(D)	D	A
E	D	F
F	G	E
G	F	G
H	G	D

UNIT-II

3 a) State pumping lemma for regular languages. Prove that the following language [7M]

L= { $a^n b^n$ | n≥1 } is not a regular.

b) Prove the following identity (a*ab + ba)*a* = (a + ab + ba)* [7M]

Or

4 a) Construct the right linear grammar for the language (0+1)*00(0+1)* [7M]

b) Describe the following sets by regular expressions [7M]
i) the set of all strings of 0's and 1's beginning with 00.
ii) the set of all strings of 0's and 1's beginning with 1 and ending with 00.

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Code No: R2022053 **R20** **SET - 3**

UNIT-III

5 a) Define Context free grammar and write context free grammar for the language [7M]
$L=\{a^n b^m c^k \mid n+2m=k\}$

b) Remove all useless Symbols and all ε – productions from the grammar [7M]
S→aA|aB
A→aaA|B|ε
B→b|bB
D→B

Or

6 a) Consider the grammar S→aS/aSbS/ε [7M]
Is the above grammar ambiguous?
Show in particular that the string 'aab' has to :
i. parse tree ii. Leftmost derivation iii. Rightmost derivation

b) Convert the following grammar to Greibach Normal Form [7M]
S→ABA | AB | BA | AA | B
A→aA | a
B→bB | b

UNIT-IV

7 a) Design a PDA for the language L= {w | w ε(0+1)* and no.of 0's < no.of 1's } [7M]

b) Convert the following Context Free Grammar to Push Down Automata [7M]
S → 0AA
A→ 0S | 1S | 0

Or

8 Construct the CFG for the PDA M =($\{q_0,q_1\}$, {0,1}, $\{R,Z_0\}$, δ, q_0, Z_0, Φ)and δ is given by [14M]

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0,Z_0)=(q_0,Z_0)$
$\delta(q_0,\varepsilon,Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$

UNIT-V

9 a) Design a TM to recognize the language L= { $0^n1^n0^n \mid n\geq 1$ } [7M]

b) Write a short note on linear bounded automata. [7M]

Or

10 a) What are undecidable problems? Explain with example. [7M]

b) Check whether the following post correspondence problem has a solution or not. [7M]

I	List A	List B
1	111	11
2	1001	01
3	1110	1001

Code No: R2022053 **R20** **SET - 4**

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Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks

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UNIT-I

1 a) Convert the following NFA with ε to equivalent DFA [7M]

	0	1	ε
→A	Φ	A	B
B	B	Φ	C
Ⓒ	B	A	Φ

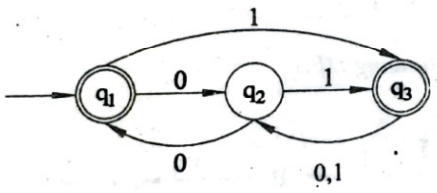
b) Draw the transition diagram of a FA which accepts all strings of 0's and 1's in which the number of 0's are odd and 1's are odd. [7M]

Or

2 a) Construct the minimum state automata for the following. [7M]

	0	1
→A	B	C
B	B	C
C	B	C
D	B	E
Ⓔ	B	C

b) Obtain a regular expression for the following FA [7M]



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UNIT-II

3 a) Show that L={ 0^i1^j | gcd(i,j) =1} is not regular. [7M]

b) Write equivalent regular expression for the following DFA. [7M]

δ	0	1
→q_1	q_2	q_3
(q_2)	q_3	q_1
(q_3)	q_2	q_2

Or

4 a) Find the regular expression for the Language L={$a^{2n}b^{2m}$ | n≥0, m≥0} [7M]

b) Simplify the following R.E. r= ε + a*(abb)*(a*(abb)*)* [7M]

UNIT-III

5 a) Write CFG for the language L={a^nb^n|n≥1} i.e. the set of all strings of one or more a's followed by an equal number of b's [7M]

b) Using CFL pumping lemma show that the following language is not context free L={$a^ib^jc^k$|i<j<k} [7M]

Or

6 a) What is an ambiguous grammar? Show that the following grammar is ambiguous, where E is the start symbol. [7M]

E→E+E|E-E|E*E|E/E|(E)|a

b) Convert the following CFG to CNF [7M]

S→ASB|ε
A→aAS|a
B→SbS|A|bb

UNIT-IV

7 a) Construct PDA for the language L= { $a^{2m}b^mc^n$ | m,n ≥1 } [7M]

b) For the following grammar construct a PDA [7M]

S→aABB|aAA
A→aBB|a
B→bBB|A
C→a.

Or

8 a) Describe the steps in conversion of a CFG to a PDA with a suitable example. [7M]

b) Compare and contrast PDA with two stack PDA. [7M]

UNIT-V

9 a) Design a TM to accept the language L= { wcw^R | w ε (a+b)* } [7M]

b) Define a Turing Machine. Give its classification with suitable examples. [7M]

Or

10 a) Write a short note on Church's hypothesis. [7M]

b) Briefly explain about post's correspondence problem. [7M]