Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

B E- COE, CSE (Auxiliary Examination)	Course Code: UCS701 Course Name: Theory of Computation
August 27, 2023, 05:30 PM	
Time: 3 Hours, M. Marks: 100	Name Of Faculty: SUG, NKA, CHP, NIS, SSS, and JDN

Note: Attempt all questions with proper justification. Assume missing data, if any, suitably.

Q.1. Design a deterministic finite automata which will accept
(a) All the binary numbers divisible by 4.
(b) All the binary strings that begins with a 0 and ends with 101. (5+5)

Q2. Write down the steps needed to convert a given Context-free grammar into Chomsky Normal Form. Use the above steps to convert the following Context-free grammar into Chomsky Normal Form.
S→ ABA
A→ $aA \mid \varepsilon$
B→ $bB \mid \varepsilon$. (5+5)

Q3. Design a pushdown automata for the language L=$\{a^n b^{2n} \mid n, m \geq 1\}$. Draw the transition diagram along with a neat flowchart. (10)

Q4. Design a post machine for the language, L=$\{ a^n b^n a^n \mid n \geq 1\}$. (10)

Q5. Prove that L=$\{ a^n b^n c^n \mid n \geq 1\}$ is not a context-free language using Pumping Lemma. (10)

Q6. Design a Turing machine to multiply two numbers. Explain with appropriate transitions, transition diagram, and tuple representation. (15)

Q7 Consider the following grammar and convert it into equivalent GNF grammar.
S→ AA | a
A→ SS | b (10)

(P.T.O.)

Q8. Minimize the following deterministic finite automata (Consider A as initial and C as final state).

Present State	Next State	
	I/P = 0	I/P = 1
A	F	B
B	C	G
C	C	A
D	G	C
E	F	H
F	G	C
G	E	G
H	C	G

(10)

Q9. Write a regular expression for the following language.
L=Set of all strings over {a, b} that begin and end with the same symbol. (5)

Q10. Describe various variants of Turing machine in detail. (10)

******* All the best *******

NOTE: The answer sheets will be shown on September 05, 2023 at 05:00 PM in L521, CSED.