NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END SEMESTER EXAMINATIONS – MAY 2024
CSPC41 – Formal Languages and Automata Theory

Session: January 2024
Date: 13th May 2024
Sem: IV CSE A

Time: 3 hours
Max Marks: 100

Answer ALL Questions

1. a. Prove that if a language is accepted by a NFA then there exists a DFA. (CO1) (6)

b. Construct a DFA for the following ε-NFA by converting to an intermediate NFA (CO1) (10)

δ	ε	0	1
→ A	{B}	{A}	Φ
B	{D}	{C}	Φ
C	Φ	Φ	{B}
* D	Φ	{D}	Φ

c. Explain pumping lemma for regular languages with an example. *(CO1) (4)*

2. a. Prove that there exists a regular expression for a DFA. *(CO1)* *(6)*
b. Convert the following DFA to RE using Kleene's theorem. *(CO1)* *(8)*

	0	1
→ A	B	A
B	B	C
*C	C	B

c. Explain any two properties of regular languages with necessary examples (6)

3. a. Write a grammar for the "for' construct in C language and verify whether your constructed grammar is ambiguous or not. (CO5) (4)
b. Convert the following grammar to GNF where 'S'is the start symbol. (CO2) (10)

S → eSe | GH
G → cGb | ε
H → JHd | ε
J → bJ | f

c. Prove that every CFL without useless symbols can be represented with an alternate grammar. (CO2) (6)

4. a. Construct a PDA for the following language using empty stack
$\{a^i b^j c^k \mid i = j + k\}$ (CO2) (8)
b. Construct a PDA using empty stack for the language $\{0^n 1^n 2 \mid n > 0\}$ and convert this PDA to a context free grammar. (CO2) (12)

5. a. Construct TM to compute the multiplication of two integers m * n, where m, n are stored in unary on the tape. (CO3) (6)
b. Define L_u. Prove that L_u is recursively enumerable but not recursive. (CO4) (6)
c. Construct a TM for the language $\{0^n 1^n \mid n > 0\}$ and convert this to a MPCP instance. (CO5) (8)

--- Best Wishes ---