Reg. No:

Y/D/TY

VIT
Vellore Institute of Technology

Final Assessment Test – April 2025

Course: BITE306L - Theory of Computation
Class NBR(s): 3394/3400/3405
Time: Three Hours

Slot: C1+TC1+TCC1
Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

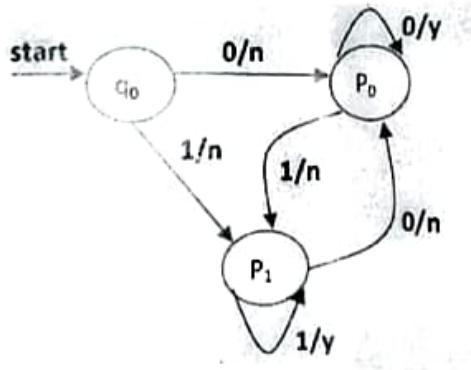
Answer ALL Questions
(10 X 10 = 100 Marks)

1. a) Construct a DFA, which accepts those words from $\Sigma = \{a, b\}$ such that the number of a's is even and the number of b's is divisible by three. [5]

   b) Construct a DFA to recognize odd number of 1's and even number of 0's over $\Sigma = \{0,1\}$. [5]

2. Define regular and non-regular language. Prove using pumping lemma, the following language is not regular language L={w ∈ {0,1}* | w contains more 0's than 1's}.

3. Convert the following Mealy machine to an equivalent Moore machine.



4. Derive the CFG for the given Context Free Language

   L= {v^r i^{r+s} t^s | r, s ≥ 0} and check the ambiguity of the given grammar.

5. Construct the given Context Free Grammar G= (V, T, P, S) into Chomsky normal form where P is the start symbol.

   P→ RPT

   Q→ RP|Ra

   R→ bRPR|b|ε

   T→ PaP|R|aa

6. Design a PDA to accept the language $L = \{a^2b^{2n}c^n \mid n >= 1\}$. Show that the string '*aabbbbcc*' is recognized by the above PDA by drawing possible instantaneous descriptions during processing the strings.

7. Define a Context-Sensitive Grammar (CSG) and explain its relation to Context-Sensitive Languages (CSL). How does a Linear Bounded Automaton (LBA) recognize a CSL?

8.a) Design Turing Machine to accept the language $L = \{a^nb^nc^n \mid n \geq 0\}$.

OR

8.b) i) Differentiate Computability and Decidability. **[5]**

ii) Prove that for the languages L_1 and L_2 Concatenation is recursive. **[5]**

$L_1 = \{a^n b^n c^n \mid n>=0\}$

$L_2 = \{d^m e^m f^m \mid m>=0\}$

9.a) Deduce the following ε-NFA to DFA.

states	ε	a	b	c
→p	{q,r}	ϕ	{q}	{q,r}
q	ϕ	{p}	{r}	{q}
*r	ϕ	ϕ	ϕ	{r}

OR

9.b) Minimize the DFA whose transition table is given below:

states	0	1
→q0	q1	q3
q1	q2	q4
q2	q3	q2
*q3	q4	q5
*q4	q3	q4
*q5	q4	q5
q6	q6	q1

Starting State: q0 and Final State: {q3, q4, q5}.

10. In the context of modern AI-driven applications, how can deterministic finite automata (DFA) be used to efficiently validate real-time user inputs and ensure security in web applications?

⇔⇔⇔ Y/D/TY⇔⇔⇔