Slot : C2+TC2+TCC2

School of Computer Science Engineering and Information Systems

Winter Semester 2024-2025

Continuous Assessment Test – II

Programme Name & Branch: B. Tech IT

Course Name & code: Theory of Computation, BITE306L

Class Number (s): 3409, 3403, 3396

Faculty Name (s): Dr. Harshita Patel, Dr. Dharmendra Singh Rajput, Dr. Chiranji Lal Chowdhary

Exam Duration: 90 Min. **Maximum Marks: 50**

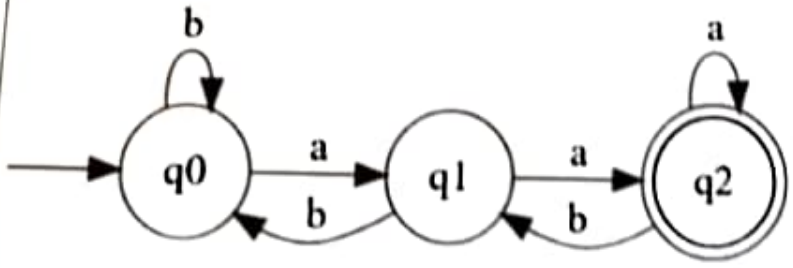
General instruction(s): ANSWER ALL THE QUESTIONS (5 X 10 Marks = 50 Marks)

- **CO – Course Outcome;**
- **BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)**
- **Course Outcomes:**

  CO2: Use and apply important properties of finite automaton to derive regular expressions from finite automation and vice versa.

  CO3: Analyze the context free grammar to simplify, remove ambiguity and perform conversion.

  CO4: Design push down automata for information technology related applications and to perform. Conversion between context free grammar and push down automation.

Q.No.	Question	Max Marks	CO	BL
1.	Consider the following transition table for a Deterministic Finite Automaton (DFA):  Identify the language accepted by this DFA and provide at least two example strings that belong to this language. Using Arden's Theorem, derive a regular expression that represents the language recognized by this automaton. Clearly show the system of equations formed and justify each step in your derivation.	10	2	3
2.	Grammars can be classified based on their structural properties, one of which is linearity. A Linear Grammar is a Context-Free Grammar (CFG) in which there is at most one non-terminal on the	10	3	3

	right-hand side of each production. Understanding the difference between Left-Linear Grammars (LLG) and Right-Linear Grammars (RRG) is essential for converting a given grammar into its equivalent form. Consider the following Left-Linear Grammar (LLG) and convert it into Right-Linear Grammars (RRG): S→Aa | Ba | a A→Bb | Cb B→Cc | b C→Sd | c			
3.	Consider the grammar with the following productions: S→aS | SbS | λ I. Discuss the ambiguity of the grammar and determine if the given grammar is ambiguous or not. (5 **Marks)** II. Find the derivation trees for the string "aababaa" and identify two more strings in L(G) with derivation trees of height five or greater. (5 **Marks)**	10	3	4
4.	The following grammar contains redundant or unnecessary productions: S→AB | aB A→aA | B | a B→bB | C | λ C→cC | c Identify and eliminate any useless symbols in the given grammar. Then, simplify the grammar while ensuring that it still generates the same language. After simplification, convert the resulting grammar into Greibach Normal Form (GNF).	10	3	3
5.	Construct a PDA that recognizes the following language: $L=\{a^n b^m a^m b^n \mid n, m \geq 1\}$ Clearly define the transitions and explain how the PDA processes input strings. Provide a brief explanation of how the PDA ensures the correct acceptance condition with example.	10	4	5

NOTE*: Please refer below to the BL – Bloom's Taxonomy Levels and mention the respective level in the questions.

Bloom's Taxonomy Levels	Category
BL1	Remembering
BL2	Understanding
BL3	Applying
BL4	Analyzing
BL5	Evaluating
BL6	Creating