UCS1503 - THEORY OF COMPUTATION

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AP/CSE

OBJECTIVES

- To construct finite automata for any given pattern and find its equivalent regular expressions

- To understand the language hierarchy and to design a context free grammar for any given language

- To construct pushdown automata for any CFL

- To understand Turing machines and their capability

- To understand undecidable problems.

SYLLABUS

UNIT I FINITE AUTOMATA AND REGULAR LANGUAGES   10

- Basic Mathematical Notation and Techniques; Finite Automata (FA): Deterministic Finite Automata (DFA) -- Non-deterministic FiniteAutomata (NFA) -- Finite automata with epsilon transitions -- Equivalence of FAs -- Minimization of DFA; Regular Expressions and Languages: Regular expressions -- Finite automata and regular expressions; Properties of Regular Languages: Proving languages not to be regular -- Closure and decision properties of regular languages.

UNIT II CONTEXT FREE GRAMMARS AND LANGUAGES   8

- Chomsky's Hierarchy of Languages; Context-Free Grammar and Languages: Context-Free Grammar (CFG) -- Parse trees -- Ambiguity in grammars and languages; Normal Forms for Context Free Grammars: Eliminating useless symbols -- Computing the generating and reachable symbols -- Eliminating null productions -- Eliminating unit productions – Chomsky Normal Form (CNF) -- Greibach Normal Form (GNF).

SYLLABUS CONT…

UNIT III PUSHDOWN AUTOMATA   **9**

- Pushdown Automata (PDA): Definition of the Pushdown automaton -- The languages of a PDA -- Equivalence of PDAs and CFGs -- Deterministic Pushdown automata; Pumping Lemma for Context Free Languages.

UNIT IV TURNING MACHINES   **9**

- The Turing Machine -- Programming Techniques for Turing Machines -- Extensions to the Basic Turing Machine -- Restricted Turing Machines.

UNIT V UNDECIDABILITY   **9**

- Undecidability: Language that is not Recursively Enumerable (RE) -- Undecidable problem that is RE -- Undecidable problems about Turing machines -- Post's Correspondence Problem (PCP) -- Other undecidable problems.

SSN

OUTCOMES

On successful completion of this course, the student will be able to:

- Construct automata, regular expression for any given pattern (K3)

- Understand the need of formal languages, and grammars (K3)

- Design pushdown automata for any CFL (K3)

- Design Turing machines for any Languages (K3)

- Explain the Decidability or Undecidability of various problems (K2).

REQUIRED TEXTBOOKS

TEXTBOOKS

- 1. Hopcroft J E, Motwani R, Ullman J D, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition,2008.

REFERENCE BOOKS

1. Harry R Lewis, Christos H Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India,2nd Edition,2003.

2. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishers, 3rd Edition,2002.

3. Mishra K L P, Chandrasekaran N, "Theory of Computer Science – Automata, Languages and Computation", Prentice Hall of India, 3rd Edition,2004.