

COURSE CODE	COURSE TITLE	L	T	P	C
UCS1203	THEORY OF COMPUTATION	3	2	0	4

## 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.

## UNIT I FINITE AUTOMATA AND REGULAR LANGUAGES 10

Basic Mathematical Notation and Techniques; Finite Automata (FA): Deterministic Finite Automata (DFA) -- Non-deterministic Finite Automata (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).

## 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.

**TOTAL PERIODS: 60**

## 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).

### **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.