CS 203: AUTOMATA AND FORMAL LANGUAGES (3-0-0 : 3)

Introduction: Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages; Mathematical Induction: Inductive proofs, Principles; Recursive Definitions; Set Notation.

Finite Automata and Regular Expressions: Finite State systems, Regular Languages & Regular Expressions, Deterministic Finite Automata; Nondeterministic Finite Automata, Kleene's Theorem; Two-way Finite Automata, Finite Automata with output, Properties of Regular Sets: The Pumping Lemma for Regular sets, Closure properties, Decision properties of regular languages, Equivalence and minimization of Automata.

Context Free Grammars: Definition, Derivation trees & Ambiguity, Inherent ambiguity, Parse tree, Application of CFG, Simplification of CFG, Normal form of CFG, Chomsky Normal form and Chomsky Hierarchy, Unrestricted grammars, Context-sensitive languages, Relations between classes of languages, Properties of Context Free Languages: The Pumping Lemma, Closure properties, Decision properties of CFL.

Pushdown Automata: Definitions, Languages of PDA, Equivalence of PDA and CFG, Deterministic PDA.

Turing Machines: Turing Machine Model, Language of a Turing Machine, Programming techniques of the TM, Variations of TM (Multiple TM, One-tape and Multi-tape TM etc), Deterministic and Non deterministic TM, Universal TM, Church thesis, Recursively Enumerable Languages.
Computational Complexity: Time and Space Complexity, Growth Rate, Complexity classes, Tractable and Non tractable Problems: P and NP, Cooks's theorem.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, Introduction to Automata theory, languages, and computation, Pearson India.
2. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill.

References:

1. Daniel I.A. Cohen, Introduction to Computer Theory, John Wiley & Sons.
2. A. M. Natarajan, A. Tamilarasi, Theory of computation, New Age Publication.
3. Sushil Kumar Azad, Theory of Computation - An introduction to automata, Formal Languages, and Computability, Dhanpat Rai & Co., New Delhi.