II B.Tech II Sem

15ACS13-FORMAL LANGUAGES AND AUTOMATA THEORY

L	T	P	C
3	1	0	3

Course Objective

The course aims to introduce the basic methods and conclusions of the Theory of Computation. At the end of the course, students learn to apply these methods to problems from different fields and be guided by the results in searching for computational solutions to the problems.

1. Understand formal definitions of machine models.
2. Classify machines by their power to recognize languages.
3. Understanding of formal grammars, analysis
4. Understanding of hierarchical organization of problems depending on their complexity
5. Understanding of the logical limits to computational capacity
6. Understanding of undecidable problems

UNIT - I :

Introduction: Basics of set theory, Relations on sets, Types of Formal Proof, Deductive proofs, Functions, Types of functions, Proofing Techniques, proof by Contrapositive, Proof by contradiction, Counter examples, Fundamentals of Automata Theory:- Alphabets, Strings, Languages, Problems, Grammar formalism, Chomsky Hierarchy

Finite Automata: An Informal picture of Finite Automata, Deterministic Finite Automata (DFA), Non Deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions (ϵ-NFA or NFA- ϵ), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill-Nerode Theorem.

UNIT – II:

Regular Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic laws for Regular Expressions, The Arden's Theorem, Using Arden's theorem to construct RE from FA, Pumping Lemma for RLs, Applications of Pumping Lemma, Equivalence of Two FAs, Equivalence of Two REs, Construction of Regular Grammar from RE, Constructing FA from Regular Grammar, Closure properties of RLs, Decision problems of RLS, Applications of REs and FAs

UNIT – III :

Context Free Grammars and Languages: Definition of Context Free Grammars (CFG), Derivations and Parse trees, Ambiguity in CFGs, Removing ambiguity, Left recursion and Left factoring, Simplification of CFGs, Normal Forms, Linear grammars, Closure properties for CFLs, Pumping Lemma for CFLs, Decision problems for CFLs, CFG and Regular Language

UNIT – IV :

Push Down Automata (PDA): Informal introduction, The Formal Definition, Types of PDA, Graphical notation, Instantaneous description, The Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic Push Down Automata, Two Stack PDA.

UNIT – V :

Turing Machines and Undecidability: Basics of Turing Machine (TM), Transitional Representation of TMs, Instantaneous description, Non Deterministic TM, Conversion of Regular Expression to TM, Two stack PDA and TM, Variations of the TM, TM as an integer function, Universal TM, Linear Bounded Automata, TM Languages, Unrestricted grammar ,

Properties of Recursive and Recursively enumerable languages, Undecidability, Reducibility, Undeciadable problems about TMs, Post's Correspondence Problem(PCP), Modified PCP.

Text Books :

1."Introduction to Automata Theory, Languages, and Computation", Third Edition, John E.Hopcroft, Rajeev Motwani, Jeffery D. Ullman, PEARSON.

Reference Books :

1. "Introduction To Languages And The Theory of Computation", John C Martin, The McGraw-Hill Companies, Third Edition. (TATA McGRAW HILL)
2. "Theory of Computation", Vivek Kulkarni, OXFORD.
3. Introduction to the Theory of Computation., Michel Sipser, 2nd Edition, Cengage Learning
4. "Theory of computer Science Automata, Languages and Computation", K.L.P. Mishra, N.Chandrasekaran, PHI, Third Edition.
5. "Fundamentals of the Theory of Computation, Principles and Practice", Raymond Greenlaw, H. James Hoover, MK(MORGAN KAUFMANN)
6. Finite Automata and Formal Language A Simple Approach, A.M. Padma Reddy, Pearson