

<p align="center">Savitribai Phule Pune University T.Y.B.Sc. (Computer Science) Sem - V Course Type: DSEC - III Course Code: CS - 356 Paper Title: Theoretical Computer Science</p>		
Teaching Scheme 3 Lect/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites <ul style="list-style-type: none"> Mathematical Preliminaries Sets (Subset, Set Operations), Relations (Properties of Relations, Closure of Relations) and Functions Discrete Mathematics- Graphs, Trees, Logic and Proof Techniques 		
Course Objectives <ul style="list-style-type: none"> To understand the Finite Automata, Pushdown Automata and Turing Machine. To understand the Regular Language, Context Free Language, Context Sensitive Language and Unrestricted Language. To understand the relation between Automaton and Language 		
Course Outcomes On completion of the course, student will be able to– <ul style="list-style-type: none"> Understand the use of automata during language design. Relate various automata and Languages. 		
Course Contents		
Chapter 1	Finite Automaton	10 Lect
Introduction: Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages. Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as pattern recognizer. Nondeterministic finite automaton – Definition and Examples. NFA To DFA (Myhill Nerode Method) NFA with ϵ - transitions Definition and Examples. NFA with ϵ -Transitions to DFA & Examples Finite automaton with output – Mealy and Moore machine, Definition and Examples. Minimization of DFA, Algorithm & Problem using Table Method.		
Chapter 2	Regular Expressions and Languages	6 Lect
Regular Expressions (RE): Definition & Example Regular Expressions Identities. Regular language-Definition and Examples. Conversion of RE to FA-Examples. Pumping lemma for regular languages and applications. Closure Properties of regular Languages		

Chapter 3	Context-Free Grammars and Languages	10 Lect
Grammar - Definition and Examples. Derivation-Reduction - Definition and Examples. Chomsky Hierarchy. CFG: Definition & Examples. LMD, RMD, Parse Tree Ambiguous Grammar: Concept & Examples. Simplification of CFG: Removing Useless Symbols, Unit Production, ϵ -production and Nullable Symbol. Normal Forms: Greibach Normal Form (GNF) and Chomsky Normal Form (CNF) Regular Grammar: Definition. Left linear and Right Linear Grammar-Definition and Example. Equivalence of FA & Regular Grammar Construction of regular grammar equivalent to a given DFA. Construction of a FA from the given right linear grammar		
Chapter 4	Push Down Automata	5 Lect
Definition of PDA and examples. Construction of PDA using empty stack and final State method: Examples using stack method. Definition DPDA & NPDA, their correlation and Examples of NPDA CFG (in GNF) to PDA: Method and examples		
Chapter 5	Turing Machine	5 Lect
The Turing Machine Model, Definition and Design of TM Problems on language recognizers. Language accepted by TM. Types of Turing Machines (Multitrack TM, Two-way TM, Multitape TM, Non-deterministic TM) Introduction to LBA (Basic Model) & CSG. (Without Problems)		
Reference Books		
1. Introduction to Automata Theory, Languages and Computation, John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education Publication, 2008 2. Introduction to Automata theory, Languages and computation By John E. Hopcroft and Jeffrey Ullman – Narosa Publishing House, 1995 3. Theory of Computer Science Automata, Languages and Computation, K.L.P. Mishra, N. Chandrasekaran, Publication- Prentice Hall of India, 2008 4. Introduction to Computer Theory Daniel I. A. Cohen – 2 nd edition – John Wiley & Sons, 1996 5. Introduction to Languages and The Theory of Computation John C. Martin The McGraw-Hill, Fourth Edition, 2011		