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				
Teaching Scheme 3 Lect/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks		
 Prerequisites Mathematical Prelim Relations, Closure of Discrete Mathematic Discrete Mathematic Course Objectives To understand the Finit To understand the Regular Language and Unrestrict To understand the relation To understand the relation 	ninaries Sets (Subset, Set Operat of Relations) and Functions cs- Graphs, Trees, Logic and Pro e Automata, Pushdown Automat lar Language, Context Free Lan cted Language. ion between Automaton and Lan	ions), Relations (Properties of of Techniques a and Turing Machine. guage, Context Sensitive guage		
 Understand the use of a Relate various automata Course Contents 	utomata during language design. a and Languages.			
Chapter 1Finite AutomaIntroduction: Symbol, AlphabeLanguage, Operations on LangDeterministic finite AutomatorDFA as pattern recognizer.Nondeterministic finite automaNFA To DFA (Myhill NerodeNFA with ε- transitions DefinitNFA with ε- Transitions to DFAFinite automaton with output –Examples.Minimization of DFA, Algorith	ton t, String, Prefix & Suffix of Strinuages. a – Definition, DFA as language aton – Definition and Examples. Method) ion and Examples. A & Examples Mealy and Moore machine, Definition https://www.communication.com/participation.com/parti	inition and		
Chapter 2Regular Expressions (RE): DefRegular Expressions (RE): DefRegular Expressions IdentitieRegular language-DefinitionConversion of RE to FA-ExpPumping lemma for regularClosure Properties of regular	ssions and Languages Finition & Example es. and Examples. amples. languages and applications. r Languages	6 Lect		

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	on 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 s	tack			
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				
JeffreyUllman – 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				

Savitribai Phule Pune University					
T.Y.B.Sc. (Computer Science) - Sem - VI					
Course Type: DSEC - VI Course Code: CS - 366					
Course Title: Compiler Construction					
Teaching Scheme	No. of Credits	Examination Scheme			
3 Lect / week	2	IE: 15 marks			
		UE: 35 marks			
Prerequisites					
• Knowledge of Autor	nata Theory and Languages.				
Course Objectives					
• To understand design is	sues of a lexical analyzer and us	e of LEX tool.			
• To understand design is	sues of a parser and use of YAC	C tool.			
• To understand and desig	gn code generation and optimiza	tion techniques.			
Course Outcomes					
On completion of the course, st	udent will be able to-				
• Understand the process	of scanning and parsing of sour	ce code.			
• Learn the conversion co	de written in source language to	machine language.			
Understand tools like L	EX and YACC.				
Course Contents					
Chapter 1 Introduction			4 Lect		
Definition of Compiler, Aspect	s of compilation.				
The structure of Compiler.					
Phases of Compiler – Lexical A	Analysis, Syntax Analysis, Sema	ntic Analysis,			
Intermediate Code generation,	code optimization, code generation	on.			
Error Handling.					
Introduction to one pass & Mul	tipass compilers, cross compiler	, Bootstrapping.			
Chapter 2 Lexical Analys	is (Scanner)		4 Lect		
Review of Finite automata as a	lexical analyzer,				
Applications of Regular Expres	sions and Finite Automata (lexi	cal analyzer,			
searching using RE), Input buff	tering, Recognition of tokens.				
LEX: A Lexical analyzer gener	ator (Simple Lex Program)				
Chapter 3 Syntax Analysi	s (Parser)		14 Lect		
Ten Down Barger					
Top-Down Parser –	adving Mathed & Drohlang				
Drawbacka of Top Da	acking: Method & Problems	2 2Elimination of	. off		
Drawbacks of 1 op-Down parsing with backtracking, 3.2.3 Elimination of Left					
Recursion (direct & in Pagursiya Dascant Parsing: Das	finition	ring & examples			
Implementation of Decursive	IIIIIIIIII Descent Perser Using Peoursiu	e Procedures			
A Predictive [1, (1)] Parser (Definition, Model)					
3.4.11mplementation of Predictive Parser [L.J. (1)]					
3 4 2 FIRST & FOLLOW					
$J.\tau.2$ I IND I & FOLLOW					

Construction of	f LL (1) Parsing Table				
Parsi	ng of a String using LL (1) Table.				
Bottom-Up Pa	rsers				
Operator Prec	edence Parser -Basic Concepts				
Operator Prec	edence Relations form Associativity & Precedence				
Operator Pr	ecedence Grammar				
Algorithm	or LEADING & TRAILING (with ex.)				
Algorithm	or Operator Precedence Parsing (with ex.)				
Precedence	Functions				
Shift Reduce I	Shift Reduce Parser				
Reduction,	Handle, Handle Pruning				
Stack Imple	mentation of Shift Reduce Parser (with examples)				
LR Parser: Mo	odel, Types [SLR (1), Canonical LR, LALR]-Method & examples.				
YACC (fro	m Book 3) – program sections, simple YACC program for expression	evaluation			
Chapter 4	Syntax Directed Definition	7 Lect			
Svntax Direct	ed Definitions (SDD)				
Inherited & Sy	vnthesized Attributes				
Evaluating an	SDD at the nodes of a Parse Tree. Example				
Evaluation	Orders for SDD's				
Dependency (iraph				
Ordering the H	Evaluation of Attributes				
S-Attributed I	Definition				
L-Attributed I	Definition				
Application	of SDT				
Construction of	of syntax trees.				
The Structure of a Type					
4 4 Translation Schemes					
4 4 1 Definition Postfix Translation Scheme					
Chapter 5	Code Generation and Optimization	7 Lect			
Compilation of	f expression –	, Leet			
Concepts of operand descriptors and register descriptors with example					
Intermediate code for expressions – postfix notations					
Triples Quadruples and Expression trees					
Code Optimization – Optimizing transformations – compile time evaluation elimination of					
common sub expressions, dead code elimination frequency reduction strength reduction					
Three address code					
DAG for Three address code					
The Value-number method for constructing DAG's					
Definition of basic block, Basic blocks, and flow graphs					
Directed acyclic graph (DAG) representation of basic block.					
Issues in design of code generator.					
	6				

Reference Books

- 1. Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, 2004
- 2. Principles of Compiler Design By: Alfred V. Aho, Jeffrey D. Ullman, Narosa Publication House, 2002
- 3. LEX & YACC, 2nd edition, O'reilly Publication, 2012