



## Savitribai Phule Pune University

### Fourth Year of Computer Engineering (2015 Course)

#### Elective III

#### 410252(B): Compilers

<b>Teaching Scheme:</b> TH: 03 Hours/Week	<b>Credit</b> 03	<b>Examination Scheme:</b> <b>In-Sem (Paper): 30 Marks</b> <b>End-Sem (Paper): 70 Marks</b>
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**Prerequisite Courses:** Theory of Computation(310241), 310251-Systems Programming and Operating System

**Companion Course:** 410255-Laboratory Practice IV

#### Course Objectives:

- To introduce process of compilation
- To introduce compiler writing tools
- To address issues in code generation and optimization

#### Course Outcomes:

On completion of the course, student will be able to–

- Design and implement a lexical analyzer and a syntax analyzer
- Specify appropriate translations to generate intermediate code for the given programming language construct
- Compare and contrast different storage management schemes
- Identify sources for code optimization

### Course Contents

Unit I	Notion and Concepts	08 Hours
	Introduction to compilers Design issues, passes, phases, symbol table Preliminaries Memory management, Operating system support for compiler, Lexical Analysis Tokens, Regular Expressions, Process of Lexical analysis, Block Schematic, Automatic construction of lexical analyzer using LEX, LEX features and specification.	
Unit II	Parsing	08 Hours
	Syntax Analysis CFG, top-down and bottom-up parsers, RDP, Predictive parser, SLR, LR(1), LALR parsers, using ambiguous grammar, Error detection and recovery, automatic construction of parsers using YACC, Introduction to Semantic analysis, Need of semantic analysis, type checking and type conversion.	

Unit III	Syntax Translation Schemes	08 Hours
Syntax Directed Translation - Attribute grammar, S and L attributed grammar, bottom up and top down evaluations of S and L attributed grammar, Syntax directed translation scheme, Intermediate code - need, types: Syntax Trees, DAG, Three-Address codes: Quadruples, Triples and Indirect Triples, Intermediate code generation of declaration statement and assignment statement.		
Unit IV	Run-time Storage Management	08 Hours
Storage Management – Static, Stack and Heap, Activation Record, static and control links, parameter passing, return value, passing array and variable number of arguments, Static and Dynamic scope, Dangling Pointers, translation of control structures – if, if-else statement, Switch-case, while, do -while statements, for, nested blocks, display mechanism, array assignment, pointers, function call and return. Translation of OO constructs: Class, members and Methods.		
Unit V	Code Generation	08 Hours
Code Generation - Issues in code generation, basic blocks, flow graphs, DAG representation of basic blocks, Target machine description, peephole optimization, Register allocation and Assignment, Simple code generator, Code generation from labeled tree, Concept of code generator.		
Unit VI	Code Optimization	08 Hours
Need for Optimization, local, global and loop optimization, Optimizing transformations, compile time evaluation, common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination, DAG based local optimization, Introduction to global data flow analysis, Data flow equations and iterative data flow analysis.		
<b>Books:</b>		
<b>Text:</b> <ol style="list-style-type: none"> <li>1. V Aho, R Sethi, J D Ullman, “Compilers: Principles, Techniques, and Tools”, Pearson Edition, ISBN 81-7758-590-8</li> <li>2. Dick Grune, Bal, Jacobs, Langendoen, “ Modern Compiler Design”, Wiley, ISBN 81-265-0418-8</li> </ol>		
<b>References:</b> <ol style="list-style-type: none"> <li>1. Anthony J. Dos Reis, “Compiler Construction Using Java”, JavaCC and Yacc Wiley, ISBN 978-0-470-94959-7</li> <li>2. K Muneeswaran, “Compiler Design”, Oxford University press, ISBN 0-19-806664-3</li> <li>3. J R Levin, T Mason, D Brown, “Lex and Yacc”, O'Reilly, 2000 ISBN 81-7366-061-X</li> </ol>		