Computer Science Paper 6
Compiler Construction
[DESC-III]

Semester: VI	Credits: 2	Subject Code: BS62206	Lectures: 36

Course Outcomes:

At the end of this course, the learner will be able to:

- Explain the phases of the compiler.
- Apply the process of scanning and parsing of source code.
- Use techniques in code generation and code optimization.
- Implement tools like LEX and YACC.
- Design the conversion code written in source language to machine language.

Unit 1: Introduction	**5**
• Definition of Compiler, Aspects of compilation. • The structure of Compiler. • Phases of Compiler – Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code generation, code optimization, code generation. • Error Handling. • Introduction to one pass & Multipass compilers, cross compiler, Bootstrapping.	

Unit 2: Lexical Analysis (Scanner)	**4**
• Review of Finite automata as a lexical analyzer, • Applications of Regular Expressions and Finite Automata (lexical analyzer, searching using RE), Input buffering, Recognition of tokens. • LEX: A Lexical analyzer generator (Simple Lex Program)	

Unit 3: Syntax Analysis (Parser)	**14**

• Definition, Types of Parsers
• Top-Down Parser
  ○ Top-Down Parsing with Backtracking: Method & Problems
  ○ Drawbacks of Top-Down parsing with backtracking
  ○ Elimination of Left Recursion (direct & indirect)
  ○ Need for Left Factoring & examples
• Recursive Descent Parsing: Definition, Implementation of Recursive Descent Parser Using Recursive Procedures
• Predictive [LL (1)] Parser (Definition, Model)	

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○ Implementation of Predictive Parser [LL (1)] ○ FIRST & FOLLOW ○ Construction of LL (1) Parsing Table ○ Parsing of a String using LL (1) Table • Bottom-Up Parsers ○ Shift Reduce Parser ○ Reduction, Handle, Handle Pruning ○ Stack Implementation of Shift Reduce Parser (with examples) • Operator Precedence Parser ○ Basic Concepts, ○ Operator Precedence Relations form Associativity & Precedence ○ Operator Precedence Grammar ○ Algorithm for LEADING & TRAILING (with ex.) ○ Algorithm for Operator Precedence Parsing (with ex.) Precedence Functions • LR Parser: ○ Model, Types ○ SLR (1)- Method & examples. ○ Canonical LR-Method & examples. ○ LALR-Method & examples. • YACC –program sections, simple YACC program for expression evaluation	

Unit 4: Syntax Directed Definition	**5**
• Syntax Directed Definitions (SDD) • Inherited & Synthesized Attributes • Annotated Parse Tree, Evaluating an SDD at the nodes of a Parse Tree, Example • Evaluation Orders for SDD's • Dependency Graph • S-Attributed Definition • L-Attributed Definition • Applications of SDT • Translation Schemes-Definition	

Unit 5: Code Generation and Optimization	**8**
• Compilation of expression – 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.	

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• 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.	

Recommended Reference Books:
• Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman *Compilers: Principles, Techniques, and Tools*; 2004. • Alfred V. Aho, Jeffrey D. Ullman, Narosa Publication House *Principles of Compiler Design*; 2002.O'reilly Publication *LEX & YACC*, 2nd edition; 2012

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