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Course Code: CSE402

COMPILER ENGINEERING

Course Objectives

This course will help the learner to explain various phases in translating source language to target language construct scanner and parser, design Adhoc syntax directed translator, and identify the opportunities for optimization.

UNIT - I

15 Periods

Overview: Introduction - Compiler structure - Overview of translation **Scanners:** Introduction - Implementing Scanners - **Using Lex:** Regular expressions - A word count program **Parsers:** Introduction - Review of top down parsing - Bottom up parsing

UNIT - II

15 Periods

Using YACC: A YACC parser-The lexer - Arithmetic expression and ambiguity - Variables and typed tokens **Context Sensitive Analysis:** Introduction - Adhoc syntax directed translation. **Intermediate Representations:** Introduction - Graphical IRs - Linear IRs - Mapping values to names - Symbol tables

UNIT - III

15 Periods

Introduction to optimization: Introduction - Background - Scope of optimization - Local optimization - Regional optimization - Global optimization - Inter procedural optimization. **Instruction Selection:** Introduction - Code generation - Extending the Simple Tree Walk scheme - Instruction selection via Tree Pattern matching - Instruction selection via Peephole Optimization

UNIT - IV

15 Periods

Instruction Scheduling: Instruction Scheduling problems - Local List scheduling - Regional Scheduling: **Register Allocation:** Background issues - Local Register Allocation and Assignment - Global register Allocation and Assignment

TEXTBOOKS

1. Keith D.Cooper and Linda Torczon. *Engineering a Compiler*, Morgan Kauffman Publishers, Second Edition, 2013.
2. Levine, John R., Tony Mason, and Doug Brown. *Lex & yacc*, O'Reilly Media, Inc., Second Edition, 2013.

REFERENCES

1. Dick Grune, Kees Van Reewijk, Henry E.Bal, C. J.H. Jacobs, Koen G. Langendoen, *Modern Compiler Design*, Springer, Second Edition, 2012.
2. Das, Vinu V. *Compiler Design using FLEX and YAC*, Prentice Hall of India Learning Pvt.Ltd, 2007.
3. Alfred V.Aho, Ravi Sethi, Jeffrey D. Ullman, Monica S. Lam. *Compilers: Principles, Techniques and Tools*, Pearson Education, Second Edition, 2006.

ONLINE MATERIALS

1. <http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/compiler-desing/ui/TOC.html>
2. <http://nptel.ac.in/courses/106108052/>

UNITWISE LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to

Unit I	<ul style="list-style-type: none"> Describe the phases of compiler Design and develop scanners using Lex Construct LL and LR parsers
Unit II	<ul style="list-style-type: none"> Develop parser using Lex & YACC Describe the significance of ad-hoc syntax directed translation Construct intermediate representations
Unit III	<ul style="list-style-type: none"> Identify the different techniques for code optimization for compiler construction Demonstrate the techniques used for instruction selection in the backend phase of compiler
Unit IV	<ul style="list-style-type: none"> Implement the local list scheduler and explain about regional scheduler Elucidate the register allocation process in the backend phase of a compiler

COURSE LEARNING OUTCOMES

Upon successful completion of this course, the learner will be able to

- Demonstrate the scanner construction from using Lex
- Develop parser using Lex & YACC
- Apply context sensitive analysis for type Inferencing
- Construct intermediate code representation for a given source code
- Identify appropriate techniques for code optimization
- Explain about the instruction selection, instruction scheduling, and register allocation components in the backend phase of a compiler