CSE437: Compiler Design

Programme: B.Tech (CSE) **Year :** III **Semester :** VI
Course: Core **Credits :3/4** **Hours :** 40 hours (Theory)

Course Context:
This course gives a basic compiler definition, which help students to decide the corresponding compiler structure and identify the relationship among different phases of compiler. Student can analyse and quantify different potential implementation of high level programming construct. Student can analyse algorithms or computer code for correctness and efficiency.

Objective:

- Be able to build a compiler for a (simplified) (programming) language
- Know how to use compiler construction tools, such as generators of scanners and parsers
- Be familiar with assembly code and virtual machines, such as the JVM, and bytecode
- Be able to define LL(1), LR(1), and LALR(1) grammars
- Be familiar with compiler analysis and optimization techniques

Prerequisite Courses: Theory of Computation

Course outcomes (COs):

The Outcomes of this Course are	
CO1:	To understand major phases of compilation, particularly lexical analysis, parsing semantic analysis and code generation.
CO2:	To create lexical rules and grammars for a programming language
CO3:	To extend the knowledge of parser by parsing LL parser and LR parser.
CO4:	To implement semantic rules into a parser that performs attribution while parsing.
CO5:	To learn the code optimization techniques to improve the performance of a program in terms of speed & space

Course Topics

Contents		Lecture Hours	
UNIT – 1 Introduction to compilers			3
1.1	Compilers, Interpreters and translators	1	
1.2	Structure of a compiler, Lexical Analysis, Syntax analysis, Intermediate Code generation, Optimization, Code generation	1	
1.3	Compiler-writing tools, Bootstrapping	1	
UNIT –2 Lexical Analysis			2
2.1	Regular expressions and Finite state machines	1	
2.2	Lexical analysis techniques and applications	2	
UNIT-3 Syntax Analysis			
3.1	Grammars and language definition	1	17
3.2	Top-down parsing and Bottom up Parsing	2	
3.3	Recursive descent and predictive (LL) parsing	2	
3.4	Shift reduce and Operator precedence parsing	2	
3.5	LR parsers, The canonical collection of LR(0) items	2	
3.6	Constructing SLR parsing tables	1	
3.7	The canonical collection of LR(1) items	1	
3.8	Constructing canonical LR and LALR parsing tables	2	
3.9	Using ambiguous grammars, Implementation of LR parsing tables	2	
			8
UNIT-4 Syntax – Directed Translation			
4.1	Syntax – directed translation schemes, Implementation of Syntax-directed Translators	2	
4.2	Intermediate code, Postfix notation, Parse trees and syntax trees	2	
4.3	Translation of assignment statements, Boolean expressions.	3	
4.4	Statements that alter the flow of control, Postfix translations	2	
4.5	Symbol Tables: The contents of a symbol table, Data structures for symbol tables, Representing scope information.	2	

UNIT-5 Code optimization and Generation			
5.1	Principal sources of Optimization – DAG -Optimization of basic block	2	10
5.2	Global data flow analysis - Efficient data flow algorithms	2	
5.3	Issues in design of a code generator, a simple code generator algorithm	1	
5.4	Code generation from DAG, Code generation from a tree (arithmetic expressions, Boolean expressions, conditional statements)	2	

Textbook references (IEEE format):

Text Book:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffery D, "*Compilers: Principles*", *Techniques and Tools*, (2nd edition) by. Ullman. Addison Wesley, Boston, MA, 2006.

Reference books:

1. Dhamdhere D M, "*Compiler Construction Principles and Practice*", second edition, Macmillan India Ltd., New Delhi, 2001.
2. Jean Paul Tremblay, Paul G Serenson, "*The Theory and Practice of Compiler Writing*", McGraw Hill, New Delhi, 2001.
3. Dick Grone, Henri E Bal, Ceriel J H Jacobs and Koen G Langendoen, "*Modern Compiler Design*", John Wiley, New Delhi, 2000.
4. K. Muneeswaran, "*Complier Design*", Oxford University press

Evaluation Methods:

Item	**Weightage**
Quiz-I	10
Quiz-II	05
Mid Term	30
Class Participation	05
End Term	50

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Last Update: 26.12.2016