



## COURSE SYLLABUS

1. **COURSE TITLE**

Compiler Construction

2. **COURSE CODE**

COMP3173

3. **PRE-REQUISITE**

COMP1013 Structured Programming, or  
COMP2013 Object-Oriented Programming

4. **CO-REQUISITE**

Nil

5. **NO. OF UNITS**

3

6. **CONTACT HOURS**

42

7. **OFFERING UNIT**

Computer Science and Technology Programme, Division of Science and Technology

8. **SYLLABUS PREPARED & REVIEWED BY**

Prepared by: Dr. Weifeng SU

Reviewed by: Dr. Xin FENG

9. **AIMS & OBJECTIVES**

This course introduces the fundamentals of compiler construction, and illustrates those fundamentals with examples from various languages. Topics include syntax and semantic analysis, bindings, type systems, programming paradigms, control abstraction and flow, and runnable programme buildup.

10. **COURSE CONTENT**

- I. Introduction
- II. DFA, Regular language and Scanner



- A. DFA & NFA
- B. Regular expression
- C. Regular languages
- D. Scanner

### III. Formal Language Syntax PDA and its equivalent, Parser

- A. PDA
- B. Context free languages
- C. Derivation and parse tree
- D. Top-down parsing
- E. Bottom-up parsing

### IV. Semantic Analysis

- A. Scope analysis
- B. Type checking
- C. Static semantic
- D. Symbol table

### V. Intermediate Code Generation

- A. Three-Address Code
- B. Expressions Translation
- C. Array Element Translation
- D. Type Conversion
- E. Boolean Expression Translation
- F. Procedure Translation

### VI. Runtime Organisation

- A. Programme Organisation
- B. Memory pools
- C. Activation Records
- D. Parameter Passing Modes

## **11. COURSE INTENDED LEARNING OUTCOMES (CILOS) WITH MATCHING TO PILOS**

### **Programme Intended Learning Outcomes (PILOs)**



Programme Title: Bachelor of Science (Honours) in Computer Science and Technology	
PILO	Upon successful completion of the Programme, students should be able to:
PILO 1	<b>analyse</b> the basic principles of computer science and technology;
PILO 2	<b>translate</b> real world problems into IT requirements;
PILO 3	<b>design</b> and <b>develop</b> complex software;
PILO 4	<b>apply</b> up-to-date technology to <b>solve</b> general problems in specific areas;
PILO 5	<b>communicate</b> effectively and <b>collaborate</b> in a team.

### CILOs-PILOs Mapping Matrix

Course Code & Title: COMP3173 Compiler Construction		
CILO	Upon successful completion of the course, students should be able to:	PILO(s) to be addressed
CILO 1	<b>explain</b> the fundamental principles of programming languages;	PILO 1
CILO 2	<b>use</b> compiling tools to describe grammar to solve real problems;	PILO 2
CILO 3	<b>implement</b> the compiler for a simple programming language;	PILOs 2,5
CILO 4	<b>present</b> documents describing the implementation of a simple programming language.	PILO 5

## 12. TEACHING & LEARNING ACTIVITIES (TLAS)

CILO No.	TLAs
CILO 1	<ul style="list-style-type: none"><li>● <b>Lecture:</b> The instructor will explain the course material in detail.</li><li>● <b>Assignment:</b> Each student is required to independently work on 5 assignments.</li><li>● <b>Hands-on practice:</b> The instructor will arrange tutorials in labs where each student can practice some common tools.</li></ul>
CILO 2	<ul style="list-style-type: none"><li>● <b>Hands-on practice:</b> The instructor will arrange tutorials in labs where each student can practice some common tools.</li><li>● <b>Project:</b> Each student is required to use the flex and bison so create a grammar describing the real world problem.</li></ul>

CILO 3	<ul style="list-style-type: none"> <li>● <b>Lecture:</b> The instructor will explain the course material in detail.</li> <li>● <b>Project:</b> Each student is required to construct a compiler. In such a project, a student needs to implement different stages of constructing a compiler. The student also needs to write a technical report to explain their implementation.</li> </ul>
CILO 4	<ul style="list-style-type: none"> <li>● <b>Project:</b> Each student is required to construct a compiler. In such a project, a student needs to implement different stages of constructing a compiler. The student also needs to write a technical report to explain their implementation.</li> </ul>

### 13. ASSESSMENT METHODS (AMS)

Type of Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
Assignment	10%	1	Each student is required to do 5 assignments independently.
Project	40%	2-4	Each student is required to construct a compiler. In such a project, a student needs to implement different stages of constructing a compiler. The students also need to write a technical report to explain their implementation.
Final Examination	50%	1, 2	This final examination aims to assess the major learning outcomes achieved by students upon completion of the course.

### 14. TEXTBOOKS / RECOMMENDED READINGS

#### TEXTBOOK:

Nil

#### RECOMMEND READINGS:

[1] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques, and Tools, 2<sup>nd</sup> ed, Prentice Hall, 2006.

[2] Michael L. Scott, Programming Language Pragmatics, 3<sup>rd</sup> ed, Morgan Kaufmann, 2009.

[3] Appel, Andrew Wilson, Modern Compiler Implementation in Java (2nd ed.). Cambridge University Press. 2002.

[4] Srikant, Y. N.; Shankar, Priti. The Compiler Design Handbook: Optimizations and Machine

Code Generation. 2003

[5] Terry, Patrick D. Compilers and Compiler Generators: An Introduction with C++. International Thomson Computer Press. 1997.

[6] Allen, Frances E. "A History of Language Processor Technology in IBM". IBM Journal of Research and Development (IBM) 25 (5). 1981.

[7] Cooper, Keith D.; Torczon, Linda. Engineering a Compiler. Morgan Kaufmann. 2004.

[8] Wirth, Niklaus. Compiler Construction. Addison-Wesley. 1996.

[9] Allen, Randy; Kennedy, Ken. Optimizing Compilers for Modern Architectures. Morgan Kaufmann Publishers. 2001.

[10] Appel, Andrew Wilson. Modern Compiler Implementation in ML. Cambridge University Press. 1998.

## 15. MEDIUM OF INSTRUCTION (MOD)

English

**Revised on: <2016-12-20>**