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## 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 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>**