City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electronic Engineering
with effect from Semester B in 2017/2018

Part I   Course Overview

Course Title:	Data Structures and Algorithms
Course Code:	EE2331
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B2
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	CS2363 Computer Programming or CS2311 Computer Programming or equivalent
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. **Abstract**

   This aim of this course is to provide students with an understanding of fundamental concepts of data structures and algorithm design, and to cultivate systematic programming discipline.

2. **Course Intended Learning Outcomes (CILOs)**
   (CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	apply structural programming approach to solve more complex computation problems		✓	✓	
2.	demonstrate applications of standard data structures such as linked list, stack, queue and tree		✓	✓	
3.	solve computation problems using recursion where appropriate		✓	✓	
4.	apply different sorting and searching algorithms		✓	✓	

* If weighting is assigned to CILOs, they should add up to 100%.   100%

[#] *Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.*

   A1: *Attitude*
   Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.
   A2: *Ability*
   Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.
   A3: *Accomplishments*
   Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. **Teaching and Learning Activities (TLAs)**
   (TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Explain key concepts in data structures and algorithm design. Explain implementation details in the C++ language.	√	√	√	√			5hrs/wk (3 hrs Lect, 2 hrs Tut/Lab)
Tutorials and assignments	Provide students with hands on and practical experiences in programming. Provide students with training in problem solving.	√	√	√	√			

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 40%								
Tutorials/test/at least 3 assignments	✓	✓	✓	✓			40%	
Examination:60% (duration: 2hrs, if applicable)								

The weightings should add up to 100%.

100%

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels

6. **Constructive Alignment with Major Outcomes**

MILO	How the course contribute to the specific MILO(s)
1	An ability to apply knowledge of mathematics, science and engineering.
3	An ability to design a system, component, or process that conforms to a given specification within realistic constraints.
5	An ability to identify, evaluate, formulate and solve engineering problems.
10	An ability to use necessary engineering tools.

Part III Other Information (more details can be provided separately in the teaching plan)

1. **Keyword Syllabus:**

   Introduction
   Overview of data types and data structures; Pointers in C/C++; Linear and multi-dimensional arrays and address mapping function; Parameter passing in function call; Review of structured programming; Introduce concepts of data encapsulation and program invariants.; Class and object in C++; Dynamic memory allocation and de-allocation.

   Analysis of Algorithms
   Overview of complexity analysis; Introduce the big-O notation; Ω and Θ Notation; Asymptotic Complexity; Best, average and worst cases.

   Linked Lists
   Singly and doubly linked lists; Circular lists.

   Stacks and Queues
   Stacks and their applications; Queues and their applications; Overview of the C++ STL.

   Recursion
   Introduce the concept of recursion; Examples of recursive algorithms: factorials, Ackerman function, recursive binary search, towers of Hanoi, etc; Recursion and backtracking.

   Trees
   Binary tree; Tree traversals; Example algorithms for tree operations; Applications: Huffman tree; Binary search tree; Heap. General tree and representations;

   Sorting Algorithms
   Study different sorting techniques, for example bubble sort, insertion sort, heapsort, merge sort, quicksort, and radix sort; Comparison of the performance and complexity of the sorting algorithms.

   Hash Tables
   Design of hash functions; Collision resolution and overflow handling; Algorithms for search, insert and delete operations; Performance analysis.

2. **Reading List**
2.1 **Compulsory Readings**
   (Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Nil

2.2 **Additional Readings**
   (Additional references for students to learn to expand their knowledge about the subject.)

1.	D. S. Malik : C++ Programming Program Design Including Data Structures, 6th ed. (Cengage Learning 2013)
2.	http://www.cplusplus.com/