City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A in 2021/2022

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)*	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 computation problems		✓	✓	✓
2.	demonstrate applications of standard data structures such as list, heap, tree, and graph		✓	✓	✓
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/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.	√	√	√	√			

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:

lntroduction
Overview of data types and data structures; Control structure, pointers in C/C++; Linear and multi-dimensional arrays; Parameter passing in function call; Review of structured programming; Introduce concepts of data encapsulation and program invariants.; Class and object in C++.

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

One dimensional data structure
Such as linked list/array/stacks/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 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.

Depending on the students' level and progress, we may also cover the following topics (optional).

Graph representation
Graph representation and basic graph operation algorithms

Brief introduction to general algorithm design techniques
Alternative implementation using dynamic programming; basic introduction to greedy algorithm design technique

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.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein: Introduction to Algorithms, MIT Press
2.	D. S. Malik : C++ Programming Program Design Including Data Structures, 6th ed. (Cengage Learning 2013)
3.	http://www.cplusplus.com/