FACULTY OF SCIENCE

COURSE OUTLINE

DEPARTMENT: **COMPUTER & INFORMATION SCIENCE**

PROGRAMME: Bachelor of Science in Computer Science Y3S1 **SEMESTER**: 1

UNIT CODE: CMT 304 **UNIT TITLE**: Data Structures & Algorithms

LECTURE HOURS: 45 **PRE-REQUISITES**: None

LECTURER: **Michael Ndege Kinyua**

LECTURER CONTACTS: **mkinyua@cuea.edu** **Tel: 0722387716**

1.0 COURSE PURPOSE

The goal of this course is to enable students:-

- ✓ Develop your knowledge and understanding of the underlying principles of foundational data structures.
- ✓ Build up your capacity to evaluate different algorithm techniques.
- ✓ Develop your competence in analyzing data structures.
- ✓ Build up your capacity to write programmes for developing simple applications.

2.0 LEARNING OUTCOMES

Upon successful completion of this course, the student should be able to:

- ✓ To understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
- ✓ To understand the notations used to analyze the Performance of algorithms.
- ✓ To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- ✓ To choose the appropriate data structures for a specified application
- ✓ To write programs in C++ to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

3.0 COURSE OUTLINE

Week	Topic	Sub-topic	Remarks
1.	Introduction to DSA	- Data Types - Data Structures - Abstract Data Types (ADTs) - Algorithm - Analysis of Algorithms - Running Time Analysis - How to Compare Algorithms - Rate of Growth	
2.	Array & Linked Lists	- Linked List - Linked Lists ADT - Why Linked Lists? - Arrays Overview - Comparison (Arrays & Dynamic Arrays) - Singly Linked Lists	

		- Doubly Linked Lists - Circular Linked Lists	
3. & 4.	Stacks	- What is a Stack? - How Stacks are used - Stack ADT - Applications - Implementation - Comparison of Implementations - Stacks: Problems & Solutions	
5	**CAT I**	**- CAT I**	
6.	Queues	- What is a Queue? - How are Queues Used? - Queue ADT - Exceptions - Applications - Implementation - Queues: Problems & Solutions	
7. & 8.	Trees	- What is a Tree? - Binary Trees - Types of Binary Trees - Properties of Binary Trees - Binary Tree Traversals - Generic Trees (N-ary Trees) - Binary Tree Traversals - Binary Search Trees (BSTs) - Balanced Binary Search Trees	
9.	Priority Queues and Heaps	- What is a Priority Queue? - Priority Queue ADT - Priority Queue Applications - Priority Queue Implementations - Heaps and Binary Heaps - Binary Heaps - Heapsort - Priority Queues [Heaps]: Problems & Solutions	
10.	**CAT 2**	**- CAT 2**	
11..	Sorting	- What is Sorting? - Classification of Sorting Algorithms - Bubble Sort - Selection Sort - Insertion Sort - Shell Sort - Merge Sort - Comparison of Sorting Algorithms - Sorting: Problems & Solutions	
12	Searching	- What is Searching? - Types of Searching - Unordered Linear Search - Sorted/Ordered Linear Search	

		- Binary Search - Comparing Basic Searching Algorithms - Searching: Problems & Solutions	
13..	Classification	- Greedy Algorithms - Divide and Conquer Algorithms - Dynamic Programming	
13	Review	-	
14.	Exams	-	

4.0 TEACHING METHODOLOGY

Lectures, assignment, practical and tutorial sessions in Computer Laboratory, individual and group assignments, exercises and project work.

5.0 INSTRUCTIONAL MATERIALS

Overhead projector and computer, handouts, white boards, Textbooks.

COURSE EVALUATION

CAT 1	= 10%
CAT 2	= 10%
Other Assessments	= 10%
Examination	= 70%
Total	= 100%

Pass mark: 40%

7.0 COURSE TEXTBOOKS

1. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.
2. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

8.0 REFERENCE TEXTBOOKS

1. Data structures and Algorithms in C++, Michael T. Goodrich, R. Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
2. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
3. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
5. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

9.0 COURSE JOURNALS

10.0 REFERENCE JOURNALS