

CS2104: DISCRETE COMPUTATIONS

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Discrete Computations

Subject Code

CS - Computer Science

Course Number

2104

Academic Unit

Computer Science (CS)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

CS2303 Data Structures for Media

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to introduce basic ideas of discrete mathematics such as formal mathematical reasoning techniques, basic counting techniques and their applications for BSCCM students. The objective is for students to understand the basic

theory and some applications of discrete mathematics and algorithm design. The course gives students training in the ability to think quantitatively and analyse problems critically.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain at high levels concepts from discrete mathematics.	x		
2	Implement basic operations in discrete mathematics.		x	
3	Use formal mathematical reasoning techniques and basic counting techniques.		x	
4	Create design using mathematical models for media applications through relations, combinatorics, and functions, and apply algorithm design techniques to media applications.		x	x

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 real-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.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	The instructor will explain the course material in detail. Lectures support ILOs 1, 2 and 3.	1, 2
2	Assignment	Each student is required to independently work on 2-3 assignments. Each assignment contains several questions designed to help students consolidate the concepts/ algorithms learned. This learning method supports ILOs 2 and 3.	2, 3

3	Hands-on Practice	The instructor will arrange tutorials where each student can practice on related problems. This learning method supports ILO 1, 2 and 3.	1, 2	
4	Project	Each student is required to complete and implement a media project based on the discrete computation methods and algorithm design techniques learned in the course. This learning method supports ILOs 2 and 4.	2, 4	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Peer Review	1	5	
2	Project	2, 4	10	
3	Coursework	3	15	

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)**Assessment Task**

Peer Review

Criterion

ABILITY to answer peers' questions

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Coursework

Criterion

ABILITY to answer course related questions

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Project

Criterion

ABILITY to DESIGN and IMPLEMENT a media project using discrete computation and algorithms

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Final Examination

Criterion

ABILITY to answer course related questions under time pressure

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information**Keyword Syllabus**

Set theory; Counting; Equivalence relation; Boolean logic and proof; Induction; Recursion; Recurrences; Probability; Graph; Divide and Conquer.

Syllabus

- Counting
The Sum Principle; The Product Principle; Summing Consecutive Integers; Bijection Principle; Binomial Coefficients; Equivalence Relation.
- Number Theory
Greatest Common Divisor; Modular Equations; Computing Inverses.
- Logic and Proof
DeMorgan's Laws; Variables and Quantifiers; Boolean Logic; Rules of Inference for Direct Proofs; Proof by Contradiction.
- Recursion and Recurrences
Mathematical Induction; Solving Recursive Equations; The Master Theorem.
- Probability
Probability and Hashing; Principle of Inclusion and Exclusion; Conditional Probability; Random Variables.
- Graph and Algorithms
Spanning Trees; Divide and Conquer; Matching; Greedy Algorithm.

Reading List**Compulsory Readings**

Title	
1	Kenneth Bogart, Clifford Stein and Robert L. Drysdale (2010). Discrete Mathematics for Computer Science. Key College Publishing.

Additional Readings

Title	
1	Nil