CS4465: COMPUTATIONAL BIOLOGY AND BIOINFORMATICS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Computational Biology and Bioinformatics

Subject Code
CS - Computer Science
Course Number
4465

Academic Unit
Computer Science (CS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
(BMS2801 Molecules and Cells or
BME2106 Introduction to Cellular and Biomolecular Engineering or equivalent)
AND
(CS1102 Introduction to Computer Studies or
CS1302 Introduction to Computer Programming or equivalent)

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to introduce students concepts and techniques in computational biology and bioinformatics, and to develop practical skills in applying bioinformatics approaches to solve problems in biological studies.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the main characteristics of different computational methods in bioinformatics.		x		
2	Explain the effectiveness and efficiency of current computational biology and bioinformatics techniques.			x	x
3	Identify the problems in biological studies that can be analyzed using computational methods.		x	x	
4	Design bioinformatics solutions for practical problems in biological studies by applying and integrating suitable computational tools.		x	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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will engage in formal lectures to gain knowledge about computational biology and bioinformatics techniques, and the features of the main bioinformatics software tools.	1, 2, 3	3 hours per week

2	Laboratory	Students will discover the characteristics of the main computational methods in bioinformatics. They will also perform a critical evaluation of the effectiveness and efficiency of these methods in the form of lab sheets.	1, 2, 3	8 hours per semester
3	Project and Assignments	Students will identify suitable problems in biological studies that are amenable to computational analysis, and create new bioinformatics solutions to address these problems.	2, 3, 4	After class
4	Final Exam	Students will be tested for their understanding and ability to discover and assess bioinformatics techniques. Students will also be assessed for their abilities to identify and create bioinformatics solutions.	1, 2, 3, 4	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Lab Sheets	1, 2, 3	10	-	Yes
2	Assignments	2, 3, 4	10	-	Yes
3	Project Report and Deliverables	2, 3, 4	20	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

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
Laboratory Participation

Criterion
1.1 CAPACITY for SELF-DIRECTED LEARNING to understand and apply the principles of bioinformatics methods and tools
1.2 CAPACITY for ASSESSING different computational biology and bioinformatics techniques critically

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
Assignments

Criterion
2.1 ABILITY to EXPLAIN different bioinformatics techniques and discover their characteristics
2.2 ABILITY to PERFORM a critical assessment of different computational biology and bioinformatics techniques
2.3 ABILITY to EXPLAIN different examples of problems in biological studies, and their ability to identify the suitable class of problems which are amenable to bioinformatics analysis

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

3.1 ABILITY to EXPLAIN in DETAIL and with ACCURACY about different examples of problems in biological studies, and their ability to identify the suitable class of problems which are amenable to bioinformatics analysis
3.2 ABILITY to DISCOVER/INTEGRATE and CREATE new bioinformatics solutions for practical problems in biological studies

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 Exam

Criterion
4.1 ABILITY to EXPLAIN and COMPARE in DETAIL and with ACCURACY about different bioinformatics methods
4.2 ABILITY to EXPLAIN in DETAIL and with ACCURACY about different examples of problems in biological studies, and their ability to identify the suitable class of problems which are amenable to bioinformatics analysis

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
Pairwise sequence alignment, multiple sequence alignment, phylogenetic tree reconstruction, motif identification, RNA informatics, protein domain annotation and prediction, protein structure prediction, contemporary topics in bioinformatics.

Reading List

Compulsory Readings

	Title
1	W.K.Sung (2009). Algorithms in Bioinformatics: A Practical Introduction. Chapman and Hall/CRC.

Additional Readings

	Title
1	J. Pevsner (2015). Bioinformatics and Functional Genomics. Wiley-Blackwell, 3rd edition.
2	A. Lesk (2014). Introduction to Bioinformatics. Oxford University Press, 4th edition.
3	N. Cristianini and M. Hahn (2007). Introduction to Computational Genomics: A Case Studies Approach. Cambridge University Press.