

BME2106: INTRODUCTION TO CELLULAR AND BIOMOLECULAR ENGINEERING

Effective Term

Semester B 2022/23

Part I Course Overview

Course Title

Introduction to Cellular and Biomolecular Engineering

Subject Code

BME - Biomedical Engineering

Course Number

2106

Academic Unit

Biomedical Engineering (BME)

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

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course is designed for students with an engineering background to learn the basics of cell and molecular biology, biochemistry, and biotechnology. This course aims to provide you with a complete and concise overview of bioscience, with a focus on its relationship to biomedical engineering. Topics covered include the relationship between molecular structure and function, the dynamic properties of organelles, the interaction between cells and the microenvironment, the mechanisms that regulate cell activity, and the practical applications of cell and molecular biology.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Describe the fundamentals of cell and molecular biology, especially those related to biomedical engineering.			x	
2	Explain the main biomedical engineering-related techniques and processes of biochemistry, and biotechnology.		x	x	
3	Apply bioscience principles to explore the relationship between molecular structure and function, as well as the interaction between cells and the microenvironment.		x	x	x
4	Apply techniques for the biochemical characterizations of cells for biomedical 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	Classroom lectures on the topics of the keyword syllabus.	1, 2, 3, 4	3 hrs/week
2	Laboratory	Lab experiment projects.	1, 2, 3, 4	3 hrs/week for 2 weeks

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Project presentation	1, 2, 3, 4	30	Students will carry out literature review to identify a research topic aimed to advance healthcare technologies.
2	Test	1, 2, 3	20	
3	Lab reports	3, 4	20	Students will familiarise themselves with concepts and definitions pertaining to cell and molecular biology.

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

2

Additional Information for ATs

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

Assessment Rubrics (AR)**Assessment Task**

Project presentation

Criterion

Ability to identify the principles of fabrication for existing devices or to design a device based on these principles.

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

Test

Criterion

Ability to describe the fundamentals of biochemistry, and biotechnology and to explain the main biomedical engineering-related techniques.

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

Lab Reports

Criterion

Ability to describe the fundamentals of bioscience concepts.

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

Examination

Criterion

Ability to describe the fundamentals and processes of biochemistry, and biotechnology and to explain the main molecular, functional and cell related concepts related to biomedical engineering.

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

Biomolecules; membrane structure, organelles, cytoskeleton, intercellular and extracellular matrix interactions; cell division and cell cycle; cell death; DNA replication, transcription and translation; DNA repair and recombination; control of gene expression; properties of enzymes and kinetics; metabolism: glycolysis, oxidative phosphorylation and ATP synthesis; fatty acid metabolism; recombinant DNA technology, protein production and purification.

Reading List**Compulsory Readings**

Title	
1	Stephen L. Wolfe [U of California, Davis (Ph.D., Johns Hopkins University)] Biology of the Cell, Biology: The Foundations, Cell Ultrastructure, Molecular and Cellular Biology, and Introduction to Cell and Molecular Biology.
2	Basic Cell and Molecular Biology: What We Know & How We Found Out - 4e Gerald Bergtrom, University of Wisconsin, Milwaukee

Additional Readings

Title	
1	Molecular Biology of the Cell, 4th edition Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter.