# BME2106: INTRODUCTION TO CELLULAR AND BIOMOLECULAR ENGINEERING

**Effective Term**
Semester B 2024/25

## 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 Biomedicine (BD)

**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 app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|---|---|---|---|---|---|
| 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.

**Learning and Teaching Activities (LTAs)**

| | LTAs | Brief Description | CILO No. | Hours/week (if applicable) |
|---|---|---|---|---|
| 1 | Lecture | Students will develop an understanding on the topics of the keyword syllabus. | 1, 2, 3, 4 | 3 hrs/week |
| 2 | Laboratory | Students will gain hands-on experience via the 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

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**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

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**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

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**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

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# 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. |