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)

<table>
<thead>
<tr>
<th>CILOs</th>
<th>Weighting (if app.)</th>
<th>DEC-A1</th>
<th>DEC-A2</th>
<th>DEC-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe the fundamentals of cell and molecular biology, especially those related to biomedical engineering.</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>2. Explain the main biomedical engineering-related techniques and processes of biochemistry, and biotechnology.</td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>3. Apply bioscience principles to explore the relationship between molecular structure and function, as well as the interaction between cells and the microenvironment.</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4. Apply techniques for the biochemical characterizations of cells for biomedical applications.</td>
<td></td>
<td></td>
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<td>x</td>
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</table>

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)

<table>
<thead>
<tr>
<th>TLAs</th>
<th>Brief Description</th>
<th>CILO No.</th>
<th>Hours/week (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lecture</td>
<td>Classroom lectures on the topics of the keyword syllabus.</td>
<td>1, 2, 3, 4</td>
<td>3 hrs/week</td>
</tr>
<tr>
<td>2 Laboratory</td>
<td>Lab experiment projects.</td>
<td>1, 2, 3, 4</td>
<td>3 hrs/week for 2 weeks</td>
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### Assessment Tasks / Activities (ATs)

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

### 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

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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
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**

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<tr>
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**Additional Readings**

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