

# BME8123: REGENERATIVE MEDICINE

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## Effective Term

Semester B 2024/25

## Part I Course Overview

### Course Title

Regenerative Medicine

### Subject Code

BME - Biomedical Engineering

### Course Number

8123

### Academic Unit

Biomedical Engineering (BME)

### College/School

College of Biomedicine (BD)

### Course Duration

One Semester

### Credit Units

3

### Level

R8 - Research Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

Nil

### Precursors

Nil

### Equivalent Courses

MBE5111/BME5111 Regenerative Medicine

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

The course Regenerative Medicine is an interdisciplinary and translational subject between clinical medicine, biomedical engineering and developmental biology which deals with the process of replacing, engineering or regenerating human

cells, tissues or organs to restore or establish normal function. It is an emerging biomedical engineering field which applies both engineering and biologic technologies to regenerate damaged tissues and even substitute non-functioning organs in human bodies.

This course is set up in such a way that student can understand this interdisciplinary subject with minimal background. Its major components include cell and tissue biology, biomaterials, and the engineering and clinical implementation. Clinical applications covered in this course include tissue regeneration of bone, cartilage etc.

### Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic principles of stem cell biology and tissue engineering approaches.		x	
2	Explain fundamental concepts on stem cell biology and tissue development.		x	
3	Assess the existing techniques to design and fabricate tissue culture systems, and to develop implementation protocols for proper tissue development in the systems on basis of therapeutic cells and functional biomaterials.		x	x
4	Identify the practical issues for implementation.	x	x	
5	Design a feasible and effective engineering approach to a specific tissue engineering problem, by applying the knowledge involved in all the above CILOs as a whole.	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	Introduction of key concepts.	1, 2, 3, 4, 5	2 hrs/week
2	Tutorial	Sample questions and case studies.	1, 2, 3, 4, 5	1 hr/week

### Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	Quiz I	1, 2, 3	20	
2	Quiz II	3, 4, 5	20	

**Continuous Assessment (%)**

40

**Examination (%)**

60

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

0

**Minimum Examination Passing Requirement (%)**

0

**Assessment Rubrics (AR)**

**Assessment Task**

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability to Explain the principles and methodology related to engineered regenerative medicine including stem cell technology and tissue 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

**Assessment Task**

Quizzes (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability to Explain the principles and methodology related to engineered regenerative medicine including stem cell technology and tissue engineering.

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**Assessment Task**

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Ability to Explain the principles and methodology related to engineered regenerative medicine including stem cell technology and tissue engineering.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Significant

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**Assessment Task**

Quizzes (for students admitted from Semester A 2022/23 to Summer Term 2024)

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(B-, C+, C) Basic

**Failure**

(F) Not even reaching marginal levels

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## Part III Other Information

**Keyword Syllabus**

Principles: tissue development; therapy concepts; biomaterials; microenvironment; construct; bioreactor.

Tissue and cell biology: cell type; stem cell; growth; differentiation; stemness; cell signalling; adhesion; migration; extracellular matrix; morphogenesis.

Biomechanics and biomaterials: mechanical properties; transport; flow; biocompatibility.

Engineering strategies: cell/tissue culture techniques; biologic scaffold; polymers; degradable polymers; bioreactor design.

Tissue structure and regeneration: skin; bone; cartilage; neural system; cardiovascular tissues; musculoskeletal tissues.

Other Issues: cell source; immune response; ethical considerations.

## Reading List

### Compulsory Readings

Title	
1	Blitterswijk, C. V. (2008). Tissue Engineering. Academic Press, London: Elsevier.
2	Lanza, R. and Atala, A. (2013). Essentials of Stem Cell Biology. Academic Press, London: Elsevier.

### Additional Readings

Title	
1	Palsson, B., Bhatia, S. (2004). Tissue engineering. Upper Saddle River, N.J.: Pearson Prentice Hall.
2	Vunjak-Novakovic, G. (2006). Culture of cells for tissue engineering. Hoboken, N.J.: Wiley-Liss. (Accessible via <a href="http://encore.lib.cityu.edu.hk">http://encore.lib.cityu.edu.hk</a> ).
3	Pallua, N., Suscheck, C. V. (2011). Tissue Engineering: From Lab to Clinic. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg. (Accessible via <a href="http://encore.lib.cityu.edu.hk">http://encore.lib.cityu.edu.hk</a> ).
4	Alberts, B. (2008). Molecular biology of the cell. 5th ed. New York: Garland Science.
5	Solomon, E. P., Phillips, G. A. (1987). Understanding human anatomy and physiology. Philadelphia: Saunders.
6	Panno, J. (2010). Stem cell research: medical applications and ethical controversies. Rev. ed. N.Y.: Facts On File, Inc.