BME5111: REGENERATIVE MEDICINE

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Regenerative Medicine

Subject Code
BME - Biomedical Engineering
Course Number
5111

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
MBE5111/BME8123 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

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

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.

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 (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

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Quizzes (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

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

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: Elservier.
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 http://encore.lib.cityu.edu.hk).
3	Pallua, N., Suscheck, C. V. (2011). Tissue Engineering: From Lab to Clinic. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg. (Accessible via http://encore.lib.cityu.edu.hk).
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.