BME2104: TISSUE ENGINEERING

Effective Term
Semester B 2022/23

Part I Course Overview

Course Title
Tissue Engineering

Subject Code
BME - Biomedical Engineering
Course Number
2104

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
MBE2104 Tissue Engineering

Exclusive Courses
Nil

Part II Course Details

Abstract
The course Tissue Engineering is designed to help students establish the fundamental knowledge and sense, as well as to introduce about the basic engineering techniques applied in the field. Tissue engineering is an emerging biomedical

engineering field which applies both biologic and engineering 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 skin, bone, cartilage, etc.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic principles of tissue engineering approaches.			x	
2	Explain fundamental concepts on cell biology and tissue development.			x	
3	Practice the existing techniques relevant to the assessment of tissue culture and protocols for proper tissue development in the systems.			x	x
4	Identify the practical issues for implementation.		x	x	
5	Apply 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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Introduction of key concepts.	1, 2, 3, 4, 5	3 hrs/week
2	Tutorial	Case studies and introduction of project.	1, 2, 3, 4, 5	1 hr/week
3	Laboratory	Provide opportunity to students for gaining hands-on experience via the laboratory works.	1, 2, 3	3 hrs/week for 3 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment	1, 2, 4	15	1 individual presentation
2	Laboratory Reports	1, 2, 3	15	2-3 reports to be submitted
3	Project Report	3, 4, 5	20	Report to be submitted

Continuous Assessment (%)

50

Examination (%)

50

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

1. Assignment

Criterion

Ability to Identify and Explain the technology related to 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

2. Laboratory Reports

Criterion

Ability to Explain and Analyze the experimental results obtained in the laboratories related to 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
3. Project Report

Criterion
Capacity for Self-directed Learning, Discovery and Innovation of the new tissue engineering technology.

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
4. Examination

Criterion
Ability to Explain the methodology and procedure related to 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

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.

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.