BME3123: MATERIALS FOR BIOMEDICAL ENGINEERING

Effective Term
Semester B 2022/23

Part I Course Overview

Course Title
Materials for Biomedical Engineering

Subject Code
BME - Biomedical Engineering
Course Number
3123

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
BCH1200/CHEM1200 Discovery in Biology and BCH1100 Chemistry/CHEM1300 Principles of General Chemistry#

Precursors
BME2105 Introduction to Biomedical Engineering

Equivalent Courses
Nil

Exclusive Courses
Nil

Additional Information
Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

This is an introductory course to biomaterials. It is designed to include basic properties of biomaterials, biomaterial degradation, processing and biocompatibility, in vitro and in vivo testing, inflammation and the immune response, thrombosis, tumorigenesis and calcification, and its applications.

At the end, the students should understand the interaction between a biomaterial and the biological environment from two points of view: "What happens with the biomaterial after implantation in a biological environment?" vs. "What happens with the biological environment after implantation of a biomaterial?"

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the various classes of biomaterials on the basis of structure and function		x	x	
2	Understand how basic chemical properties and constituents of a biomaterial affect their physical, mechanical, and degradation properties		x	x	
3	Apply various processing and surface modifications methods in order to manipulate properties of the material		x	x	x
4	Understand the physiological consequences during implantation, the biological events associated, and basic methods for in vitro and in vivo testing		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	Explain key concepts, theories, and applications etc.	1, 2, 3, 4	3 hrs/week
2	Tutorial	Exercise practice	1, 2, 3, 4	1 hr/week
3	Laboratory	Practice lab work	1, 2, 3, 4	3 hrs/week for 3 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Test	1, 2, 3, 4	25	
2	Lab Experiment Projects and Reports	1, 2, 3, 4	15	

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 in the final examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

Mid-term Test

Criterion

Ability to Understand and Explain the definition, scientific principles and the working mechanisms, and how the principles are applied to science and technology for solving medical problems.

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

Lab Experiment Projects and Reports

Criterion

Ability to Understand the experimental principles and evidence of original thinking and communicate ideas via written texts.

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

Criterion
Ability to Identify and Explain the scientific principles and the working mechanisms, and how the principles are applied to science and technology for solving medical problems.

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
Introduction of biomaterials; properties of polymeric materials, ceramics, and metal materials for biomedical applications; surface properties and characterization of biomaterials; biological response to foreign materials, biocompatibility; degradable materials; applications in drug formulation and delivery, manufacturing of medical device and consumables, medical implantation; regulation

Reading List

Compulsory Readings

	Title
1	Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, “Biomaterials Science: an introduction to materials in medicine”, Academic Press, 3rd edition, 2013, ISBN: 9780123746269 (CityU library)

Additional Readings

	Title
1	Joon Park and R. S. Lakes, “Biomaterials: An Introduction”, Springer, 3rd edition, 2007, ISBN: 978-0387378794 (CityU library)
2	Johnna S. Temenoff, Antonios G. Mikos, “Biomaterials: The Intersection of Biology and Materials Science”, Upper Saddle River, N.J. : Pearson/Prentice Hall, 2008. ISBN : 0130097101 (CityU library)