

BME3123: MATERIALS FOR BIOMEDICAL ENGINEERING

Effective Term

Semester B 2024/25

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 Biomedicine (BD)

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	Explain 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	Describe 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.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will develop an understanding on key concepts, theories, and applications etc.	1, 2, 3, 4	3 hrs/week
2	Tutorial	Students will discuss the exercise practice problems.	1, 2, 3, 4	1 hr/week

3	Laboratory	Students will gain hands-on experience via the 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 mid-term test and 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)