BME6101: MANUFACTURING OF BIOMEDICAL DEVICES

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Manufacturing of Biomedical Devices

Subject Code
BME - Biomedical Engineering
Course Number
6101

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
MBE6101/MBE8103/BME8103 Manufacturing of Biomedical Devices

Exclusive Courses
Nil

Part II Course Details

Abstract

Biomedical manufacturing is currently a rapidly growing industry over the past decades. It can be viewed as the application of manufacturing technology to biomedical products, of which the development processes are often tedious and multidisciplinary, involving advanced 3D modelling, surgical machining, pharmaceutical production and biomechanics. This course aims at providing essential knowledge in the biomedical product development (e.g. material properties, fabrication processes and design techniques for different applications) in order to provide ways to speed up the product development cycle. This course is multidisciplinary and covers the principles in mechanical, chemical, biological, and physiological aspects. Students can learn the techniques to apply the acquired knowledge for particular applications they are interested.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the mechanical and biochemical properties of bio-related materials, as well as their major applications as medical devices or other bio-products.			x	
2	Explain the principles of the fabrication/ manufacturing techniques for existing biomedical devices; and identify the manufacturing processes for the biomedical applications.			x	
3	Compare the pros and cons of different bio-materials and their corresponding manufacturing processes.		x	x	
4	Select the appropriate bio-related materials and manufacturing processes for specific applications; and employ basic design principles to specific bio-related products.		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	In the form of classroom teaching. Case studies, demonstrations of biomedical devices, discussions on selected questions will be arranged to supplement the lectures.	1, 2, 3, 4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Problem sets	1, 2, 3, 4	20	Three problem sets are assigned in the course and each one focuses on one CILO.	No
2	Individual term project (report)	1, 2, 3, 4	30	Grading of this individual term project is based on a presentation and a final report. The project should focus on review of an existing biomedical product.	Yes

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

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 methodology and procedure related to manufacturing of biomedical system, and to DESIGN and MODEL defined biomedical systems

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

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

Criterion

ABILITY to EXPLAIN in DETAIL and with the acquired engineering methods for designing and characterizing of biomedical devices and for CONSTRUCT proper manufacturing procedures

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

Individual term project (report) (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

ABILITY to integrate multidisciplinary science and engineering knowledge to DESIGN or CONSTRUCT a novel biomedical devices with defined applications

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 methodology and procedure related to manufacturing of biomedical system, and to DESIGN and MODEL defined biomedical systems

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

ABILITY to EXPLAIN in DETAIL and with the acquired engineering methods for designing and characterizing of biomedical devices and for CONSTRUCT proper manufacturing procedures

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

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Assessment Task

Individual term project (report) (for students admitted from Semester A 2022/23 to Summer Term 2024)

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ABILITY to integrate multidisciplinary science and engineering knowledge to DESIGN or CONSTRUCT a novel biomedical devices with defined applications

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(B-, C+, C) Basic

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Part III Other Information

Keyword Syllabus

- Materials: metals, ceramics, polymers, adhesives.
- Material properties: biomaterials, biocompatibility, haemocompatibility, elastic modulus, surface roughness, porosity, nanostructures.
- Fabrication: scaffolds, nano/microparticles, rapid prototyping, electro-spinning, self-assembly, solid freeform fabrication, polymer coating, vapour deposition, biomodelling, 3D medical imaging, reverse engineering.
- Considerations: cell-material interaction, tissue attachment, bonding criteria, surface pretreatment corrosion, degradation, ion release, implants, sterilization, surgery and infection.
- Applications: biosensors, drug delivery, tissue engineering, orthopaedic devices, internal fixation, joint prostheses, cartilage reconstruction.

Reading List

Compulsory Readings

	Title
1	Lam, R. H. W., and Chen, W. (2019). Biomedical Devices: Materials, Design and Manufacturing New York: Springer Publishing.

Additional Readings

	Title
1	Migonney V. (2014). Biomaterials England: John Wiley & Sons, Inc.
2	Kucklick T. R. (2012). The Medical Device R&D Handbook Florida: CRC Press.
3	Masataka Y. (2010). System Design Optimization for Product Manufacturing London: Springer Publishing.