

# BME6101: MANUFACTURING OF BIOMEDICAL DEVICES

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## Effective Term

Semester B 2024/25

## 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 (e.g. Parameter for GenAI use)
1	Problem sets	1, 2, 3, 4	20	Three problem sets are assigned in the course and each one focuses on one CILO.
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.

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Additional Information for ATs**

There is a 2-hour examination at the end of the semester. A part of the examination contains questions specifically designed for the BME6101 students.

**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 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

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**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**

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**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

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**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

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

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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.