BME6118: BIOMEDICAL IMAGING AND BIOPHOTONICS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Biomedical Imaging and Biophotonics

Subject Code
BME - Biomedical Engineering
Course Number
6118

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

Equivalent Courses
MBE6118 Biomedical Photonics
BME8131 Biomedical Imaging and Biophotonics

Part II Course Details

Abstract
This aim of this course is to develop students' knowledge and understanding about the fundamental principles of medical imaging technologies and biophotonics, and their applications to real-world devices. The topical coverage includes magnetic resonance imaging, x-ray computed tomography, ultrasonography, optical scattering theory and modelling, optical sensing and spectroscopy, optical microscopy, and photoacoustic tomography. Following the completion of this course, students will have a good understanding of various methods and instruments used in biomedical optical research and clinical applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the concepts and principles of major medical imaging technologies.			x	
2	Employ concepts of photon-tissue interaction in biological tissues.			x	
3	Explain principles of optical sensing, spectroscopy, and imaging techniques.		x	x	
4	Interpret the principles of major imaging and their techniques, select proper imaging techniques for different biomedical imaging applications.			x	
5	Discuss medical and biological photoacoustic imaging for biomedical applications technologies to clinical or preclinical problems.		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	Lectures/Tutorial	Explain key concepts and mathematical models related to medical and optical imaging and sensing technologies.	1, 2, 3, 4	3
2	Homework/ Examination	Require students to solve the problems based on the theories and models discussed during lectures.	1, 2, 3, 4, 5	
3	Project	Require students to propose an improvement or a new design of an optical imaging technology through literature survey.	1, 3, 4, 5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Project	1, 3, 4, 5	20	Applicable CILO(s) depend on the topic chosen by the student.	Yes
2	Assignments	1, 2, 3, 4, 5	20	-	No

Continuous Assessment (%)

40

Examination (%)

60

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 analyze problems in medical imaging and biophotonics,
- Ability to apply principles to solve biomedical problems.

Excellent

High

Good

Significant

Fair

Moderate

Marginal

Basic

Failure

Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to acquire knowledge related to a medical imaging or biophotonic technique, identify a problem, and propose a methodology to solve the problem.

Excellent
High

Good
Significant

Fair
Moderate

Marginal
Basic

Failure
Not even reaching marginal levels

Assessment Task
Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to solve problems relevant to medical imaging, optical sensing, spectroscopy, and imaging.

Excellent
High

Good
Significant

Fair
Moderate

Marginal
Basic

Failure
Not even reaching marginal levels

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
- Ability to analyze problems in medical imaging and biophotonics,
- Ability to apply principles to solve biomedical problems.

Excellent
High

Good
Significant

Marginal
Basic

Failure
Not even reaching marginal levels

Assessment Task
Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to acquire knowledge related to a medical imaging or biophotonic technique, identify a problem, and propose a methodology to solve the problem.

Excellent
High

Good
Significant

Marginal
Basic

Failure
Not even reaching marginal levels

Assessment Task
Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to solve problems relevant to medical imaging, optical sensing, spectroscopy, and imaging.

Excellent
High

Good
Significant

Marginal
Basic

Failure
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Magnetic resonant imaging, X-ray computed tomography, Ultrasonography, Tissue-photon interaction, Optical sensing and spectroscopy, Optical microscopy, Optical coherence tomography, and Photoacoustic imaging.

Reading List

Compulsory Readings

	Title
1	Biomedical optics: principles and imaging. Wang, Lihong V., and Hsin-I. Wu. 2012.
2	Fundamentals of Medical Imaging. Suetens, Paul, 2009

Additional Readings

	Title
1	Fundamentals of Photonics, 2nd Edition. Bahaa E. A. Saleh, Malvin Carl Teich. 2007
2	P. N. Prasad, "Introduction to biophotonics", John Wiley & Sons, Inc., New Jersey, 2003.
3	Markolf H. Niemz, "Laser-Tissue Interactions", Springer, Berlin, 2007.