

**City University of Hong Kong
Course Syllabus**

**offered by
Department of Biomedical Engineering
with effect from Semester A 2024/25**

Part I Course Overview

Course Title:	<u>Biomedical Imaging and Biophotonics</u>
Course Code:	<u>BME6118</u>
Course Duration:	<u>1 semester</u>
Credit Units:	<u>3 credits</u>
Level:	<u>P6</u>
Medium of Instruction:	<u>English</u>
Medium of Assessment:	<u>English</u>
Prerequisites : <i>(Course Code and Title)</i>	<u>Nil</u>
Precursors: <i>(Course Code and Title)</i>	<u>Nil</u>
Equivalent Courses: <i>(Course Code and Title)</i>	<u>MBE6118 Biomedical Photonics BME8131 Biomedical Imaging and Biophotonics</u>
Exclusive Courses: <i>(Course Code and Title)</i>	<u>Nil</u>

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Describe the concepts and principles of major medical imaging technologies.			✓	
2.	Employ concepts of photon-tissue interaction in biological tissues.			✓	
3.	Explain principles of optical sensing, spectroscopy, and imaging techniques.		✓	✓	
4.	Interpret the principles of major imaging and their techniques, select proper imaging techniques for different biomedical imaging applications.			✓	
5	Discuss medical and biological photoacoustic imaging for biomedical applications technologies to clinical or preclinical problems.		✓	✓	✓
		N.A.			

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.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lectures/Tutorial	Explain key concepts and mathematical models related to medical and optical imaging and sensing technologies.	✓	✓	✓	✓		3 hrs/week
Homework/ Examination	Require students to solve the problems based on the theories and models discussed during lectures.	✓	✓	✓	✓	✓	N.A.
Project	Require students to propose an improvement or a new design of an optical imaging technology through literature survey	✓		✓	✓	✓	N.A.

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 40%							
Project	✓*		✓*	✓*	✓*	20%	
Assignments	✓	✓	✓	✓	✓	20%	
Examination: 60%							
Examination	✓		✓	✓	✓	60%	Duration: 2 hours
						100%	

*Depending on the topic chosen by the student

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	1.1 Ability to analyze problems in medical imaging and biophotonics, 1.2 Ability to apply principles to solve biomedical problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Project	Ability to acquire knowledge related to a medical imaging or biophotonic technique, identify a problem, and propose a methodology to solve the problem.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Assignment	Ability to solve problems relevant to medical imaging, optical sensing, spectroscopy, and imaging.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C,)	Failure (F)
1. Examination	1.1 Ability to analyze problems in medical imaging and biophotonics, 1.2 Ability to apply principles to solve biomedical problems.	High	Significant	Basic	Not even reaching marginal levels
2. Project	Ability to acquire knowledge related to a medical imaging or biophotonic technique, identify a problem, and propose a methodology to solve the problem.	High	Significant	Basic	Not even reaching marginal levels
3. Assignment	Ability to solve problems relevant to medical imaging, optical sensing, spectroscopy, and imaging.	High	Significant	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

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

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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.