

Introduction to medical imaging and optical microscopy

Lecturers

Olivier DEBEIR (Coordinator) and Simon-Pierre GORZA

Course mnemonic

BIME-H407

ECTS credits

5 credits

Language(s) of instruction

English

Course period

First term

Campus

Solbosch

Course content

Introduction to Medical Imaging

- > Objectives of medical imaging, history and physical aspects
- > X-Ray
- > Tomography
- > Magnetic Resonance
- > Nuclear Imaging (SPECT-PET)
- > Ultrasound
- > Magneto-encephalography (MEG)

Introduction to optical microscopy

- > Revision of geometric and wave optics
- > General architecture of an optical microscope
- > The components of an optical microscope
- > The different types of usual microscopes
- > The holographic microscopy
- > Optical tomography in reduced coherence
- > Fluorescence microscopy
- > Confocal microscopy

Objectives (and/or specific learning outcomes)

Introduction to medical imaging

- > Provide an overview of the history of the medical image acquisition, recalling its physical foundations.
- > Be able to recognize an imaging modality, to give the specifics. Illustrate the different techniques with concrete examples from research and clinical practice.

- > Understand the medical and technological constraints related to the acquisition of medical images.

Introduction to optical microscopy

- > Optical microscopy is extremely common in the life sciences and is increasingly used as a quantitative measurement technique. It is therefore very important that students gain a detailed knowledge of the different type of microscope. A goal of this course is to give students the necessary skills to enable them, depending on a particular application, the optimal choice of the microscope type and choice of components.
- > Learn the optical microscopy techniques with emphasis on the capabilities and limitations of each type of instrument for students to be able to select and set the type of microscope suitable for each specific application

Teaching method and learning activities

Introduction to medical imaging

Lectures, guests seminars given by professionals (researchers / doctors) in the field of medical imaging.

Introduction to optical microscopy

Lectures, exercise sessions and practicals

Contribution to the teaching profile

This teaching unit contributes to the following competences:

- > > Process and analyze signals of any kind, 1D, image, video, especially those from medical devices- Representing the fundamental biological mechanisms since the biochemistry of the cell to the functioning of the main systems of human physiology- Translate the constraints of living in the language of the engineer, anticipate the impact of development on living (choice of materials, processes, etc.)- Having a critical analysis of the choice of an optical microscopy technique based screening sample

References, bibliography and recommended reading

Introduction to medical imaging

The Biomedical Engineering Handbook Joseph D. Bronzino (Author) 2896 pages Publisher: CRC Press; 1 edition (June 7, 1995) Language: English ISBN-10: 0849383463 ISBN-13: 978-0849383465 Handbook of Medical Imaging: Processing and Analysis Isaac Bankman (Editor) 901 pages Publisher: Academic Press; 1st edition (October 13, 2000) Language: English ISBN-10: 0120777908 ISBN-13: 978-0120777907 Handbook of Medical Imaging, Volume 1. Physics and Psychophysics (SPIE Press Monograph Vol. PM79/SC) Richard L. Van Metter (Author), Jacob Beutel (Author), Harold L. Kundel (Author) 968 pages Publisher: SPIE Publications (June 1, 2009) Language: English ISBN-10: 0819477729 ISBN-13: 978-0819477729 Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis (SPIE Press Monograph Vol. PM80/SC) [Paperback] J. Michael

Fitzpatrick (Author), Milan Sonka (Author) 1108 pages Publisher: SPIE Publications (April 21, 2009) Language: English ISBN-10: 0819477605 ISBN-13: 978-0819477606 Handbook of Medical Imaging, Volume 3. Display and PACS (SPIE Press Monograph Vol. PM81) [Hardcover] Steven C. Horii (Author), Yongmin Kim (Author) 512 pages Publisher: SPIE Publications; 1 edition (October 1, 2000) Language: English ISBN-10: 0819436232 ISBN-13: 978-0819436238

Introduction to optical microscopy

Jerome Mertz, « Introduction to optical microscopy », Roberts & Company Publishers, 2009

Mortimer Abramowitz, « Fluorescence microscopy, The essentials », Volume 4, Basics and beyond series, Olympus America Inc. 1993

Web sites

<http://zeiss-campus.magnet.fsu.edu/referencelibrary/structured.html>

<http://www.olympusmicro.com/index.html>

Davidson and Abramowitz, "Optical Microscopy", <http://www.olympusmicro.com/primer/opticalmicroscopy.html>

Course notes

Université virtuelle and Podcast

Other information

Place(s) of teaching

Solbosch

Contact(s)

Olivier.Debeir@ulb.be - Simon.Pierre.Gorza@ulb.be

Evaluation method(s)

Other

Evaluation method(s) (additional information)

- > Two questions are asked for each of the two parts of the course (imaging and microscopy).
- > A preparation period, without notes, is provided before the presentation of each answer.
- > Depending on the circumstances, the exam can be done at a distance using Teams.

Determination of the mark (including the weighting of partial marks)

The grade is constructed according to the geometric mean (identical weighting for both parts of the course).

Main language(s) of evaluation

English

Other language(s) of evaluation, if applicable

French

Programmes

Programmes proposant this course at the Brussels School of Engineering

MA-IRBC | **Master in Chemistry and Bio-industries Bioengineering** | finalité Professional/unit 2, MA-IRCB | **Master of science in Biomedical Engineering** | finalité Professional/unit 1 and MA-IRPH | **Master of science in Physical Engineering** | finalité Professional/unit 1

Programmes proposant this course at the faculty of Sciences

MA-IRBC | **Master in Chemistry and Bio-industries Bioengineering** | finalité Professional/unit 2