PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2101 BIOMEDICAL IMAGES

Credits and contact hours:	10 UC credits / 10 hours (3 hours: Lecture and 7 hours: Independent Study)
Instructor's name:	Cristián Tejos
Course coordinator's name	Por definir
Textbook:	Andrew Webb Introduction to Biomedical Imaging, IEEE press 2003.
Course Catalog Description:	Nowadays, Biomedical Images are a clinical standard for diagnostic, follow up and evaluation of certain pathologies and therapies. There are different biomedical imaging techniques each one of them based in different physical phenomena. With them, is possible to create images of cells, tissue, organs or more complex structures in living animals. A few examples are X-Ray, Ultrasound, Computer Tomography using X-Ray (CT), Single-photon emission computed tomography (SPECT), Positron emission tomography (PET), and Magnetic resonance imaging MRI), among others. From the capture of the physical phenomena until the generation of the clinical image, exists a process in which complex mathematical resources are required. The result of this process yields a very useful image, yet that has limitations and distortions. Through this course, students will understand the physical phenomena and mathematical processing used to create several types of biomedical images, identifying their advantages and the limitations.
Prerequisite Courses:	IEE2123 Electrical Circuits
Co-requisite Courses:	Por definir
Status in the Curriculum:	Optativo
Course Learning Outcomes:	1. To understand and analyze the physical phenomena used in each of the different biomedical imaging techniques. 2. To understand and analyze how this physical phenomenon is measured. 3. To understand and analyze how the images are built from the measurement of the physical phenomena. 4. To understand and analyze the advantages and limitations of each of the different biomedical imaging techniques. 5. To design and implement solutions to theoretical and practical problems in biomedical imaging.

6. To communicate orally and in writing the elements of analysis and proposed solutions to problems in biomedical imaging.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
d. Multidisciplinary teams
e. Identify, formulate, and solve engineering problems
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice

Topics covered:

1. Lineal Systems and transforms
a. Lineal Systems
b. Radon Transform
c. Fourier Transform
2. X-Ray
a. Generation and detection of X-Rays
b. Attenuation models for X-Rays
c. Image formation in 2D using X-Rays
d. Tomography using X-Rays
e. Reconstruction Methods for Tomography using X-Rays
f. Applications
3. Nuclear Medicine
a. Generation of Gamma Rays and Positrons
b. Generation of Markers (radioisotopes)
c. Detection of Gamma Rays
d. Image formation in 2D using Gamma Rays
e. Single-photon emission computed tomography (SPECT)
f. Positron emission tomography (PET)
g. Reconstruction methods for SPECT and PET
h. Applications
4. Ultrasound
a. Transducers: Generation and detection of ultrasound waves
b. Wave propagation, diffraction, reflection models
c. Generation of ultrasound images: modes A, B and M
d. Doppler Effect
e. Applications
5. Magnetic Resonance Imaging
a. Magnetic Resonance Phenomena
b. Image formation: polarization, excitation, reading and reconstruction
c. Standard sequences and parameters
d. Trajectories
e. Advanced sequences and parameters
f. Applications