

BME137 INTRODUCTION TO BIOMEDICAL IMAGING

(Elective for BME)

- Catalog Data:** **BME137 Introduction to Biomedical Imaging (Credit Units: 4)**
Introduction to imaging modalities widely used in medicine and biology, including x-ray, computed tomography (CT), nuclear medicine (PET and SPET), ultrasonic imaging, magnetic resonance imaging (MRI), optical tomography, imaging contrast, imaging processing, and complementary nature of the imaging modalities. Prerequisite: BME130 or equivalent. (Design Units: 1)
- Textbook:** Webb, A. *Introduction to Biomedical Imaging*. John Wiley & Sons, 2003.
- References:** Cho, Z. *Foundations of Medical Imaging*. John Wiley & Sons, 1993.
Handouts
- Coordinator:** Joerg Meyer
- Relationship to Program Outcomes:** This course relates to the Program Outcomes for BME - a. b. c. e. f. g. and k as stated at:
<http://undergraduate.eng.uci.edu/degreeprograms/biomedical/mission>
- Course Outcomes / Performance Criteria:** Students will:
Identify and describe in qualitative terms the principles of the x-ray generation, x-ray-tissue interaction, x-ray detections, and x-ray imaging. (BME a, g)
Describe the principle of the Computed Tomography (CT) and the 2D/3D image reconstruction methods involved. (BME a, g)
Describe in qualitative terms, the principle of ultrasound, PET, SPECT and MRI imaging. (BME a, g)
Identify and describe image contrast, image resolution, and signal to noise ratio involved in biomedical imaging. (BME a, g, k)
Identify and describe the Complementary nature of various imaging techniques. (BME b, c, e, f, k)
- Prerequisites By Topic:** Introductory physics, linear algebra, and ordinary differential equations
- Lecture Topics:** Introduction to imaging.
X-ray and computed tomography (CT).
Nuclear medicine (PET and SPECT).
Magnetic resonance imaging (MRI).
Ultrasonic imaging.
Optical coherence tomography (COT).
Image contrast and image processing.
- Class Schedule:** Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.
- Computer Usage:** MATLAB may be required to perform imaging reconstruction problems in homework.

Laboratory Projects:

Professional Component: Contributes toward the Biomedical Engineering Topics and Major Design experience.

Design Content Description

- Approach:** Students will be given a set of pathological conditions and asked to identify the appropriate imaging modality that has the best chance to diagnose the pathological condition. Factors to be considered include spatial resolution, contrast, signal to noise ratio, contrast to noise ratio, and costs. (20%)
- Lectures:** Lectures will cover the fundamental principles of various imaging modalities, including image contrast, resolution, and signal-to-noise ratio. (80%)
- Laboratory Portion:** 0%

Grading Criteria:

Weekly homework problems:	30%
Midterm exam:	30%
Final:	<u>40%</u>
	100%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%
Engineering Science: 3 credit units or 75%
Engineering Design: 1 credit units or 25%

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CEP Approved: Winter 2006