EE 582 - Medical Imaging – 3 hours
(Cross listed with ME 582)

Elective course

1. 2007-2008 Catalog description

Introduction to the common methods and devices employed for medical imaging, including conventional x-ray imaging, x-ray computed tomography (CT), nuclear medicine (single photon planar imaging, single photon emission computed tomography (SPECT), and positron emission tomography (PET), magnetic resonance imaging (MRI), and ultrasound imaging. The physics and design of systems, typical applications, medical image processing, and tomographic reconstruction. Cross-listed as ME 582. Prerequisite: senior standing in engineering or consent of instructor.

2. Prerequisites by topics

Univeristy physics

3. Textbook

Medical Imaging: Signals and Systems, Jerry L. Prince and Jonathan M. Links, Pearson Prentice Hall Bioengineering, ISBN 0-13-065353-5, 2006

4. Class schedule

Two 75 minute lectures per week for 14 weeks

5. Topics covered (Course outcomes influenced)

- Physics of x-rays and gamma-rays (7a)
  Production
  Interaction
  Transport
- Biological effects of ionizing radiation (7a,b)
- Detection of x-rays and gamma-rays (7a)
- Image formation (7a,c)
- Planar x-ray imaging (7a,c)
- Tomographic reconstruction (7a,b,c)
  Radon transform
  Filtered backprojection
- Computed Tomography (7a,b,c)
- Anger Camera (7a,c)
- Planar gamma-ray imaging (7a,c)
- Single photon emission computed tomography (SPECT) (7a,c)
- Positron emission tomography (PET) (7a,c)
- MRI physics (7a)
- MRI imaging (7c)
- MR spectroscopy (7c)
- Ultrasound physics (7a)
- Ultrasound imaging (7c)

6. *Contribution of course to meeting the professional component*

Engineering science - 100%

7. Course Outcomes (Program Outcome contributions): In learning the course topics, the student will attain the following outcomes.

a. The student will learn the physics of x-ray and gamma-ray production and interactions, image formation, and image manipulation. (9A,D)
b. The student will learn medical topics such as anatomy, physiology, and disease processes as they relate to medical imaging. (9A,D)
c. The student will use their knowledge of physics and engineering to understand the design of systems to accomplish medical imaging tasks. (9A,B,D,G)

8. Grading policy: The degree to which students attain the course outcomes is determined by the following grading policy. The graded deliverables are homework, a midterm exam and a final exam. Homework counts for 35%, the midterm is 25%, and the final is 40% of the total grade. Homework is expected to be completed by the assigned date and is qualitatively evaluated on the basis of approach and work performed.

9. *Relationship of course to program outcomes*

label	Program Objective (A graduate from the program will)	Contribution
A	demonstrate knowledge of the mathematical and scientific foundation of electrical engineering.	Strong
B	demonstrate knowledge of and the ability to apply techniques and technology of electrical engineering.	Moderate
C	complete a design project sequence, culminating in a capstone project at or near the professional level.	Foundational
D	understand that acquisition of new knowledge is needed for success in the electrical engineering profession.	Strong
E	meet Bradley's general education requirements which are based on the principles of liberal education.	NA
F	have experience in communicating technical information and working on teams.	Foundational
G	understand the importance of professional and ethical behavior.	Moderate

10. Prepared by: *Dr. John C. Engdahl 5/2/08 and Brian Huggins 6/19/08*