BME 4703/6703 – Medical Imaging

Course Description
Overview of the various methods used in generating images in medicine. Basic principles of the image-forming process and the physical properties of the resultant image are discussed.

Undergraduate/Graduate level – 4 credit hours.
BME4703R/6703R Corequisite

* Graduate students are graded on a more rigorous grading scheme. Undergraduate students will be graded on a curve, while graduate students will not.

Course Learning Objectives
Students will be able to describe the image-forming process of the various medical imaging modalities and interpret the physical meaning of the numbers represented in the image matrix.

Course Learning Outcomes
Upon successful completion of this course, students can
describe the image-forming process of the various medical imaging modalities and interpret the physical meaning of the numbers represented in the image matrix.

Tentative Weekly Schedule

Week 1	Intro, Radioisotopes, Radioisotope Spectra, Decay Equation; X-Ray Tube, X-Ray Tube Spectra
Week 2	Photon Attenuation: Attenuation Law, Attenuation Coefficient, Beam Hardening
Week 3	Radiation Exposure, Dose, Biological Effects of Radiation
Week 4	Inverse Square Law, Photon Counting Statistics; Radiography: Film, Characteristic Curve
Week 5	Radiography: Digital Radiography, Fluoroscopy, Grids; Image Quality: Resolution, Contrast, Noise
Week 6	Image Quality: Influencing Factors; Exam I
Week 7	CT: Principles of Tomography, Reconstruction from Projections, Filtered Back projection, Scanner Generations
Week 8	CT: Image Matrix, Units, Factors Impacting Projections
Week 9	Nuclear Instrumentation: Gamma Camera, Nuclear Imaging: Emission Computed Tomography
Week 10	Optical Imaging: Optical Imaging Contrasts, Light Interaction with Living Tissue
Week 11	Exam II; Optical Imaging: Techniques and Instrumentation
Week 12	Principles of Nuclear Magnetic Resonance; NMR: Longitudinal and Transverse Relaxation
Week 13	MRI: Pulse Sequences, Spatial Encoding; MRI: Imaging Parameters
Week 14	Ultrasound: US Waves, Interaction of US with Matter, Doppler Effect, US Instrumentation
Week 15	Exam III