COURSE #: NERS 481; **CREDITS:** 2/Elective	**COURSE TITLE:** Engineering Principles of Radiation Imaging
TERMS OFFERED: Winter	**For each prerequisite below, "E" denotes Enforced and "A" denotes Advised.**
TEXTBOOKS/REQUIRED MATERIAL: None	**PREREQUISITES:** None
INSTRUCTOR(S): Michael Flynn	**COGNIZANT FACULTY:** Flynn
CoE BULLETIN DESCRIPTION: Analytic description of radiation production transport and detection in radiation imaging systems. Measurements methods for image quality and statistical performance of observers. Systems for radiographic and radioisotope imaging, including film/screen, storage phosphor, and electronic radiography, fluoroscopy, computed tomography, Anger camera, and PET systems. Emphasis on impact of random process on observer detection.	**COURSE TOPICS:** Digital X-ray imaging systems. Cameras for radioisotope imaging. Emission and transmission tomography. Statistical analysis of image properties.
COURSE STRUCTURE/SCHEDULE Lecture: 1 per week @ 110 minutes	
COURSE OBJECTIVES For each Course Objective, links to the Program Educational Objectives are shown	1. To teach students the fundamental aspects of imaging with ionizing radiation [1,2] 2. To show the direct application of radiation physics and detectors to various aspects of medical imaging [1,2] 3. To explore the different methods of producing radiation and radioisotopes for medical uses [1,2] 4. To teach the analytical aspects of image formation and analysis [1,2] 5. To introduce definitions of image quality and resolution [1,2] 6. To explain how photon statistics limit image quality and how noise propagates in radiation imaging detectors[1,2] 7. To teach the basics of tomographic reconstruction methods [1,2] 8. To introduce students to concepts of image display and observer performance [1,2]
COURSE OUTCOMES For each Course Outcome, links to The Program/ABET Student Outcomes are shown [#,a-k]	Links shown in brackets are to course objectives: 1. Produce analytical descriptions of radiation transport and detection in imaging systems [1,2,3|ABET a,k,e] 2. Elucidate the relative strengths and weakness of standard radiation detection approaches in radiation imaging [2|ABET k] 3. Apply measurements methods for image quality and statistical performance of observers [2,3|ABET k,e] 4. Demonstrate knowledge of the commonalities and differences of imaging systems including film/screen, storage phosphor, fluoroscopy computed tomography, gamma camera, and PET systems [2|ABET k] 5. Show proficiency with line spread functions, modulation transfer functions, and noise power spectrum, and with their methods of measurement [2|ABET k] 6. Show knowledge of radiographic image formation by a projection line integral and the definition of subject contrast [2|ABET k] 7. Show how the noise properties of a radiation imaging detector can be analytically computed [2|ABET k] 8. Apply tomographic reconstruction methods and indicate their areas of applicability [2|ABET k] 9. Understand the statistical performance of observers in identifying targets in image noise, and the measurement of Receiver Operating Characteristics (ROC) [2|ABET k]

COURSE OUTCOMES For each Course Outcome, links to The Program/ABET Student Outcomes are shown [#,a-k]	1. Midterm and final examinations will evaluate student mastery of all outcomes 2. Course evaluations by students at the end of the course provide feedback on all outcomes 3. Faculty self-assessment provides self-assessment data on all outcomes.

Revision History: September, 1998; December; 2003, July 2006