<table>
<thead>
<tr>
<th>COURSE #: NERS 481; CREDITS: 2/Elective</th>
<th>COURSE TITLE: Engineering Principles of Radiation Imaging</th>
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<tbody>
<tr>
<td>TERMS OFFERED: Winter</td>
<td>For each prerequisite below, “E” denotes Enforced and “A” denotes Advised.</td>
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<tr>
<td>TEXTBOOKS/REQUIRED MATERIAL: None</td>
<td>PREREQUISITES: None</td>
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<td>INSTRUCTOR(S): Michael Flynn</td>
<td>COGNIZANT FACULTY: Flynn</td>
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**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]

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]
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<td>For each Course Outcome, links to The Program/ABET Student Outcomes are shown [#a-k]</td>
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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