COURSE OUTLINE

Course Number	Course Title	Credits
RAD119	**Principles of Imaging Science I**	**2**
Hours: Lecture/Lab/Other	**Co- or Pre-requisite** **Formal acceptance into professional phase of Radiography program** **Co-requisites: RAD102, RAD127**	**Implementation Semester & Year**
2		**Fall 2025**

Catalog description:

The fundamental principles of Principles of Imaging Science I are discussed including the atom, electromagnetic radiation, x-ray tube components and x-ray production. Imaging Science principles including the primary factors of technique formation and the art of film critique are presented. Clinical application of these principles is discussed.

General Education Category:
Not GenEd

Course coordinator:
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Course Instructor: Deborah Greer, 609-570-3341, greerd@mccc.edu

Required texts & Other materials:

Title: Radiologic Science for Technologists
Author: S. Bushong
Publisher: Elsevier Mosby
Edition: 13th

Title: Digital Radiography and PACS
Author: C. Carter
Publisher: Elsevier
Edition: 5th

RADTECH BOOTCAMP Online Software
https://www.radtechbootcamp.com/

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. Explain the fundamental principles of radiation and identify clinical applications of the principles. [Supports ILG # 3]
2. Compare the electromagnetic radiations that exist in the electromagnetic spectrum, summarize their properties and relevance to radiography. [Supports ILG # 2, 3]
3. Differentiate among the variety of x-ray equipment used in modern radiology departments. [Supports ILG # 2, 3]
4. Develop an understanding of the control panel settings that activate the component parts of the x-ray imaging system; describe safe operation to ensure equipment longevity. [Supports ILG # 2, 3, 11]
5. Differentiate between the types of x-ray production; apply the concepts to imaging patients. [Supports ILG # 2, 3, 11]
6. Analyze the relationship of factors that control and affect image quality, patient radiation dose and correlate to image processing. [Supports ILG # 2, 3, 9, 11]
7. Develop an understanding of the basic manifestations of pathological conditions, correlate x-ray quantity and quality to imaging patients with active disease. [Supports ILG # 2, 3, 9, 11]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Institutional Learning Goal 9. Ethical Reasoning and Action. Students will understand ethical frameworks, issues, and situations.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Units of study in detail – Unit Student Learning Outcomes:

Unit I Radiation Physics Principles [Supports Course SLO #1]

Learning Objectives

The student will be able to:

- Differentiate between the Thomson, Rutherford and Bohr atoms
- Identify the fundamental particles of an atom.
- Describe electron arrangement.
- Differentiate between isobars, isotones and isotopes.
- Interpret the periodic table of elements.

Unit II - III Electromagnetic Radiation [Supports Course SLO #2]

Learning Objectives

The student will be able to:

- Describe the photon.
- Differentiate between velocity, amplitude, frequency and wavelength.
- Describe the electromagnetic spectrum and its application to radiography.
- Define the terms radiolucent and radiopaque and discuss its application to radiography.
- Describe and calculate the inverse square law.

Unit IV - VI X-ray Tube and Equipment [Supports Course SLOs #3, 4]

Learning Objectives

The student will be able to:

- Identify the x-ray equipment used in a diagnostic radiology department.
- Describe table, tube support ancillary equipment configurations.
- Identify the components of the x-ray tube and describe the function of each.
- Discuss thermionic emission.
- Describe the characteristics of the cathode and anode.
- Describe the construction of the protective housing.
- Explain the line focus principle and anode heel effect.
- Apply the anode heel effect to diagnostic radiographic procedures.
- Interpret tube rating charts, anode cooling and housing cooling curves.
- Calculate heat units.

Unit VII – VIII X-ray Production, Emission and Filtration [Supports Course SLOs #5, 6]

Learning Objectives

The student will be able to:

- Describe bremsstrahlung and characteristic x-ray production.
- Describe the discrete and continuous x-ray spectrum.
- Plot characteristic and bremsstrahlung radiation using a continuous and bar graph.
- Differentiate between x-ray quantity and quality.
- Identify the factors which affect the emission spectra.
- State the purpose of filtration.
- Define half-value layer (HVL).
- Calculate HVL given problems.

Unit IX – XI Radiographic Technique and Attenuation [Supports Course SLOs #5, 6]

Learning Objectives

The student will be able to:

- Define radiographic density.
- Analyze relationships of factors affecting radiographic density.
- Identify the controlling factors of density.
- Analyze radiographs for density adequacy.
- Define radiographic contrast.
- Analyze relationship of factors affecting radiographic contrast.

- Describe the controlling factor of contrast.
- Analyze radiographs for contrast adequacy.
- Differentiate between long scale and short scale contrast.
- Identify the factors that affect x-ray beam attenuation.

Unit XII Scatter Radiation and Basic Pathology [Supports Course SLO #7]

Learning Objectives

The student will be able to:

- Explain the relationship between kVp and scattered radiation.
- Identify the factors that affect scatter radiation production.
- Explain the purpose and construction of beam restricting devices.
- Differentiate between the various beam restricting devices and discuss their effect on image quality.
- Describe the effect of beam restriction on patient dose.
- Identify the effects of various pathological conditions on photon absorption and image quality.

Unit XIII - XIV Digital Radiography & Picture Archiving and Communication System (PACS) [Supports Course SLOs #3, 6]

Learning Objectives

The student will be able to:

- Define digital imaging terminology
- Describe the detectors used in image acquisition
- Compare the exposure indicators for digital imaging systems
- Indicate the relationship of digital imaging and PACS

Evaluation of student learning:

A grade of "C+" (77%) or higher must be achieved in the course to progress to RAD120 and RAD128. The following grading policy will be utilized:

- **Examinations: 65%**
- **RADTECH Boot Camp 5%**
- **Final Examination 30%**