

**RADT 63A Course Outline as of Fall 2018****CATALOG INFORMATION**

Dept and Nbr: RADT 63A Title: RAD PHYSICS/IMAGING SYST

Full Title: Radiation Physics and Medical Imaging Systems

Last Reviewed: 9/25/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00

Total Student Learning Hours: 157.50

Title 5 Category: AA Degree Applicable

Grading: Grade Only

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

**Catalog Description:**

Digital aspects of radiography, principles of radiographic exposure and formulation of radiographic technique. Principles of general and applied physics, electromagnetics, digital imaging, electrostatics, x-ray tube quality control, radiologic equipment and accessories, and imaging equipment and accessories.

**Prerequisites/Corequisites:**

Course Completion of RADT 61A and Concurrent Enrollment in RADT 61B and RADT 71B

**Recommended Preparation:****Limits on Enrollment:**

Acceptance in program

**Schedule of Classes Information:**

Description: Digital aspects of radiography, principles of radiographic exposure and formulation of radiographic technique. Principles of general and applied physics, electromagnetics, digital imaging, electrostatics, x-ray tube quality control, radiologic equipment and accessories, and imaging equipment and accessories. (Grade Only)

Prerequisites/Corequisites: Course Completion of RADT 61A and Concurrent Enrollment in

RADT 61B and RADT 71B

Recommended:

Limits on Enrollment: Acceptance in program

Transfer Credit: CSU;

Repeatability: Two Repeats if Grade was D, F, NC, or NP

### **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

**AS Degree:**      **Area**      Effective:      Inactive:

**CSU GE:**      **Transfer Area**      Effective:      Inactive:

**IGETC:**      **Transfer Area**      Effective:      Inactive:

**CSU Transfer:** Transferable      Effective:      Fall 1981      Inactive:

**UC Transfer:**      Effective:      Inactive:

**CID:**

**Certificate/Major Applicable:**

Both Certificate and Major Applicable

### **COURSE CONTENT**

**Student Learning Outcomes:**

At the conclusion of this course, the student should be able to:

1. Evaluate the performance of digital radiographic systems.
2. Apply principles of radiation physics in the practice of general radiology.
3. Process and manipulate radiographic images for diagnostic quality.

**Objectives:**

At the conclusion of this course, the student should be able to:

1. Explain principles of general and applied physics as they apply to radiologic technology.
2. Explain the use of radiographic equipment and accessories.
3. Describe the laws of electrostatics and their application to radiologic technology critical for patients.
4. Identify the components of computed and digital radiography systems.
5. Identify problem-solving remedies to digital readers.
6. Demonstrate accurate use of radiographic technique.
7. Explain electromagnetism and its implication in medical imaging.
8. Demonstrate quality control techniques in image processing and equipment.
9. List important components of a digital imaging system.
10. Identify steps of processing, manipulation, and archiving of digital images.
11. Explain the relationship between the radiation exposure and sensitivity index of image receptors.

**Topics and Scope:**

I. Fundamental Units

A. Length

B. Mass

- C. Time
- II. Derived Units
  - A. Area
  - B. Volume
  - C. Density
  - D. Temperature
- III. Systems of Measurement
  - A. Conventional
  - B. Metric/International System of units (SI)
- IV. Electrostatics and Electromagnetism
  - A. Charge
  - B. Field
  - C. Applications
- V. Radiographic Technique
  - A. Kilovoltage
  - B. Milliamperage
  - C. Time
  - D. Phototiming
  - E. Technique charts
    - 1. Fixed kVp (kilovoltage peak)
    - 2. Variable kVp
- VI. X-Ray Production
  - A. Source of free electrons
  - B. Acceleration of electrons
  - C. Focusing of electrons
  - D. Deceleration of electrons
- VII. Target Interactions
  - A. Bremsstrahlung
  - B. Characteristic
- VIII. X-Ray Beam
  - A. Frequency and wavelength
  - B. Beam characteristics
    - 1. Quality
    - 2. Quantity
    - 3. Primary vs. remnant
  - C. Inverse square law
  - D. Fundamental properties
- IX. Photon Interactions with Matter
  - A. Compton
  - B. Photoelectric
  - C. Coherent scatter
  - D. Attenuation by various tissues
- X. Imaging Equipment
  - A. Operating console
  - B. X-Ray tube construction
  - C. Automatic exposure control
  - D. Manual exposure controls
  - E. Beam restriction
  - F. X-Ray circuitry
    - 1. Generator
    - 2. Transformer
    - 3. Rectification

## G. Fluoroscopic unit

1. Image Receptor
  - a. Image intensifiers
  - b. Flat panel
2. Viewing systems
3. Recording systems
4. Automatic brightness control
5. Magnification mode

## H. Components of digital imaging

1. Computed Radiography (CR) Components
2. Direct Digital Radiography (DR) Components

## XI. Image Processing and Display

- A. Raw data
- B. Corrected data
- C. Data for display
- D. Post processing
- E. Display monitors
- F. Imaging Informatics
  1. Digital Imaging Communication in Medicine (DICOM)
  2. Picture Archive Communication System (PACS)
  3. Radiology Information System (RIS) / Hospital Information System (HIS)
  4. Electronic Medical Record (EMR) / Electronic Health Record (EHR)

## XII. Criteria for Image Evaluation

- A. Exposure indicator/s-value
- B. Quantum mottle
- C. Exposure error
- D. Contrast resolution
- E. Spatial resolution
- F. Distortion
- G. Identification markers
- H. Image artifacts
- I. Radiation fog

## XIII. Quality Control of Imaging Equipment

- A. Beam restriction
- B. Recognition of malfunctions
- C. Digital receptors
  1. Maintenance
  2. QC tests
  3. Display monitor quality assurance
- D. Shielding accessories - lead apron and glove testing

## XIV. Digital Imaging Characteristics

- A. Spatial resolution
  1. Pixels
  2. Detector elements
  3. Matrix size
  4. Sampling frequency
- B. Contrast resolution
- C. Image signal
  1. Dynamic range
  2. Quantum noise
  3. Signal to noise ratio
  4. Contrast to noise ratio

## XV. Radiographic Accessories

- A. Grids
- B. Cones
- C. Screens/film
- D. Shielding
- E. Computed radiography image receptors
- F. Direct digital radiography image receptors

## XVI. Units of Measurements

- A. Gray
- B. Sievert
- C. Roentgen
- D. Kerma
- E. Rad
- F. Conversion factors

## Lab:

## XVII. Laboratory Experiments

- A. Manipulation of radiographic exposure
  - 1. mAs
  - 2. kVp
  - 3. Source Image Receptor Difference (SID)
  - 4. Time
  - 5. Focal spot
  - 6. Object Image Receptor Difference (OID)
- B. Adjusting kVp to improve density, contrast and resolution
- C. Adjusting mAs to improve density, contrast and resolution
- D. Inverse square law
- E. mAs-distance conversions
- F. Spatial resolution
  - 1. SID
  - 2. OID
  - 3. Focal Spot
- G. Magnification
- H. Distortion
- I. Grids
- J. Collimation
- K. Control of scatter radiation

## **Assignment:**

### Lecture Assignments:

- 1. Participation in class discussion
- 2. Weekly chapter reading (10-40 pages/week)
- 3. Quizzes (8 - 12), one mid-term and one written final

### Lab Assignments:

- 1. Complete weekly lab reports on x-ray circuitry, x-ray production, x-ray emission, technique factor manipulation and image quality
- 2. Completion of a technique chart project
- 3. One final lab exam
- 4. Weekly chapter assignments

## Methods of Evaluation/Basis of Grade:

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab reports, weekly chapter assignments

Writing  
0 - 10%

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Technique chart project

Problem solving  
10 - 20%

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab final exam

Skill Demonstrations  
10 - 20%

**Exams:** All forms of formal testing, other than skill performance exams.

Quizzes, mid-term, final exam

Exams  
70 - 80%

**Other:** Includes any assessment tools that do not logically fit into the above categories.

Participation

Other Category  
0 - 5%

## Representative Textbooks and Materials:

Radiologic Science for Technologists. 11th ed. Bushong, Stewart. Mosby. 2016

Radiographic Imagery and Exposure. 5th ed. Fauber, Terri. Mosby. 2016

Instructor-prepared materials