RADT 63A Course Outline as of Fall 2024

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:
In this course, students will learn digital aspects of radiography, principles of radiographic exposure and formulation of radiographic technique, including 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

Recommended Preparation:

Limits on Enrollment:
Acceptance to Program

Schedule of Classes Information:
Description: In this course, students will learn digital aspects of radiography, principles of radiographic exposure and formulation of radiographic technique, including 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

Recommended:
Limits on Enrollment: Acceptance to 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 and radiation protection.
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 (QC) 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 (milliampere-seconds)
  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-Related Assignments:
1. Participation in class discussion
2. Weekly chapter reading (10-40 pages/week)
3. Quizzes (8-12), mid-term exam (1), and written final exam (1)

Lab-Related 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. Final lab exam (1)
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.

Final lab exam	Skill Demonstrations 10 - 20%

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

Quizzes, mid-term exam, and written 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. 12th ed. Bushong, Stewart. Mosby. 2021.
Radiographic Imagery and Exposure. 6th ed. Fauber, Terri. Mosby. 2021.
Instructor-prepared materials