



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	RTEC
Course Number:	111
Descriptive Title:	Fundamentals of Radiologic Technology
Division:	Health Sciences and Athletics
Department:	Radiologic Technology
Course Disciplines:	Radiologic Technology
Catalog Description:	This course is a combination of lab and lecture that explores the basic concepts and theories of radiologic science, technology, equipment, and physics in the field of radiology. The course content includes the study of matter, varying forms of energy, and different forms of radiation in radiology. Students will learn all of the essential equipment, how it functions, and proper-safe use in radiologic technology. The lab component of the course further reinforces the concepts taught in the didactic course.
Prerequisite:	Radiologic Technology A with a minimum grade of C
Co-requisite:	Radiologic Technology 106 AND Radiologic Technology 123
Recommended Preparation:	
Enrollment Limitation:	Admission to the Radiologic Technology Program
Hours Lecture (per week):	3
Hours Laboratory (per week):	3
Outside Study Hours:	6
Total Course Hours:	108
Course Units:	4
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	03/15/1999
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	
Term:	
Other:	

<p>Student Learning Outcomes:</p>	<p>SLO #1 Exposure Factors</p> <p>Students will evaluate how exposure factors selected by the technologist can affect radiographic quality, density and contrast on a radiographic image.</p> <p>SLO #2 Control of Scatter</p> <p>Students will assess various methods to control scatter radiation.</p> <p>SLO #3 Equipment Manipulations</p> <p>Students will analyze radiographic images for diagnostic quality contrast, density and recorded detail. The student will be able to make appropriate adjustments of the x-ray equipment to correct any errors with the image.</p>
<p>Course Objectives:</p>	<ol style="list-style-type: none"> 1. Describe the physical concepts of energy and the basic structure of matter, the principles of x-ray production, the relationship of x-ray photon interaction with matter and the effects of radiation exposure produced in humans. Formulate appropriate radiographic exposure factors and select correct factors on an x-ray machine control panel to produce radiographic images using radiographic phantoms. 2. Identify, label and describe the function of the equipment used in radiography such as; an x-ray tube, the x-ray circuit, image receptors (film based and digital) , digital image (direct and indirect capture) processing equipment, a film processor and darkroom equipment. Demonstrate safe manipulation and operation of radiographic equipment. 3. Compare and contrast how radiographic images are acquired, processed, viewed and archived using screen/film, computerized and digital radiography systems. 4. List the x-ray exposure factors that are controlled by a technologist and evaluate how these factors can affect radiographic quality, density and contrast (subject and film contrast) on a radiographic image. Calculate the new kilovoltage peak or milliamperage-seconds needed to maintain density when other technical factors change. Produce images that demonstrate the effects of changes in kilovoltage, milliamperage, filtration, distance, and the anode heel effect on x-ray output exposure, density and contrast, using radiographic phantoms, stepwedge devices, and ionization chambers. 5. Demonstrate the proper use of radiographic equipment and accessory items to produce high quality radiographs, such as computerized processing, digital imaging, image display, and radiation protection techniques. Compare and contrast how proper use of these devices and processing can influence the outcome image and patient dose. 6. Perform experiments to demonstrate collimation changes and control of scatter radiation and accuracy (field size accuracy, X-ray/light-field congruence) and the effects of collimation on radiation protection and patient dose. Compare and contrast beam restriction with post processing electronic shuttering. 7. Define recorded detail and distortion and their effects on image quality. Produce radiographic images demonstrating changes in; source and subject image receptor distance, factors that influence image sharpness (penumbra), focal spot size, motion, magnification and distortion. 8. State the inverse square law, calculate and demonstrate exposure changes with a given distance change using a radiographic phantom and step-wedge in the lab.

	<ol style="list-style-type: none"> 9. Describe picture archiving and communication systems (PACS), digital imaging and communications in medicine (DICOM) and teleradiography and their function in digital imaging. 10. Differentiate how brightness and contrast, window leveling and window width influence radiographic images displayed on a computer monitor. Compare and contrast film and digital cassette exposures to quality images and patient dose. 11. Classify the units of radiation and measurement, then explain and demonstrate the use of devices to detect and measure radiation using an ionization chamber and radiographic phantom. 12. Differentiate between the various advisory groups and regulatory agencies involved in developing radiation protections standards. Correlate the protection standards set by the regulatory agencies to the standard practices of radiation safety for the patients, technologists and other medical staff. 13. Perform additional experiments, using phantoms and accessories, to illustrate various types of: grids and grid errors, air gap technique and other quality control and equipment testing.
<p>Major Topics:</p>	<p>I. Radiologic Physics (4 hours, lecture)</p> <ol style="list-style-type: none"> A. Essential concepts of Radiology B. The Structure of matter C. Electromagnetic Energy D. Electricity, magnetism, and electromagnetism <p>II. X-Radiation (9 hours, lecture)</p> <ol style="list-style-type: none"> A. The x-ray imaging system B. The x-ray tube C. X-ray production D. X-ray emission E. X-ray interaction with matter <p>III. LAB for X-Radiation (15 hours, lab)</p> <ol style="list-style-type: none"> A. The x-ray imaging system B. The x-ray tube C. X-ray production D. X-ray emission E. X-ray interaction with matter <p>IV. The Radiographic Image (6 hours, lecture)</p> <ol style="list-style-type: none"> A. Radiographic image quality

- B. Control of scatter radiation
- C. Developing radiographic technique
- D. Identify artifacts
- E. Quality control experiments for equipment accuracy

V. LAB for The Radiographic Image (12 hours, lab)

- A. Radiographic image quality
- B. Control of scatter radiation
- C. Developing radiographic technique
- D. Identify artifacts
- E. Quality control experiments for equipment accuracy

VI. The Digital Radiographic Image (12 hours, lecture)

- A. Computers in medical imaging
- B. Computed Radiography
- C. Digital Radiography
- D. Digital radiographic technique
- E. Viewing the Digital Radiographic image
- F. Digital Radiographic artifacts
- G. Digital radiographic quality control

VII. LAB for The Digital Radiographic Image (15 hours, lab)

- A. Computers in medical imaging
- B. Computed Radiography
- C. Digital Radiography
- D. Digital radiographic technique
- E. Viewing the Digital Radiographic image
- F. Digital Radiographic artifacts

VIII. Other Imaging (3 hours, lecture)

A. Fluoroscopy

B. Digital Fluoroscopy

IX. Radiobiology (8 hours, lecture)

A. Overview of cell biology

B. Principles of radiobiology

C. Molecular and cellular radiobiology

D. Early and late deterministic effects of radiation

E. Stochastic effects of radiation

X. Radiation Protection (9 hours, lecture)

A. Health Physics

B. Equipment design for radiation protection

C. Patient radiation dose management

1. ALARA (As low as reasonably achievable)

2. Cardinal Rules of Radiation Protection

D. Occupational radiation dose management

1. ALARA (As low as reasonably achievable)

2. Cardinal Rules of Radiation Protection

E. Radiation quantities and units

F. Radiation monitoring

1. Dose limits

2. Types of radiation monitoring devices

XI. LAB for Radiation Protection (12 hours, lab)

A. Equipment design for radiation protection

B. Patient radiation dose management

1. ALARA (As low as reasonably achievable)

2. Cardinal Rules of Radiation Protection

C. Occupational radiation dose management

	<ol style="list-style-type: none"> 1. ALARA (As low as reasonably achievable) 2. Cardinal Rules of Radiation Protection <p>D. Radiation quantities and units</p> <p>E. Radiation monitoring</p> <ol style="list-style-type: none"> 1. Dose limits 2. Types of radiation monitoring devices <p>XII. Radiation Laws and Regulations (3 hours, lecture)</p> <p>A. NCRP: National Council of Radiation Protection and Measurement</p> <p>B. NRC: Nuclear Regulatory Committee</p> <p>C. CDPH: California Department of Public Health</p> <ol style="list-style-type: none"> 1. RHB: Radiologic Health Branch <p>D. ARRT: American Registry of Radiologic Technologists</p> <p>E. ASRT: American Society of Radiologic Technologists</p>
Total Lecture Hours:	54
Total Laboratory Hours:	54
Total Hours:	108
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	The technique used for a hand was 100 ma, 0.1s, 55 kvp, computer radiography cassette and the image had to be repeated because the patient moved. What will your NEW technique (ma, time, and kvp) be to obtain the same optical density as your first radiograph without motion?
Critical Thinking Assignment 1:	In a brief written statement, critique the displayed radiograph for appropriate contrast and density. If you determine the radiograph needs adjustment, explain which technical factors you would change.
Critical Thinking Assignment 2:	Demonstrate in the lab how you would properly set up the imaging equipment for an immobilized trauma patient for a lateral projection of the knee. Without moving the phantom, maintain the proper distance, tube and cassette alignment, collimation, and marker placement.
Other Evaluation Methods:	Class Performance, Completion, Homework Problems, Laboratory Reports, Matching Items, Multiple Choice, Objective Exam, Other Exams, Performance Exams, Presentation, Quizzes, Reading Reports, Term or Other Papers, True/False, Written Homework
Instructional Methods:	Demonstration, Discussion, Group Activities, Lab, Lecture, Multimedia presentations, Other (specify), Role play/simulation
If other:	

Work Outside of Class:	Answer questions, Journal (done on a continuing basis throughout the semester), Problem solving activity, Required reading, Skill practice, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Texts:	<u>Principles of Radiographic Imaging, by Carlton</u> 6th ed 2020 <u>Radiation Protection In Medical Radiography</u> 8th ed. by Statkiewicz et all 2022 <u>Digital Imaging & Pacs</u> by Carter & Vealé, 2023 4 th Edition
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Prerequisite: Radiologic Technology A with a minimum grade of C Corequisite: Radiologic Technology 106 AND Radiologic Technology 123
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	<p>Compare and contrast how radiographic images are acquired, processed, viewed and archived using screen/film, computerized and direct digital radiography systems. RTEC A - Describe picture archiving and communication systems (PACS), digital imaging and communications in medicine (DICOM) and teleradiography and their function in digital imaging and distinguish between the fundamentals of direct and indirect capture. RTEC 106 - Identify and manipulate various radiographic equipment found in the radiographic suite. RTEC 106 - List the ordered sequence in the retrieval of radiographic images in storage. RTEC 123 - Demonstrate the proper use of radiographic equipment and perform radiographic procedures using the energized laboratory and phantoms.</p> <p>Perform experiments to demonstrate collimation changes and control of scatter radiation and accuracy (field size accuracy, X-ray/light-field congruence) and the effects of collimation on radiation protection and patient dose. Compare and contrast beam restriction with post processing electronic shuttering. RTEC 106 - Demonstrate knowledge of radiation protection and application principles of patients, self and staff. RTEC A - Compare and contrast how radiographic images are acquired, processed and viewed with film/screen and digital radiography systems. RTEC 123 - Identify standard radiographic positions and perform radiographic procedures and the proper use of radiographic equipment using the energized laboratory and phantoms. RTEC A - Analyze the relationship of radiographic exposure and as low as reasonably achievable (ALARA) to the direct and indirect biologic effects on humans.</p> <p>Differentiate between the various advisory groups and regulatory agencies involved in developing radiation protections standards. Correlate the protection standards set by the regulatory agencies to the standard practices of radiation safety for the patients, technologists and other medical staff. RTEC 106 - Demonstrate knowledge of radiation protection and application principles of patients, self and staff. RTEC 123 - Describe the practice standards for the radiographer as defined by the</p>

	American Society of Radiologic Technologist (ASRT). RTEC A - Classify the units of radiation and measurement, and discuss the safety precautions used for technologists and patients.
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Enrollment Limitations and Category:	Admission to the Radiologic Technology Program
Enrollment Limitations Impact:	Student must be admitted to the Radiologic Technology Program before they begin taking courses required for the major.
Course Created by:	Donald J. Visintainer
Date:	01/01/1970
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Eric Villa
Date:	02/14/2024
Last Board Approval Date:	05/20/2024
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