

RADT-2402: IMAGING SYSTEMS

Cuyahoga Community College

Viewing: RADT-2402 : Imaging Systems

Board of Trustees:

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Academic Term:

Fall 2026

Subject Code

RADT - Radiography

Course Number:

2402

Title:

Imaging Systems

Catalog Description:

Presentation of imaging systems and imaging modalities. Topics include conventional and digital fluoroscopy, image intensification, interventional radiography, computerized tomography, magnetic resonance imaging, mammography, bone densitometry, sonography, nuclear medicine, radiation therapy, pharmacology and cross-sectional anatomy.

Credit Hour(s):

3

Lecture Hour(s):

3

Requisites

Prerequisite and Corequisite

RADT-1352 Digital Image Acquisition and Evaluation or concurrent enrollment; or departmental approval

Outcomes

Course Outcome(s):

Demonstrate competency in information literacy required for effective documentation and communication in the clinical environment.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify how patient medical information is stored in and queried from hospital information systems.
2. Classify patient informed consent forms.
3. Demonstrate effective communication through patient education and explanation of imaging procedures.
4. Demonstrate competency in taking a patient history.
5. Critique orders, requests and diagnostic reports.

Course Outcome(s):

Describe the role of pharmacology, contrast media and venipuncture in medical imaging.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Distinguish between the chemical, generic and trade names of various drugs.
2. Describe pharmacokinetic, pharmacodynamic and pharmacogenetic principles of drugs.
3. Describe the use and impact on the patient of different categories of drugs.
4. Define categories of contrast agents and give specific examples for each category.
5. Explain the pharmacology of contrast agents.
6. Describe the methods and techniques for administering various types of contrast agents.
7. Identify and describe the routes of drug administration.
8. Demonstrate appropriate venipuncture technique in the laboratory environment through simulation.
9. Differentiate between the two major sites of intravenous drug administration.
10. Identify, describe and document complications associated with venipuncture and the appropriate actions to resolve these complications.
11. Discuss the steps of initiating and discontinuing intravenous access.
12. Differentiate and document dose calculations for adult and pediatric populations.
13. Prepare for injection of contrast agents or intravenous medications using aseptic technique.
14. Explain the current legal status and professional liability issues of the radiographer's role in contrast and drug administration.
15. Describe basic drug categories relevant to medical imaging including uses, side effects and impact on imaging studies.
16. State the six rights of drug safety.

Course Outcome(s):

Explain the principles and application of Conventional and Digital Fluoroscopy/Recording Systems.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Differentiate fluoroscopic examinations from static diagnostic radiographic examinations.
2. Summarize the uses of dynamic and static fluoroscopic recording systems.
3. Explain the general purpose and functioning of image-intensified and digital fluoroscopy.
4. Explain the advantages of a digital fluoroscopy system and flat panel image receptors (FPIR).
5. Explain pixel size in digital fluoroscopy.
6. Calculate flux gain, minification gain and brightness gain as they relate to image intensification.
7. Identify basic anatomy and structures seen on fluoroscopic images.
8. Describe human vision anatomy and physiology and its significance to fluoroscopy.
9. Recognize appropriate approximate kVp and mA techniques for fluoroscopic examinations.
10. Identify reasoning for using contrast media.
11. Apply general radiation safety and protection practices associated with radiographic and fluoroscopic examinations.
12. Describe a typical basic fluoroscopic image chain.
13. Apply various methods of reducing radiation dose to the patient, radiographer and radiologist during fluoroscopic examinations.
14. Explain how the TV monitor can affect the spatial resolution and image display.
15. Identify the minimum source-to-tabletop distances for fixed and mobile fluoroscopic devices.
16. Describe different post-processing fluoroscopic techniques such as digital subtraction, masking and road mapping.
17. Explain the difference between the operation of a fluoroscopic and a diagnostic x-ray tube.
18. Describe the advantages of image intensified fluoroscopy over conventional fluoroscopy.
19. Analyze the functions of the image intensification tube including the input phosphor, photocathode, electrostatic focusing lenses anode and output phosphor.
20. Summarize the operation of a multiframe magnification image intensification tube.
21. Explain the basic function of a fluoroscopic automatic brightness control (ABC) or automatic exposure control (AEC).
22. Discuss the factors that affect fluoroscopic image contrast, resolution, distortion, veiling glare and quantum mottle.
23. Indicate the function of Charged Coupling Devices (CCD), lens coupling, fiber optics, video camera, photospot and the TV monitor.

Course Outcome(s):

Explain the principles and application of Computerized Tomography (CT).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Name the individual who first demonstrated the process of CT.
2. Describe the components and functions of a CT imaging system.
3. List the CT computer data processing steps.
4. Identify the types and appearances of artifacts most commonly affecting CT images.
5. Explain the types and function of collimators in CT.
6. Describe the differences between conventional CT and helical (spiral) CT.
7. Analyze the changes seen between CT generations and state their advantages.
8. Explain CT system components and their functions including the gantry, table, computer and image detectors.
9. Define algorithm and explain its impact on scan factors and reconstruction.
10. Describe characteristics that detectors must have including stability, dynamic range and response time.
11. Define CT-based terminology including pixel, voxel, matrix, CT Hounsfield, window width (ww), window level (wl), spatial resolution, contrast resolution, noise, pitch, slip ring technology, region of interest (ROI), raw data, image data, linear attenuation coefficient, partial volume averaging and annotation.
12. Explain the difference between reconstructing and reformatting an image and define array processing used for image reconstruction.
13. Discuss detector configurations and functions.
14. Describe and explain the common controls on the CT operator console.
15. Discuss radiation protection principles for CT to include technical factor selection and adjustment, immobilization devices and dose measurement units (CTDI, MSAD and DLP).
16. Discuss image quality as it relates to spatial resolution, contrast resolution, system noise, linearity and spatial uniformity.
17. Describe the general purpose of commonly performed CT studies and the importance of patient preparation for the administration of contrast media and understanding of possible risk factors.
18. Explain how artifacts can be reduced or eliminated.
19. Discuss general radiation safety and protection practices associated with CT examinations.
20. Identify basic anatomy and structures seen on a CT image.
21. Explain how a CT scanner generates and displays images in different imaging planes.
22. Summarize CT image characteristics and CT numeric values.
23. Describe how typical CT mA and kVp techniques affect estimated patient dose measured in Computed Tomographic Dose Index (CTDI) and Multiple Scan Average Dose (MSAD).
24. Identify different CT grids and their effect on the image.
25. Explain the diagnostic advantages of CT over diagnostic radiography and summarize advantages and disadvantages of CT imaging.

Course Outcome(s):

Explain the principles and application of Magnetic Resonance Imaging (MRI).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe the source of the magnetic fields within the body that are used during MRI.
2. Describe the properties of proton precession as used in MRI.
3. Describe how magnetic resonance imaging (MRI) is a complement to diagnostic radiography and its advantages over routine radiography.
4. Describe the use of radio frequency (RF) pulses in the various MRI pulse sequence.
5. Describe the components of an MRI unit, including the stationary magnet, gradient and Radio Frequency (RF) coils, table and computer consoles.
6. Explain how MRI image contrast is controlled.
7. Describe the use of paramagnetic contrast agents.
8. Summarize the history of the creation of MRI.
9. Discuss methods of reducing MRI image noise.
10. Discuss safety measures for protection of all persons who approach the MRI unit magnetic field.

11. Discuss patient safety while in the magnet.
12. Discuss the importance of patient screening for MRI.
13. Distinguish how MRI is a unique imaging modality.
14. Explain the process hydrogen takes when introduced to the magnetic field and the subsequent imaging fields.
15. Explain how an MRI unit's magnetic field strength is measured.
16. Define superconductor, solenoid, quenching and surface coils.
17. Explain the different types of MRI units including permanent, resistive and super conductive.
18. Distinguish between extrinsic and intrinsic parameters.
19. Explain how different MRI sequences and parameters are used to create different images and gray scales.
20. Explain the importance of patient and room shielding in MRI including the Faraday cage.

Course Outcome(s):

Explain the principles and application of Interventional Radiology.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain types of equipment used in the interventional imaging suite including imaging components and patient care equipment.
2. Describe the tubes, lines catheters and other devices encountered by the radiographer.
3. Describe the specialized interventional procedures or the articulatory, nervous, respiratory, urinary, circulatory and reproductive systems.

Course Outcome(s):

Explain of the principles and application of Mammography.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Discuss the history of mammography.
2. Discuss appropriate patient contact techniques/skills relative to patient assessment and education.
3. List National Council on Radiation Protection and Measures (NCRP) regulations concerning radiation exposure.
4. Identify anatomical structures of the breast.
5. Describe changes in breast tissue as they relate to hormones, pregnancy, lactation, and menopause.
6. Describe the staging process and treatment options for breast cancer.
7. Explain basic and special mammography positioning protocols.
8. Define medical terms associated with mammography and breast imaging position.
9. Summarize basic Mammography physics principles.
10. Discuss how automatic exposure control (AEC), compression, grids, object-to-image distance (OID), source-to-image distance (SID), and focal spot size relate to image quality for mammograms.
11. Contrasts the difference between screening mammograms and diagnostic mammograms.
12. Explain the components and design characteristics of digital mammography units.
13. Justify how important quality assurance control tests are in Mammography.
14. Summarize some of the Food and Drug Administration (FDA) and Occupational Safety and Health Administration (OSHA) regulations in regards to mammography.
15. Identify some of the risk factors for the development breast cancer.
16. Describe specialized mammography procedures such as biopsies, localization procedures utilizing ultrasonography, ductography, scintimammography, and other stereotactic procedures.

Course Outcome(s):

Explain the principles and application of Bone Densitometry.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Define osteoporosis.
2. Describe the basic components of a bone densitometry unit.
3. Demonstrate basic positioning protocols for bone density studies.
4. Describe how bone density is measured including T and Z scores.
5. Identify reasons for bone loss.
6. Differentiate between different bone densitometry units.

Course Outcome(s):

Explain the principles and application of Ultrasonography.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe the basic concepts of ultrasonography.
2. Summarize the different procedures performed using ultrasonography.
3. Explain proper patient preparation techniques for different ultrasonographic exams.
4. Justify the advantages and disadvantages of ultrasonography compared to other imaging modalities.
5. Identify basic anatomy viewed on ultrasonographic images.
6. Describe the equipment used in ultrasonography including the transducer.
7. Define Doppler ultrasound.
8. Explain how attenuation affects ultrasonographic images.
9. Define the conservation of energy law and how it pertains to ultrasonography.
10. Discuss different sound wave parameters including frequency, period, wavelength and amplitude.
11. Describe how different sound wave variables including pressure, tissue density, particle vibrations and temperature affect the ultrasonographic image.
12. Define a longitudinal sine wave.
13. Identify the compression and rarefaction on an ultrasonographic wave.

Course Outcome(s):

Explain the principles and application of Nuclear Medicine.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain the basic concepts of Nuclear Medicine.
2. Summarize the history of Nuclear Medicine.
3. Summarize the basic physics behind Positron Emission Tomography (PET).
4. Explain PET's significance to diagnostic radiography.
5. Explain radiation safety used in Nuclear Medicine as it relates to the patient, technologist and lab.
6. Distinguish the different types of imaging studies seen in Nuclear Medicine and their purpose.
7. Describe the relationship between radiopharmaceuticals, radioactive isotopes, half life and hot spots and how they affect imaging in Nuclear Medicine.
8. Compare different imaging techniques used in Nuclear Medicine including gamma cameras, CT, PET, SPECT and hybrid fusion studies.
9. Describe Nuclear Medicine lab radiation detecting devices including Geiger-Mueller counter, scintillation detectors, dose calibrator and survey meters.

Course Outcome(s):

Explain the principles and application of Radiation Therapy.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Define radiation therapy.
 2. Explain the uses of radiation therapy.
 3. Identify the equipment used in radiation therapy.
 4. Explain how radiation is administered for radiation therapy.
 5. Describe the benefits of radiation therapy.
 6. Describe the disadvantages and side effects of radiation therapy.
 7. Summarize radiation safety techniques used in radiation therapy for the patient and therapist.
 8. Explain the radiation therapy workflow and those who are involved in creating a radiation therapy treatment plan.
 9. Define the unit of measurement that radiation therapy utilizes.
 10. Explain proton therapy and Bragg's peak.
 11. Define simulation and why it is used in radiation therapy.
 12. Differentiate between PET and SPECT imaging seen in radiation therapy.
 13. Explain the difference between fusion imaging and structural imaging used in radiation therapy.
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Course Outcome(s):

Explain the education and certification required for technologists to practice in Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Interventional Radiography, Mammography, Bone Densitometry, Sonography, Nuclear Medicine and Radiation Therapy.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain the educational requirements for all specialized imaging modalities and radiation therapy.
 2. Explain the certification and licensure requirements for all specialized imaging modalities and radiation therapy.
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Course Outcome(s):

Identify anatomical planes and basic anatomy on cross-sectional images.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain the advantages of a cross-sectional image compared to a diagnostic two-dimensional image.
 2. Identify the body regions and cavities.
 3. Describe anatomy using proper directional terms.
 4. Identify the imaging planes used on different CT, MR and sonographic images.
 5. Differentiate images produced by various modalities.
 6. Identify major sectional anatomical structures found within the head/neck, thorax and abdomen/pelvis.
 7. Name and describe the function of select anatomical structures located in the head/neck, thorax and abdomen/pelvis.
 8. Locate select anatomical structures of the head/neck, thorax and abdomen/pelvis on CT, MR and sonographic images in the transverse axial, coronal, sagittal and orthogonal (oblique) cross-sectional imaging planes.
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Methods of Evaluation:

1. Take-home assignments
2. Tests/quizzes
3. Midterm/final exam
4. Oral presentations
5. Written reports
6. Venipuncture demonstration
7. Participation/attendance

Course Content Outline:

1. Information literacy in the healthcare environment
 - a. Storage and retrieval systems for patient health information (Hospital information systems (HIS), Radiology Information System (RIS), Picture Archive Communication System (PACS), etc.)
 - b. Effective communication for patient education
 - c. Understanding orders, requests and diagnostic reports
 - i. Procedure orders and requests
 1. Patient identification
 2. Procedure ordered
 3. Patient history
 4. Clinical indications
 5. Ordering physician/provider
 - ii. Diagnostic reports
 1. Content
 2. Interpretation
 - d. Patient consent
 - i. Definition
 - ii. Types
 - iii. Condition for valid consent
 - iv. Documentation of consent
2. Pharmacology
 - a. Drug nomenclature
 - i. Chemical name
 - ii. Generic name
 - iii. Trade/brand name
 - b. Drug classification
 - i. Chemical group
 - ii. Mechanism and site of action
 - iii. Primary effect
 - c. General pharmacological principles
 - i. Pharmacokinetics
 - ii. Pharmacodynamics
 - iii. Pharmacogenetics
 - d. Six rights of drug safety
 - i. Right medication
 - ii. Right dose
 - iii. Right patient
 - iv. Right time
 - v. Right route
 - vi. Right documentation
 - e. Drug categories relevant to radiography (uses and effects)
 - i. Analgesics
 - ii. Anesthetics
 - iii. Antihistamines
 - iv. Antianxiety drugs
 - v. Antiarrhythmics
 - vi. Antibacterial drugs
 - vii. Anticholinergics
 - viii. Anticoagulants
 - ix. Coagulants

- x. Anticonvulsants
- xi. Antidepressants
- xii. Antidiabetics
- xiii. Antiemeticd
- xiv. Antihypertensive drugs
- xv. Anti-inflammatory drugs
- xvi. Antiseptic and disinfectant agents
- xvii. Antiviral drugs
- xviii. Bronchodilators
- xix. Cathartic and antidiarrheal drugs
- xx. Corticosteroids
- xxi. Diuretics
- xxii. Hormones
- xxiii. Laxatives
- xxiv. Sedative and hypotonic drugs
- xxv. Vasodilators and vasoconstrictors

f. Contrast agents

- i. Types of contrast agents
 - 1. Metallic salts
 - 2. Organic iodides
 - a. Ionic contrast agents
 - b. Nonionic contrast agents
 - 3. Gases
- ii. Beam attenuation characteristics
 - 1. Radiolucent (negative)
 - 2. Radiopaque (positive)
 - 3. Effect of ionic number
- iii. Pharmacologic profile
 - 1. Chemical comparison
 - 2. Absorption
 - 3. Distribution
 - 4. Metabolism
 - 5. Elimination
 - 6. Indications
 - 7. Effects
 - 8. Interactions and contraindications
 - 9. Patient reactions

iv. Contrast media dose calculation

v. Preparation

g. Routes of drug administration

- i. Enteral
 - 1. Sublingual
 - 2. Buccal
 - 3. Rectal
- ii. Tube or catheter
- iii. Inhalation
- iv. Topical
- v. Parenteral
 - 1. Intravenous
 - 2. Intra-arterial
 - 3. Intrathecal
 - 4. Intramuscular
 - 5. Subcutaneous
 - 6. Intradermal
 - 7. Intraosseous

3. Venipuncture

- a. Methods
 - i. Infusion
 - ii. Intermittent infusion
 - iii. Direct injection
 - 1. Hand injection
 - 2. Automatic pressure injector
 - b. Sites of administration
 - i. Peripheral
 - ii. Central
 - c. Venipuncture procedures
 - i. Equipment and supplies
 - ii. Patient identification, assessment and instructions
 - iii. Informed consent
 - iv. Dosage, dose calculations and dose-response
 - 1. Adults
 - 2. Pediatric patients
 - v. Patient preparation
 - vi. Application of standard precautions
 - vii. Procedure
 - 1. Injection through an existing line
 - 2. Venipuncture
 - viii. Site observation
 - ix. Emergency medical treatment procedure
 - 1. Appropriate codes
 - 2. Emergency cart (crash cart)
 - 3. Emergency medications
 - 4. Accessory equipment
 - 5. Radiographer's response and documentation
 - d. Complications
 - i. Infiltration
 - ii. Extravasation
 - iii. Phlebitis
 - iv. Air embolism
 - v. Drug incompatibility
 - vi. Low fluid level in container
 - e. Discontinuation
 - i. Equipment and supplies for withdrawal
 - ii. Patient preparation
 - iii. Application of standard precautions
 - iv. Withdrawal procedure
 - v. Site observation
 - vi. Patient observation
 - vii. Postprocedural tasks
 - f. Documentation of administration
 - g. Technologist's response and documentation
4. Fluoroscopy
- a. Conventional Fluoroscopy
 - i. Origin
 - ii. Equipment
 - iii. Radiation safety concerns
 - iv. Image intensified fluoroscopy
 - 1. Image intensification
 - a. Origin
 - b. Development
 - c. Equipment
 - d. Multifield image intensification
 - e. Uses in Radiography
 - f. Radiation safety and measurements
 - i. Techniques

2. Viewing Systems
 - a. Film
 - b. Optical mirror system
 - c. Thermionic TV camera tube
 - d. Video monitor
 - i. Frames
 - ii. Interlacing
 - iii. 525 line system
 - e. Cineradiographic camera
 - f. Coupling
3. Recording systems
 - a. Cassette-loaded spot film
 - b. Photospot camera
- b. Digital Fluoroscopy
 - i. Digital imaging process in fluoroscopy
 1. Origin
 2. Development
 3. Equipment
 4. Image acquisition
 5. Uses in Fluoroscopy
 6. Radiation safety and measurement
 - ii. Viewing systems
 1. Digital camera
 2. Digital monitor
 - a. 1024 line system
 - b. Spatial resolution
 - c. Pixel size
 3. Cineradiographic camera
 4. Charged coupled device
 5. Flat Panel Image Receptor
 6. Digital Subtraction
 - a. Mask mode
 - b. Road mapping
 - c. Subtraction
 - iii. Recording systems
 1. Digital Image recording Systems
 - a. ADC and DAC storage systems
 2. Digital Image Storage Systems
 - a. Types of storage and review media
5. Computerized Tomography
 - a. Origin
 - b. Development
 - i. Generations
 - c. Equipment
 - i. Table
 - ii. Gantry
 - iii. X-ray tube
 - iv. Image detectors
 - v. Operator console
 - vi. Image storage
 - vii. Immobilization devices
 1. Straps
 2. Head holders
 3. IV arm boards
 - viii. Uses in radiography
 1. Contrast
 - d. Radiation safety and measurements

- i. Techniques
 - ii. Dose
 - iii. Reducing exposure to scatter radiation
 - e. Image creation
 - i. Hounsfield units
 - ii. Windowing
 - iii. Leveling
 - iv. Matrix
 - v. Pixel vs Voxel
 - vi. Artifacts
 - vii. Recons
 - f. Basic computed tomography physics
 - g. Spiral computed tomography
 - i. Slip ring technology
 - h. Multi detector array computed tomography systems
 - i. Development
 - ii. Pitch
 - iii. Volume imaging
 - iv. Detector dose efficiency
 - v. Grids
 - i. Digital Imaging Modality
 - i. Recons
 - j. Current Trends
 - i. Research
 - ii. Health Concerns
- 6. Magnetic Resonance Imaging
 - a. Origin
 - b. Development
 - c. Equipment
 - i. Main magnet
 - ii. RF subsystem
 - 1. Transmitter
 - 2. Receiver coils
 - iii. Gradient Coils
 - iv. Couch
 - v. Operator console
 - vi. Computer
 - vii. Faraday cage
 - viii. Shim system
 - d. Basic Magnetic Resonance Physics
 - i. Hydrogen
 - ii. Magnetic movement
 - iii. Precession
 - iv. B0 and B1 fields
 - v. Resonance
 - vi. Larmor frequency
 - e. Digital Imaging Modality
 - i. See M. Digital Image Processing
 - f. 3 Plane Direct Imaging
 - i. Cartesian Coordinates
 - ii. Parameters
 - 1. Intrinsic
 - 2. Extrinsic
 - iii. Sequences
 - iv. Protocols
 - v. Advantages provided by Magnetic Resonance Imaging
 - g. MRI Safety

- i. Patient
 - ii. Public
 - iii. Personnel
 - h. Current Trends
 - i. Research
 - ii. High field magnets
 - iii. Health concerns
 - 7. Interventional Radiography
 - a. Interventional X-ray equipment and accessories
 - i. Generators
 - ii. X-ray tubes
 - iii. Timers
 - iv. Image amplifiers and television circuits
 - v. Pressure injectors
 - vi. Tables
 - vii. C-arms
 - b. Vital signs and associated equipment
 - i. Temperature
 - ii. Pulse
 - iii. Pulse oximetry
 - iv. Respiration
 - v. Blood pressure
 - vi. Normal ranges and values
 - vii. Interfering factors
 - viii. Adult vs. pediatric
 - ix. Acquiring and recording vital signs
 - c. Tubes, lines, catheters and other devices
 - i. Function and handling of devices
 - ii. Nasogastric/nasointestinal
 - iii. Suction
 - 1. Adult vs. pediatric
 - 2. Special precautions
 - iv. Tracheostomy
 - 1. Suction techniques
 - 2. Cardiopulmonary resuscitation (CPR) with tracheotomy
 - v. Chest (thoracostomy) tube
 - 1. Purpose
 - 2. Location
 - vi. Implanted devices
 - 1. Types
 - 2. Purpose
 - 3. Location
 - vii. Venous catheters
 - 1. Types
 - 2. Purpose
 - 3. Location
 - 4. Care (e.g. infection control)
 - 5. Access
 - viii. Tissue drains
 - ix. Oxygen administration
 - 1. Values
 - 2. Oxygen therapy
 - 3. Oxygen delivery systems
 - a. Low-flow systems
 - b. High-flow systems
 - 4. Special precautions
 - x. Urinary collection

1. Procedure
 - a. Male
 - b. Female
2. Alternative methods of urinary drainage
- xi. Ostomies
 1. Types
 2. Purpose
 3. Location
 4. Care
 5. Access
- xii. Seldinger technique
- d. Interventional procedures
 - i. Arthrography
 1. Hip
 2. Shoulder
 3. Wrist
 4. Knee
 - ii. Nervous system
 1. Myelogram
 - iii. Urinary system
 1. Cystography
 2. Cystourethrography
 - iv. Circulatory system
 1. Cerebral angiography
 2. Carotid angiography
 3. Cardiac catheterization studies
 4. Coronary arteriography
 5. Aortography
 6. Renal arteriography
 7. Inferior vena cava (IVC) filter placement
 8. Selective visceral arteriography and venography
 9. Percutaneous transluminal angioplasty and stenting
 10. Peripheral angiography
 - v. Digestive system
 1. Cholecystography
 2. Cholangiography
 3. Endoscopic retrograde cholangiopancreatography (ERCP)
 - vi. Reproductive system
 1. Hysterosalpingogram
8. Bone Densitometry
 - a. Origin
 - b. Development
 - c. Equipment
 - i. DEXA
 - d. Image acquisition
 - i. Hip
 - ii. Lumbar Spine
 - iii. Forearm
 - iv. Heel
 - e. Bone anatomy
 - i. Cortical bone
 - ii. Trabecular bone
 - f. How used in radiology
 - i. World Health Organization
 - ii. T Score
 - iii. Z Score
 - iv. Osteoporosis
 1. Risk factors
 2. Indicators

- g. Radiation safety
 - i. Dose to patient
 - ii. Dose to personnel
- 9. Ultrasonography
 - a. Origin
 - b. Development
 - i. History of ultrasonography
 - ii. Accreditation
 - c. Equipment
 - i. Transducers
 - ii. Crystal
 - iii. Computer system
 - iv. Operator console
 - d. Image acquisition
 - i. Sound waves
 - 1. Compression
 - 2. Rarefaction
 - 3. Variables
 - 4. Types
 - 5. Parameters
 - ii. Law of conservation of energy
 - iii. Attenuation
 - e. How used in Radiology
 - i. Doppler ultrasound
 - ii. Types of exams
 - f. Ultrasonographic safety
- 10. Mammography
 - a. Origin
 - b. Breast anatomy
 - c. Breast Cancer
 - i. Types
 - ii. Statistics
 - iii. Risks
 - iv. Treatment options
 - d. Development
 - e. Equipment
 - i. Digital equipment for Mammography
 - ii. Digital storage systems for Mammography
 - iii. Digital viewing systems for Mammography
 - 1. Image manipulation
 - 2. Exam enhancements for diagnosis
 - f. Protocols
 - i. Techniques
 - ii. Positioning
 - iii. Compression
 - iv. Magnification
 - g. Uses of Mammography in Radiology
 - i. Current trends in Mammography
 - 1. Ultrasound
 - 2. Surgical alternatives
 - 3. Positioning techniques
 - h. Radiation safety in Mammography
 - i. FDA Guidelines
 - 1. BSE- Breast Self Exam
 - 2. CBE- Clinical Breast Exam
 - ii. OSHA Guidelines
- 11. Nuclear Medicine
 - a. Origin
 - b. Development
 - c. Equipment

- i. Gamma camera
 - 1. Hot spots
 - ii. SPECT
 - iii. PET
 - iv. Hybrid scanners
 - d. Image acquisition
 - i. Radiopharmaceuticals
 - 1. Tc-99m
 - 2. Half life
 - 3. Uptake
 - a. Vehicles
 - 4. Nuclear decay
 - 5. Radioactive isotopes
 - a. Positrons
 - e. How used in Radiology
 - i. Common exams
 - f. Radiation safety
 - i. Patient
 - ii. Technician
 - iii. Lab
 - 1. Radiation detectors
- 12. Radiation Therapy
 - a. Origin
 - b. Development
 - i. Workflow
 - ii. Prescription
 - iii. Treatment plan
 - c. Equipment
 - i. Linear Accelerator
 - d. Image acquisition
 - i. Simulation
 - ii. Image fusion
 - 1. PET
 - 2. SPECT
 - 3. CT
 - 4. MRI
 - iii. Image Guided Radiation Therapy (IGRT)
 - 1. Side effects
 - iv. Proton Therapy
 - 1. Braggs peak
 - e. How used in Radiology
 - f. Radiation safety
- 13. Educational and Certification Requirements
 - a. Computed tomography
 - b. Magnetic resonance imaging
 - c. Mammography
 - d. Bone densitometry
 - e. Cardiac interventional radiography
 - f. Vascular interventional radiography
 - g. Ultrasonography
 - h. Nuclear Medicine
 - i. Radiation Therapy
- 14. Cross-Sectional Anatomy
 - a. Anatomy Nomenclature
 - i. Terms of direction
 - ii. Body planes
 - iii. Body cavities
 - iv. Body quadrants
 - v. Body regions
 - b. Cross-sectional anatomy of structures and their locations

- i. Head/Cranium
 - 1. Surface anatomy of the brain
 - 2. Sinuses
 - 3. Bones/Cranium
 - 4. Lobes of brain
 - 5. Head/face muscles
 - 6. Cranial nerves
 - 7. Brain stem
 - 8. Circle of Willis
 - 9. Veins
- ii. Thorax
 - 1. Neck/Chest
 - a. Bones
 - b. Respiratory organs
 - c. Circulatory organs
 - d. Vasculature
 - e. Musculature
- iii. Abdomen
 - 1. Surface landmarks
 - 2. Main Arteries/Veins
 - 3. Bony structures
 - 4. Abdominal/GI organs
- iv. Pelvis
 - 1. Reproductive organs
 - 2. Bony structures
 - 3. Pelvic vasculature

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/ReligiousAccommodationForm>. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	Syllabus/Schedule/Projects/Information Literacy
Week 2	Pharmacology
Week 3	Venipuncture
Week 4	Fluoroscopy
Week 5	Computed Tomography
Week 6	Computed Tomography
Week 7	Magnetic Resonance Imaging
Week 8	Magnetic Resonance Imaging
Week 9	Interventional Radiography
Week 10	Bone Densitometry/Mammography
Week 11	Sonography
Week 12	Nuclear Medicine

Week 13	Radiation Therapy
Week 14	Cross-sectional Anatomy
Week 15	Final Review/Projects
Week 16	Final Exam

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Reading will be from one of the below recommended textbooks, as selected by the individual instructors.

1. Bushong, S. C. *Radiologic Science for Technologists: Physics, Biology, and Protection*. 13th ed. St. Louis, MO: Elsevier Mosby, 2025.
2. Carlton, R. & Adler, A. *Principles of Radiographic Imaging: An Art and a Science*. 6th ed. Albany, NY: Delmar, 2019.
3. Pope, T. L. Jr. *Aunt Minnie's Atlas and Imaging- Specific Diagnosis*. 5th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2023.
- 4.
5. Madden, M. E. *Introduction to Sectional Anatomy*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins, 2012.
6. Seeram, E. *Computed Tomography: Physical Principles, Patient Care, Clinical Applications, and Quality Control*. 5th ed. Elsevier Health Sciences, 2022.
7. Westbrook, C., Roth, C. K. & Talbot, J. *MRI in Practice*. 5th ed. Chichester, West Sussex: Blackwell Publishing, 2018.
8. Hall Rollins, J. & Smith, B. J. *Merrill's Atlas of Radiographic Positioning & Procedures*. 16th ed. St. Louis, MO: Elsevier Mosby, 2025.
9. Carter, C. & Veale, B. *Digital Radiography and PACS*. 3rd ed. Maryland Heights, MO: Elsevier Mosby, 2018.
10. American Society of Radiologic Technologists Radiography Curriculum www.asrt.org (<http://www.asrt.org/>)
11. American Registry of Radiologic Technologists Radiography Examination Content Specifications www.arrt.org (<http://www.arrt.org/>)
12. Clover Learning (<https://cloverlearning.com/>) Diagnostic Imaging Training and Exam Prep

Resources for the Instructor

Bushong, S. C. (2025). *Radiologic science for technologists: Physics, biology, and protection*, Elsevier Mosby.

Carlton, R. & Adler, A. (2019). *Principles of radiographic imaging: An art and a science*, Delmar.

Pope, T. L. (2023). *Aunt Minnie's atlas and imaging- specific diagnosis*, Lippincott Williams & Wilkins.

Madden, M. E. (2012). *Introduction to sectional anatomy*, Lippincott Williams & Wilkins.

Seeram, E. (2022). *Computed tomography: Physical principles, patient care, clinical applications, and quality control*, Elsevier Health Sciences.

Westbrook, C., Roth, C. K. & Talbot, J (2018). *MRI in practice*, Blackwell Publishing.

Hall Rollins, J. & Smith, B. J (2025),. *Merrill's atlas of radiographic positioning & procedures*, Elsevier Mosby.

Carter, C. & Veale, B (2018). *Digital radiography and PACS*, Elsevier Mosby.

Additional Resources for the Instructor

American Society of Radiologic Technologists Radiography Curriculum www.asrt.org (<http://www.asrt.org/>)

American Registry of Radiologic Technologists Radiography Examination Content Specifications www.arrt.org (<http://www.arrt.org/>)

Clover Learning (<https://cloverlearning.com/>) Diagnostic Imaging Training and Exam Prep

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