

R T 55A: PRINCIPLES OF RADIOLOGIC TECHNOLOGY I

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	3
Hours:	3 lecture per week (36 total per quarter)
Prerequisite:	R T 50; CHEM 25 or 30A.
Advisory:	Not open to students with credit in R T 52A.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

Student Learning Outcomes

- Describe the parts of the x-ray tube.
- Differentiate between the quality factors of mAs and kV.

Description

Introduction to elementary principles of x-ray physics, technique, radiation protection and digital radiography. Intended for students in the Radiologic Technology Program; enrollment is limited to students accepted in the program.

Course Objectives

The student will be able to:

- Define ionization and its effect on the atom.
- Differentiate SI vs. classical radiation units.
- Describe the components and function of diagnostic x-ray tubes.
- Evaluate the probability of attenuation based on patient factors and exam type.
- Explain the rationale for using beam restriction.
- Explain how beam filtration affects x-ray beam intensity, beam quality and patient exposure.
- Summarize the relationship of factors affecting scattered radiation.
- Interpret grid efficiency in terms of grid ratio and frequency.
- Apply conversion factors for changes in the following areas: distance, grid, image receptors, reciprocity law and the 15 percent rule.
- Evaluate exposure to a digital receptor utilizing manufacturer based exposure indexes and deviation index.
- Describe the methods of image acquisition using CR and DR digital systems.
- Distinguish and evaluate CR-based and DR-based image artifacts.

Course Content

- Structure of the atom
 - Composition
 - Nucleus

- Structure—proton and electron balance
- Electron shells
 - Binding energy
 - Valence shell
 - Ionization
 - Excitation
- Nomenclature
 - Atomic number
 - Mass number
- Nature of radiation
 - Electromagnetic
 - Spectrum
 - Wave-particle duality
 - Properties (e.g., frequency, wavelength, velocity)
 - Particulate
 - Types
 - Characteristics
 - Nonionizing (excitation) vs. ionizing
 - Energy
 - Probability
 - Radiation units
 - Système International d'Unités (SI Units)
 - Exposure—Coulomb/kilogram (C/kg)
 - Absorbed dose—Gray (Gy)
 - Air kerma
 - Measurement unit in gray
 - Kinetic energy release in matter
 - Dose equivalent—Sievert (Sv)
 - Classical
 - Exposure—Roentgen (R)
 - Absorbed dose (Rad)
 - Dose equivalent (Rem)
- X-ray production
 - Historical introduction
 - X-ray tube components
 - Metal housing
 - Glass/metal envelope
 - Cathode
 - Tungsten filament
 - Focusing cup
 - Anode
 - Focal spot
 - Effective vs. actual
 - Line focus principle
 - Anode heel effect
 - Rotor
 - Stator
 - Target interactions
 - Bremsstrahlung
 - Characteristic
 - Common terms related to the x-ray beam
 - Primary beam
 - Exit/remnant beam

- 3. Leakage radiation
- 4. Off-focus/stem radiation
- v. Conditions necessary for x-ray production
 - 1. Source of electrons
 - 2. Acceleration of electrons
 - 3. Focusing the electron stream
 - 4. Deceleration of electrons
- vi. Beam quality
 - 1. kV
 - 2. Filtration
 - 3. HVL
- vii. Beam quantity
 - 1. mAs
 - 2. kV
 - 3. Distance
 - 4. Filtration
- d. Interaction of photons with matter
 - i. Transmission of photons
 - ii. Differential attenuation
 - 1. Scatter
 - 2. Absorption
 - iii. Exit/remnant radiation
 - iv. Types and descriptions
 - 1. Unmodified scattering (coherent)
 - 2. Photoelectric effect
 - 3. Modified scattering (Compton)
 - v. Probability of occurrence
 - vi. Effect on image
 - vii. Patient and operator dose effects
- e. Beam restriction
 - i. Function/purpose
 - 1. Reduce irradiated tissue volume
 - 2. Reduce patient dose
 - 3. Scatter production reduction
 - ii. Types
 - 1. Collimators
 - 2. Lead blockers
 - iii. Collimator components
 - 1. Automatic collimators
 - 2. Cylinders
- f. Beam filtration
 - i. Types
 - 1. Inherent
 - 2. Added
 - 3. Compensating
 - ii. Function/mechanism
 - iii. Impact on image characteristics
 - iv. Impact on HVL
- g. Scatter radiation
 - i. Prevention
 - 1. Collimation
 - 2. kVp
 - ii. Reduction
 - 1. Grid
 - 2. Air gap (OID)
- iii. Effects
 - 1. Image quality
 - 2. Patient dose
 - 3. Occupational exposure
- h. Grids
 - i. Function/mechanism
 - ii. Construction
 - iii. Types
 - 1. Focused
 - 2. Parallel
 - 3. Linear
 - 4. Crossed
 - 5. Moving
 - 6. Stationary
 - 7. Short dimension
 - 8. Long dimension
 - 9. Virtual
 - iv. Characteristics
 - 1. Grid radius/focal range
 - 2. Ratio
 - 3. Frequency
 - 4. Grid conversion factor
 - v. Selection
 - 1. kVp
 - 2. Patient/exam
 - 3. Focal range
 - 4. Alignment latitude
 - vi. Primary cutoff
- i. Receptor exposure
 - i. Factors that affect exposure receptors (e.g., anode-heel, OID, patient pathology)
 - 1. Distance
 - 2. mA
 - 3. Time
 - 4. kV
 - 5. Grids
 - 6. Beam restriction
 - 7. Filtration
 - ii. Receptor exposure calculations
 - 1. Inverse square law
 - 2. Reciprocity law
 - 3. 15 percent rule
 - 4. Grid conversion factor
 - 5. Direct square law/exposure maintenance formula
- j. Digital introduction
 - i. Advantages of digital-based imaging systems over film-based systems
 - 1. Increased exposure latitude
 - 2. Increased dynamic range
 - 3. Improved structure visualization
 - 4. Ability to electronically store and transmit images
 - 5. Increased workflow and productivity

- ii. Exposure evaluation in digital imaging
 1. Exposure index
 2. Target index
 3. Deviation index (DI)
 4. Exposure indicators per manufacturer
- k. Digital image acquisition
 - i. Direct conversion and thin film transistor (TFT) arrays
 - ii. Indirect conversion and thin film transistor (TFT) arrays
 - iii. Charge-coupled device (CCD) system
 - iv. Photostimulable phosphor (PSP) plate
 - v. CMOS
- l. Artifacts
 - i. Patient-related
 - ii. Equipment-related
 - iii. Workflow-related

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

- a. Weekly reading assignments from assigned chapters, approx. 1 chapter per week
- b. Assigned videos and quizzes from Clover Learning online platform

Discipline(s)

Radiological Technology

Lab Content

Not applicable.

Special Facilities and/or Equipment

1. Multimedia classroom
2. Classroom with viewboxes
3. QC evaluation equipment for visual aids and practical use

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Quizzes
 Midterms
 Final examination
 Group project presentation

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
 Discussion
 Cooperative learning exercises
 Demonstration

Representative Text(s) and Other Materials

Bushon, Stewart. [Radiologic Science for Technologists](#). 2021.

Fauber, Terri. [Radiographic Imaging and Exposure](#). 2021.

Clover Learning online system