



# School of Nursing and Health Professions Syllabus



**Term:** Credit: 4CR **Office Hours:**

**Course Code:** RAD 101 **Office Location:**

**Title of Course:** Radiography 1 **Email:**

**Days & Times:** **Phone:**

**Location:** **Prerequisites/ Corequisites:** NONE

**Instructor:**

## **COURSE DESCRIPTION:**

Content is designed to provide an overview of the general principles of patient care, ethics and medico-legal standards. Principles of mathematical formulas, prime factors and electromagnetic energy are introduced. Equipment operation introduces the use of grids, computer, and digital imaging processing, and all components involved in image production. The foundation of radiation protection and safety standards in radiographic imaging is emphasized. Introduction to Radiologic Science and its relationship in the health care system is covered. Learning the basics of medical terminology for use in the health care environment is given.

## **COURSE OBJECTIVE:**

- Define general radiographic and anatomic relational terminology.
- Identify specific anatomical structures in radiographs and drawings for contrast studies, skull and advanced imaging studies.
- List the correct central ray placement, part position, and criteria for contrast studies, skull, and advanced imaging studies.
- Based on clinical situations, describe the preferred positioning routine to assist the physician with the diagnosis of a specific condition or disease process.
- Distinguish between acceptable and unacceptable radiographs based on exposure factors, motion, collimation, positioning, or other errors.
- Given a hypothetical situation, identify the correct modifications of positions, exposure factors, or both to improve the radiographic image.

## **STUDENT LEARNING OUTCOMES:**

### **1. Medical Terminology**

#### **SLO1: Simplified Medical Language**

- Recognize prefixes, suffixes, word roots, and combining forms.

- Demonstrate understanding of the rules for combining word parts to write medical terms correctly.
- Identify and distinguish abbreviations from eponyms.
- Use the rules learned in this chapter to write the singular or plural forms of medical terms.
- Demonstrate understanding of primary and secondary accent marks.

### **SLO2: Suffixes and Combining Forms Made Easy**

- Match medical specialist with the areas in which they specialize.
- Identify the common medical conditions associated with each specialty.
- Identify the suffixes for surgical procedures, symptoms, and diagnoses.
- Identify combining forms for select body structures.
- Build and analyze medical terms with combining forms and suffixes.
- Write the correct term when presented with its definition, or match terms with their definitions.
- Spell medical terms correctly.

### **SLO3: Essential Prefixes and More**

- Use prefixes for numbers, quantities, position, and direction to write medical terms.
- Use combining forms for colors to write medical terms.
- Identify and combine word parts correctly, and use clues to write medical terms.
- Write the correct term when presented with its definition or match terms with their definitions.
- Build and analyze medical terms with word parts.
- Spell medical terms correctly.

## **2. Methods of Patient Care**

### **SLO4: Introduction to Imaging and Radiologic Sciences**

- Explain the use of radiation in medicine.
- Provide an overview of the history of medicine.
- Describe the discovery of x-rays.
- Define terms related to radiologic technology.
- Explain the career opportunities within the profession of radiologic technology.
- Identify the various specialties within a radiology department.
- Describe the typical responsibilities of the members of the radiology team.
- Explain the career-ladder opportunities within a radiology department.
- Discuss the roles of other members of the health care team.

### **SLO 5: Introduction to Clinical Education**

- Explain the purpose of the clinical education component.

- Define terms that relate to the clinical education component of the radiography curriculum.
- Describe the physical and human resources necessary for effective clinical education.
- Explain the importance of adhering to major clinical education policies.
- Discuss the methods used in effectively teaching clinical course content.
- Describe methods of assessment that can be used to measure cognitive, psychomotor, and affective aspects of clinical education.
- Summarize the clinical education process.

#### **SLO 6: Safe Patient Movement and Handling Techniques**

- Define the terms associated with body mechanics.
- Describe the cause, signs, symptoms, and treatment of orthostatic hypotension.
- Describe the basic principles of proper lifting and transfer techniques.
- Explain four types of wheelchair-to-bed transfers.
- Explain a standard cart transfer procedure.
- Identify five standard patient positions.

#### **SLO 7: Patient Interactions**

- Identify qualities needed to be a caring radiologic technologist.
- Specify needs that cause people to enter radiologic technology as a profession.
- Discuss general needs that patients may have according to Maslow's hierarchy of needs.
- Relate differences between the needs of inpatients and those of outpatients.
- Explain why patient interaction is important to patients, as well as their family and friends.
- Analyze effective methods of communicating with patients of various ages.
- Explain appropriate interaction techniques for various types of patients.
- Discuss considerations of the physical changes of aging with regard to radiologic procedures.
- Discuss appropriate methods of responding to terminally ill patients.

#### **SLO 8: Human Diversity**

- Define human diversity.
- List some of the human diversity characteristics.
- Describe the human diversity traits of age, ethnicity or national origin, race, gender or sexual orientation, and mental and physical ability.
- Name the values that are prescribed to U.S. mainstream culture.
- List the elements associated with cultural competency.
- Discuss valuing diversity.
- Know the empathetic practices that help foster cultural insight and produce improved outcomes.

- Describe the six areas of human diversity that health care providers need to understand to provide high quality and effective care.
- Discuss ways in which professional medical imaging organizations have expressed valuing human diversity.

### **SLO 9: History Taking**

- Describe the role of the radiologic technologist in taking patient clinical histories.
- Describe the desirable qualities of a good patient interviewer.
- Differentiate objective from subjective data.
- Explain the value of each of the six categories of questions useful in obtaining patient histories.
- Describe the importance of clarifying the chief complaint.
- Detail the important elements of each of the sacred seven elements of the clinical history.

### **SLO 10: Immobilization Techniques**

- Demonstrate a range of immobilization techniques.
- Explain the importance of high-quality communication with the patient.
- Describe reduction of patient radiation exposure by using proper immobilization methods.
- Apply immobilization techniques in routine situations.
- Use immobilization devices effectively.
- Describe trauma immobilization techniques as they pertain to specific anatomic involvement.
- Explain the importance of establishing rapport with pediatric patients.
- Use various methods of pediatric immobilization.
- Describe appropriate application of immobilization techniques pertinent to geriatric patients.

### **SLO 11: Professional Ethics**

- Explain the ethics of the radiologic technology profession.
- Differentiate the systems of ethics, law, and morals.
- Explain the four-step problem-solving process of ethical analysis.
- Explain two sources of moral judgment that underlie ethical decision making.
- Identify moral dilemmas encountered in patient relationships.
- Identify moral dilemmas encountered in physician relationships.
- Identify moral dilemmas encountered in relationships with other health professionals.
- Recognize values associated with ethical decision making in the practice of radiologic technology.
- Apply critical analysis to ethical decision making.

### **SLO 12: Vital Signs, Oxygen, Chest Tubes, and Lines**

- Discuss the significance of homeostasis.
- Explain the mechanisms that adapt and maintain homeostasis.
- Discuss the significance of each of the four vital signs: temperature, respiration, pulse, and blood pressure.
- Identify the normal range for each of the vital signs.
- Explain the implications of abnormal vital signs.
- Describe how vital signs are assessed.
- Explain the indications for administering oxygen therapy.
- Differentiate high-flow and low-flow oxygen-delivery devices.
- Explain why caution must be used when performing radiographic procedures on patients receiving oxygen therapy.
- Describe the uses of, or indications for, the following thoracic tubes and lines to manage compromised
  - patients: endotracheal tubes, thoracostomy tubes, and central venous lines.
- Describe the radiographic appearance and proper placement of endotracheal tubes, thoracostomy tubes, and central venous lines.
- Differentiate various types of central venous lines.
- Recognize the clinical complications associated with use and placement of tubes and lines used in the thorax.
- Describe the electro conduction system of the heart in correlation with normal and abnormal electrocardiographic findings

### **SLO 13: Aseptic Techniques**

- Describe the use of a sterile drape to establish a sterile field.
- List the steps in a surgical scrub.
- Describe the procedures for gowning and gloving.
- List the basic principles of sterile technique.
- Describe the procedure for changing a dressing.
- Provide care to a patient with a tracheostomy.
- Provide care to a patient with chest tubes.
- Describe the care of a patient with a urinary catheter.
- Contrast intravenous and intraarterial lines.
- Describe the use of fluoroscopy for guidance in the insertion of pacemakers.
- Identify common sterile techniques that are used during surgery using the C-arm.

### **SLO 14: Student Journal**

- Upon reflection the student will identify how they applied what they have learned.
- Student will gain increased perspective of their role with patients and the departments.

## **3. Principles of Exposure/Equipment Operations 1**

### **SLO15: Mathematical Basics**

- Perform functions with fractions and decimals.
- Perform calculations converting number from scientific to ordinary and ordinary to scientific notations.
- Convert units within the SI system.

#### **SLO16: Radiographic Accessories Introduction**

- Explain the purpose of various devices/tools necessary for producing a radiographic image.

#### **SLO17: The Prime Factors**

- Explain the relationship between milliamperage (mA), exposure time, mAs, and x-ray emission. State the reciprocity law.
- Calculate mAs when given mA and exposure time, ma when given mAs and exposure time, and exposure time when given mAs and mA.
- Explain the relationship between kVp and x-ray emission.
- State the 15 percent rule and calculate the new kVp value needed to maintain the receptor exposure and radiographic film brightness when changes are made in mAs, using this rule.
- Explain the relationship between distance and x-ray emission.
- Calculate the new mA and/or mAs value needed to maintain the receptor exposure and radiographic film brightness when changes are made in distance, using the direct square law.

#### **SLO18: Digital Imaging**

- Explain terms related to CR and DR imaging.

#### **SLO19: Artifacts**

- Differentiate between common IR and exposure artifacts.
- Identify and discuss artifact causes and solutions.

#### **SLO20: Image display**

- Explain the relationship between anatomic position and image display
- Differentiate between proper an improper display
- Demonstrate correct image markings

### **4. Radiation Protection and Biology**

#### **SLO21: Preclinical protection**

- Discuss the cardinal rules of radiation protection and their impact on radiation safety.
- Identify the appropriate location on the body where a personnel dosimeter should be worn.

- Discuss radiation protective garment characteristics and how they are to be worn.

### **SLO22: General introduction to radiation protection**

- Identify the consequence of ionization in human cells and discuss the concepts of effective radiation protection.
- Explain the justification for exams and responsibility for imaging procedures.
- State the ALARA principle and discuss its significance in diagnostic imaging and explain how diagnostic efficacy of an imaging procedure can be maximized.
- List employer requirements for implementing and maintaining an effective radiation safety program in a facility that provides imaging services.
- Describe the importance of patient education as it relates to medical imaging.
- Explain how a radiographer should answer patient's questions about the risk of radiation exposure from an imaging procedure and give some examples.
- List and describe three source of natural background ionizing radiation and six sources of manmade or artificial ionizing radiation.

### **SLO23: Radiation quantities and units**

- Explain the concept of skin Erythema dose, tolerance dose and threshold dose.
- Define the radiation terms exposure, absorbed dose, and dose equivalent. Identify the appropriate symbol for each quantity.
- List and explain the international system (SI) and traditional units for radiation exposure, absorbed dose and dose equivalent.
- Define and describe the function of a tissue weighting factor.
- State the purpose of the radiation quantities, effective dose equivalent and collective effective dose equivalent.
- Determine the dose equivalent in terms of traditional units when given the quality factor and absorbed dose for different ionizing radiations.
- Explain the importance of linear energy transfer as it applies to biologic damage.
- Calculate the dose equivalent when given the absorbed dose and weighing factor to various types of ionizing radiation.
- State the formula for effective dose.

### **SLO24: Management of patient dose during imaging procedures**

- Explain how effective communication between imaging department personnel and the patient can improve exam outcome and lower radiation dose.
- Explain how voluntary motion can be eliminated or at least minimized and how involuntary motion can be compensated for during a radiographic procedure.
- Explain the need for protective shielding during imaging procedures, state the reason for using gonadal
- shielding or other specific area shields and compare the various types of shields, and compare the types of shields available for use.

- Discuss the need to use appropriate radiographic technical factors for all radiologic procedures, and explain how these factors may be adjusted to reduce patient dose.
- Explain how adequate immobilization and correct image processing techniques reduce radiography exposure for the patient.
- State the reason for reducing the number of repeat images, and describe the benefits of repeat analysis program.
- List four ways to indicate the amount of radiation received by a patient from imaging procedures and explain each.
- Explain the concept of genetically significant dose.
- Discuss the protocol to be followed when irradiation of an unknown pregnancy occurs, and how absorbed dose to the patient' embryo-fetus is determined.
- Describe special precautions employed in radiography to protect the pregnant or potentially pregnant patient during an x-ray examination.

### **SLO25: Management of personnel radiation dose**

- State the annual occupational effective dose limit for whole-body exposure for imaging personnel during
- routine diagnostic operations, and explain the significant of the ALARA concept for these individuals.
- Explain the reason that occupational exposure of imaging personnel must be limited, and state the most
- important reason for allowing a larger equivalent dose for radiation workers that for the population as a whole.
- Identify the type of x-radiation that poses the greatest occupational hazard in diagnostic radiology, and
- explain the various ways this hazard can be reduced or eliminated.
- Explain how methods that can reduce patient exposure will also reduce exposure for the radiographer and other personnel.
- Discuss the responsibilities of the employer for protecting declared pregnant imager personnel from radiation exposure.
- List and explain three basic principles of radiation protection that can be used for personnel exposure reduction.
- State and explain the inverse square law by solving mathematical problems applying its concept.
- Explain the purpose of the protective tube housing; differentiate between a primary and secondary protective barrier and list examples.
- Describe the construction of protective structural shielding, and list the factors that govern the selection of materials.
- List and describe the protective garments that may be work to reduce exposure and discuss the circumstances in which such garments are worn.

- Explain the various methods and device that may reduce exposure for personnel during fluoroscopic; mobile and operative imaging procedures.
- List three categories of radiation source that may be generated in an x-ray room; list the consideration on which the design of barriers should be based and explain their importance.
- Differentiate between a controlled area and an uncontrolled area.
- Discuss the requirements for posing caution signs for radiation areas.

### **SLO26: Radiation monitoring**

- State the reason why a radiation worker should wear a personnel dosimeter, and explain the function and
- characteristics of such devices.
- Identify the appropriate location on the body where personnel dosimeter(s) should be worn for the following
- procedures: computed digital, conventional, fluoroscopic, special radiography and pregnancy.
- Describe the various components of a personnel dosimeter and explain the use of each of these devices as monitors.
- Explain the function of radiation survey instruments.
- List three gas-filled radiation survey instruments.
- Explain the requirements for radiation survey instruments.
- Explain the purpose for the following instruments; ionizations chamber-type survey meter, proportional counter and Geiger-Muller detector.

### **SLO27: Designing for radiation protection**

- Explain the requirements for a diagnostic-type protective tube housing, x-ray control panel, examination table, and source-to-image distance indicator, and discuss their purpose.
- List the various x-ray beam limiting devices, and describe each.
- Explain the importance of luminance of the collimator light source, state the requirements for good
- coincidence between the beam and localizing light beam when variable rectangular collimator is used, and
- explain the function of the collimator's positive beam limitation feature.
- Explain the function of filtration in radiology, list two types of filtration used, describe half-value layer and
- give examples of those required for selected peak kilovolt ages.
- Explain the function of a compensating filter used for body parts of varied thickness, and list two examples.
- Explain the significance of exposure reproducibility and linearity.

- Explain how the use of high-speed screen/film combination reduces exposure for the film is the image receptor.
- Explain how grid increase patient dose.
- Identify the minimal source/skin distance that must be used for fixed and mobile x-ray equipment to ensure patient safety, and state the reason for this requirement.
- Explain the process of digital and computed radiography, and discuss why it's imperative that patients not be overexposed initially.
- Explain how patient exposure may be reduced during fluoroscopic, C-arm, and digital procedures.

## **5. Physics**

### **SLO28: Structure of Matter**

- Describe the basic structure of matter.
- Explain the basic concepts of atomic theory.
- Explain the difference between particulate and electromagnetic ionizing radiations.

### **SLO29: Electromagnetic Energy**

- Identify the properties of photons.
- Explain the inverse square law.
- Define wave theory and quantum theory.
- Discuss the electromagnetic spectrum

### **SLO30: Electricity, Magnetism and Electromagnetism**

- Define electrification and provide examples.
- List the laws of electrostatics.
- Identify units of electric current, electric potential and electric power.
- Identify the interaction between matter and magnetic fields.
- Discuss the four laws of magnetism.
- Relate the experiments of Oersted, Lenz and faraday in defining the relationship between electricity and magnetism.
- Identify between electricity and magnetism.
- Identify the laws of electromagnetic induction.

### **SLO31: The X-ray Tube**

- Describe the general design of the x-ray tube.
- Discuss the purpose of the x-ray tube components.
- Explain and interpret x-ray tube rating charts

### **Lab/Clinical:**

First Step: Lab demonstration class is mandatory and is completed in the non-energized lab room on campus before the Didactic portion of the imaging studies.

Second Step: Lab Evaluations are performed by students who have successfully passed the didactic component of the imaging study. School faculty observe and grade the student on lab evaluations. Date of performed lab is documented on Student's Individual CCE record. Passing grade on lab evaluations is 85% and must be completed before student moves onto Performance of Patient Procedure phase.

Third Step: Patient Performance Phase: *Students must perform One Patient Procedure (non-graded) under Direct Supervision Prior to performing a (graded) ICCE. Students must document and have signed by a licensed R.T. (staff radiographer) on their Student Individual CCE record that they have performed the radiographic study.* The student can perform the study immediately after passing the lab evaluation, once the study becomes available in the department.

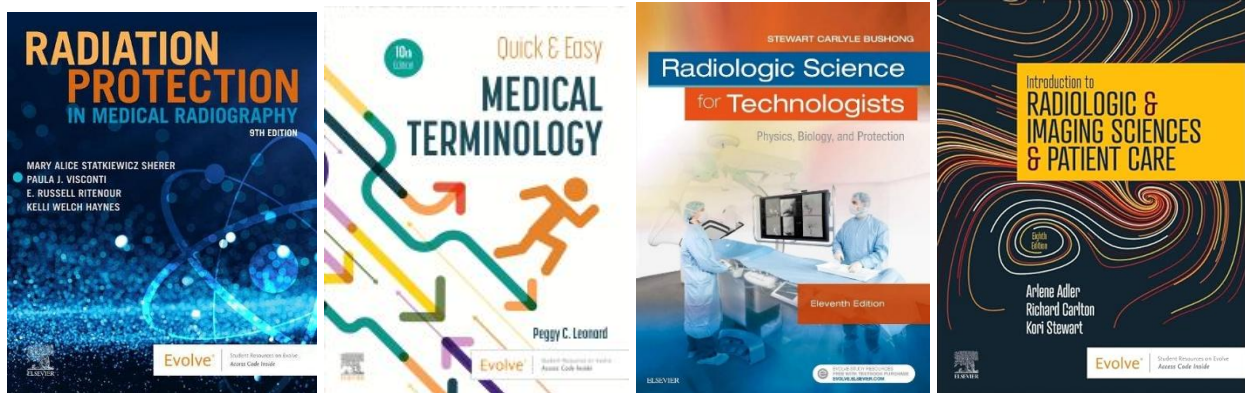
### TEXTBOOK REQUIRED:

Statkiewicz-Sherer, M., (2018), Radiation Protection in Medical Radiography, 9th ed. Leonard, (2024),

Bushong, (2020) Radiologic Science for Technologists: Physics, Biology, and Protection, 12th ed.

Quick & Easy Med Terminology, 10th ed Adler, A.

Carlton, R. (2022) Intro to Radiologic Imaging Sciences & Patient Care, 6th ed.



### EVALUATION METHODS:

- Test grades = 60%
- Final exam = 20%
- RTBC = 10%
- Quiz/homework/writing component = 10%

• Total

= 100%

**WEEKLY OUTLINE:**

<b>Week</b>	<b>Topic</b>	<b>Learning Outcomes (L.O)</b>
1	Introduction to imaging and radiologic sciences; Introduction to equipment basic; Pre-clinical/Basic concept of self protection, ALARA	SLO 4, 16, 21
2	Introduction to Clinical Education; mAs + kVp =; Risk vs. beni./consequences General sources of radiations	SLO 5, 17, 22
3	Safe patient movement and Handling techniques ; mAs + kVp relationship; Hist and dev of units	SLO 6, 18, 22, 23
4	Patient Interactions; CR and DR terminology ; Current radiation units	SLO 7, 19, 23
5	Human Diversity ; Exposure artifact types, causes and solutions; Management of patient dose, communication and immobilization	SLO 8, 17, 24
6	Human Diversity ; Digital Artifact types, causes and solutions; Management of patient dose, technical factors	SLO 8, 17, 24
7	History Taking ; SID and relationship with mAs and exposure/ISL and DSL cont. and its applications ; Management of patient dose, shielding, collimation, grids, design	SLO 9, 17, 24
8	Immobilization Techniques; Filtration and HVL ; Management of patient dose, pediatrics and pregnancy	SLO 10, 14, 17, 24
9	Professional Ethics; Radiographic brightness, define, measure, influencing and controlling factor and corrective actions; Management of personnel radiation dose shielding considerations	SLO 11, 17, 25
10	Vital Signs, Oxygen, Chest Tubes, and Lines; Radiographic contrast defined, optimizations, influencing and controlling factors, corrective actions; Management of personnel	SLO 12, 17, 25

	<b>radiation dose, technical and legal requirements</b>	
<b>11</b>	<b>Vital Signs, Oxygen, Chest Tubes, and Lines ; Radiographic contrast, corrective action for all factors; Radiation monitoring personnel devices</b>	<b>SLO 12, 17, 25, 26</b>
<b>12</b>	<b>Asepsis and the O.R. ; Proper display of images and marking; Radiation monitoring survey instruments</b>	<b>SLO 14, 20, 26</b>
<b>13</b>	<b>Asepsis and the O.R. ; Designing for radiation protection, construction considerations</b>	<b>SLO 13, 27</b>
<b>14</b>	<b>Dose limits for personnel and public/procedure dose limits</b>	<b>SLO 13, 15, 25, 26, 27</b>
<b>15</b>	<b>Final Exam</b>	<b>FINAL</b>

**HCCC POLICIES, STATEMENTS, AND SERVICES:**

<https://www.hccc.edu/administration/academic-affairs/syllabus-addendum.html>