**RADIOLOGY PROGRAM**

**SALT LAKE COMMUNITY COLLEGE**

**THEORY AND PRINCIPLES OF LIMITED RADIOLOGIC TECHNOLOGY**

**HS 1700 concurrent with HS 1710**

HS 1700 is a hybrid course that is taken concurrently with the lecture/lab course HS 1710.

CREDIT HOURS: 3



INSTRUCTOR INFORMATION:

INSTRUCTOR: Jayci Dowden R.T.

OFFICE: JHS 120D

OFFICE HOURS: by appointment only

PHONE: 801-957-6237

E-MAIL: please use the canvas course site

TEXTBOOKS:

- Radiography Essentials for Limited Practice, By Long, Frank and Ehrlich, 5th Edition

- Workbook Radiography Essentials for Limited Practice by Long, Frank, and Ehrlich, 5th edition

COURSE DESCRIPTION:

Theory & principals of basics x-ray exams in the office. It includes the role of the limited operator, radiographic equipment, basic math and physics, x-ray production, x-ray circuitry and tube heat management, principles of exposure and image quality, scatter radiation and radiation protection, digital imaging, image evaluation, ethical and legal situations, safety and infection control, managing acute situations. Also includes bone densitometry.

**SALT LAKE COMMUNITY COLLEGE STATEMENT LEARNING OUTCOMES:**

SLCC is committed to fostering and assessing the following student learning outcomes in its programs and courses by:

1. Acquiring substantive knowledge in their intended major
2. Communicate effectively
3. Develop quantitative literacies necessary for their chosen field of study
4. Think Critically and Creatively
5. Develop the knowledge and skills to be civically engaged
6. Develop the knowledge and skills to work with others in a professional and constructive manner
7. Develop computer and information literacy
8. Develop the attitudes and skills for Lifelong Wellness

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| **Course Learning Outcomes** | **SLCC CWSLO #** |
| Describe and identify the role of the radiology practical technician (RPT). | 1, 2, 5, 6, 7 |
| Identify and demonstrate the central ray, radiation field, scatter radiation, remnant radiation, components of the image receptor system, and essential features of a typical x-ray room | 1, 3, 4, 7 |
| Apply the basic mathematics of limited operators as they pertain to kVp, mAs, SID, and the 15% rule | 1, 3, 4, 6, 7 |
| Apply the basic physics of radiography including three forms of matter, fundamental particles of the atom, atomic structure, wavelength amplitude and wavelength frequency  | 1, 3, 4, 6 |
| Describe how the anode, cathode, and focal spot affect x-ray production  | 1, 2, 3, 7 |
| Describe x-ray circuit and tube management  | 1, 2, 3, 7 |
| Apply the principles of radiographic magnification and distortion | 1, 3, 7,  |
| Describe scatter radiation and its control | 1, 3, 4, 7 |
| Describe radiobiology and radiation safety  | 1, 3, 5,  |

See [SLCC Assessment webpage](http://www.slcc.edu/assessment/index.aspx) for additional details about College-Wide Student Learning Outcomes

COURSE OBJECTIVES:

By completing this course, you will be able to meet the following course learning objectives:

1. Describe the role of the practical radiologic technician (RPT)
2. Identify and demonstrate the central ray, radiation field, scatter radiation, remnant radiation, components of the image receptor system, and essential features of a typical x-ray room
3. Apply the basic mathematics of limited operators as they pertain to kVp, mAs, SID, and the 15% rule
4. Apply the basic physics of Radiography including three forms of matter, fundamental particles of the atom, atomic structure, wavelength amplitude and wavelength frequency
5. Describe how the anode, cathode, and focal spot affect x-ray production
6. Describe x-ray circuit and tube management
7. Apply the principles of radiographic magnification and distortion
8. Describe scatter radiation and its control
9. Describe radiobiology and radiation safety

Below you will find other learning objectives that relate to each chapter that we will cover. As you read the course material and complete the various assignments, you will be able to demonstrate that you can meet the several learning objectives in this course.

**Chapter 1: Role of the Limited X-ray Machine Operator**

* Compare the role of the limited x-ray machine operator with that of the registered radiologic technologist
* Identify the discoverer of x-ray and the date of the discovery
* Explain the primary purpose of the American Registry of Radiologic Technologists, American Society of Radiologic Technologists, and Joint Review Committee on Education in Radiology Technology
* Determine the legal requirements for the practice of radiography in your state
* Describe in a general way the duties of a limited x-ray machine operator
* Describe the typical work environment of the limited x-ray machine operator

**Chapter 2: Introduction to Radiographic Equipment**

* Use the correct terminology when discussing x-ray equipment and its parts
* Explain the difference between primary radiation, scatter radiation, and remnant radiation
* List two effects of scatter radiation
* List the components of the image receptor system
* List the essentials features of a typical x-ray room
* Explain the purpose of the control booth and the transformer cabinet
* Demonstrate a detent and explain its functions
* Explain the purpose of the collimator
* Describe precautions to be taken to ensure personnel safety from radiation exposure

**Chapter 3: Basic Mathematics of Limited Operators**

* Demonstrate calculations involving the use of fractions, decimals, percentages, exponents, ratios, and proportions, and simple algebraic equations
* Identify and use standards measurement units, state equivalent values for measurements in both English and metric systems, and convert measurements from one to another
* When given two of the milliampere-second (mAs) values (milliamper {mA], time, mAs) calculate the third
* Calculate changes in radiation intensity and required mAs for changes in source-image receptor distance (SID)
* Given a set of exposure factors, make appropriate adjustments for difference in patient part thicknesses using both kilovolt (kVp) and mAs
* Given a set of exposure factors, calculate the changes needed to change contrast levels using the 15% rule.
* Given a set of exposure factors, make appropriate adjustments for grid changes using mAs
* Given a set of exposure factors, make appropriate adjustments in mAs for changes in the relative speed of the image receptor system
* Perform routine medication dose calculations accurately

**Chapter 4: Basic Physics of Radiography**

* Define matter and list its three forms
* Name the fundamental particles of the atom and list characteristics of each
* Draw or describe a conceptual model of atomic structure
* List and describe five forms of energy
* Draw a single wave and measure its amplitude and its wavelength
* Relate the wavelength of a sine wave to its velocity and frequency
* Compare and contrast the characteristics of x-rays with the characteristics of visible light
* Explain the relationship between potential difference, current, and resistance in an electric current and state the units used to measure each
* State the frequency of alternating current and the United States and Canada using the correct units
* Describe the process of electromagnetic induction
* Draw simple diagrams of a step-up transformer and a step-down transformer

**Chapter 5: X-ray Production**

* Draw a simple x-ray tube and label the parts
* Describe both the composition and the functions of the basic parts of the x-ray tube
* Associate the terms anode and cathode with the appropriate parts of the x-ray tube
* Describe the production of both bremsstrahlung and characteristic radiation
* Explain what is meant by a dual-focus tube and describe its advantages
* Explain the significance of the target angle with respect to the line focus principle and the maximum field size
* Define “effective focus spot” and state its significance with respect to the radiology image
* Explain the function of a rotating anode and state its purpose
* State the effect of change in millampere (mA) and kilovolt (kVp) levels on the resulting x-ray beam

**Chapter 6: X-ray Circuit and Tube Heat Management**

* Explain the x-ray circuit, label the principal parts, and state the functions of each
* Explain what is meant by rectification and compare the three basic types
* Draw the voltage waveform for each of the following types; unrectificated, half-wave rectified, full-wave rectified, three-phase rectified, and high frequency
* List the primary features of all x-ray control panels and discuss the principal differences between conventional and computerized control consoles
* Describe the components of the automatic exposure control system and anatomically programmed exposure system
* List five possible causes of x-ray tube failure and describe methods to prevent each

**Chapter 7: Principles of Exposure and Image Quality**

* List the prime factors of exposure
* Explain the radiographic effect caused by changes in each of the four prime factors of exposure
* Recognize the changes in radiographic density and state the exposure factors used to control the radiographic density
* Identify high, low, and optimum contrast on a radiograph and state the exposure factors that primarily control radiographic contrast
* Define radiographic distortion and explain the difference between magnification and shape distortion
* Define recorded detail and list factors that influence it

**Chapter 9: Scatter Radiation and Its Control**

* List and explain three types of interactions between radiation and matter that produce scatter radiation.Explain problems caused by scatter radiation fog on a radiograph
* List four measures that can be taken to reduce the quantity of scatter radiation fog on a radiograph
* List grid ratios and state the appropriate application of each
* Define the term “grid cutoff”
* Explain the difference between a Bucky and a stationary grid

**Chapter 11: Radiobiology and Radiation Safety**

* State the units used to measure radiation exposure, absorbed dose, and the equivalent dose
* Discuss the potential effects of radiation injury to cells
* Define and compare radiation risks according to type; somatic vs genetic and short-term vs. long-term
* Explain the significance of ALARA
* List and explain methods for minimizing patient does during radiography
* List and explain precautions for the safety of limited operators
* List potential risks of radiation exposure during pregnancy and explain ways to reduce these risks.

**Chapter 10: Formulating X-Ray Techniques**

* Read and use an x-ray technique chart
* List methods of obtaining and/or creating an x-ray technique chart
* Compare fixed kilovolt peak (kVp) technique charts with variable kVp technique charts
* Select an appropriate milliamperage station for a given set of circumstances
* Explain the use of compensating filters for certain body structures

**Chapter 8: Digital Imaging**

* Explain the computed radiography (CR) digital system
* Explain the digital radiography (DR) system
* Describe the processing and post-processing of a digital image
* Explain what a picture archival and communication system (PACS) is and how it is used

**Chapter 19: Image Evaluation**

* Demonstrate a systematic review of a radiograph for diagnostic, technical and esthetic quality
* Recognize artifacts and technical errors on radiographs and state their causes
* Suggest appropriate changes in technique or procedure when image quality is less than optimal
* List appropriate criteria for determining whether a radiograph should be repeated

**Chapter 20: Ethics, Legal Considerations, and Professionalism**

* Apply ethical concepts to typical situations that arise in the health care setting
* Explain the rationale for confidentiality of professional communications
* List specific acts of misconduct and malpractice that could occur in the practice of radiography
* Demonstrate effective communication skills
* Demonstrate the use of patient charts for both obtaining and recording information

**Chapter 21: Safety and Infection Control**

* Demonstrate safe techniques when assisting patients
* List and explain factors involved in the cycle of infection
* Define medical asepsis, disinfection and sterilization
* Demonstrate the technique for effective hand-washing
* Demonstrate correct principles in of medical asepsis in linen handling, disposal of contaminated items, and disinfection of radiographic tables and equipment
* Demonstrate correct techniques for establishing a sterile field, donning sterile gloves, removing contaminated gloves, and changing dressings

**Chapter 22: Assessing Patients and Managing Acute Situations**

* List personal comfort needs common to most patients and describe appropriate responses to meet those needs
* Obtain and record a patient history
* Take vital signs
* Recognize acute life-threatening conditions and respond appropriately
* Demonstrate correct handling of patients with extremity fractures

**Chapter 26: Bone Densitometry**

* State the diagnostic criteria for osteoporosis as defined by the World Health Organization
* List the standards of bone health
* Name and identify different methodologies for bone mineral testing
* Describe the various types of dual energy x-ray absorptometry systems, including pencil beam, fan beam, and cone beam.

GENERAL POLICIES:

**SYLLABUS:** This syllabus represents an “agreement” between you the student and the instructor.  It is designed to ensure course integrity and fairness as well as provide students with a clear understanding of course expectations. The instructor and students are expected to use the syllabus and schedule as a guide for the semester.  Any deviation from the syllabus or schedule will be discussed and agreed upon by the instructor and students.

**STUDENT RESPONSIBILITIES:** If the student is having difficulty in the course, it is the student’s responsibility to make arrangements with the Instructor.  Students are expected to be self-directed and motivated in identifying their learning needs associated with the course content.Students are expected to spend about 4 hours each week reading, completing the workbook assignments, and completing the online quiz.

**DUE DATES:**Each assignment/quiz/test has a specific due date as noted on the course schedule and calendar. All must be taken or submitted by the due date before they close as they will not be reopened.

**QUIZZES:** All chapter quizzes are taken and submitted on canvas. Quizzes are open book and have no time limit.

**TESTS:** All tests must be taken at the South Jordan Testing Center or approved remote site during the scheduled test times.  Watch Canvas for test dates and availability at the testing center.

**CHAPTER WORKBOOK ASSIGNMENTS:** All workbooks will be submitted through canvas by the due date.  A point will be docked for every question not answered.

**LATE WORK:** Assignment due dates are posted.  Once the assignments are closed they will not be reopened and the points will be lost.

**CLASS FORMAT:**Modules will consist of reading material from the textbook, workbook assignments, PowerPoints, quizzes, and tests.  The successful student will read the required textbook material first prior to completing workbook assignments and taking weekly quizzes.  Students will submit workbook assignments through the Canvas course site and take quizzes on Canvas by scheduled deadlines.  Tests will be administered at the testing center on Jordan Campus or approved remote site.

**GRADING:**Due dates will be posted on the Canvas Syllabus Calendar.  The due dates are subject to change.  \*Check the Canvas site for any updates.

              Chapter quizzes            (16)                          450 pts

              Chapter workbook       (16)                          400 pts

              Tests                                (5)                          329 pts

              Final Exam                                                     150 pts

                                                                     Total of 1,329 points

**GRADING SCALE:**

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| --- | --- | --- | --- |
| Grade | Percent |  |  |
| A | 95-100% | A- | 90-94% |
| B+ | 87-89% | B | 84-86% |
| B- | 80-83% | C+ | 77-79% |
| C | 74-76% passing for practical/theory course | C- | 70-73% |
| D+ | 67-69% | D | 64-66% |
| D- | 60-63% | E | 0-59% |

**HOW TO SUCCEED IN THIS COURSE:** E-mail the instructor before assignment due dates for concerns, questions about the course set-up, or information in the syllabus.  Emails will be answered within 24 hours with the exception of weekends, emails will be answered the following Monday.  Please send an email to the instructor as soon as possible from the email within this course to ensure your email is working.  Log in often for announcements. Check the calendar for due dates.

Be proactive and take charge of your own education.  How much you get out of this course, and how much you learn about the radiology field is in large part determined by how involved you are with the course materials and discussions. The successful students are those that read the chapters, look at the PowerPoints and complete all workbook assignments.

**INCOMPLETE:** An incomplete is a conditional grade given only in extraordinary cases where a student has completed a major portion of the class but is unable to complete course work due to circumstances beyond their control such as major illness/injury or a death in the family.  Written documentation from your physician will be required. A student must be maintaining 75% or better before an incomplete is given.

**COURSE COMMUNICATION:** Students are encouraged to email or schedule an appointment with the instructor with any concerns or questions about this course.  Emails, announcements, and grading will be done through the Canvas course site.   Please check the site several times per week for updates.

**GENERAL DISTANCE LEARNING INFORMATION:** To update your browser and other information about distance learning contact the SLCC help desk at 801-957-5555.

**PLAGIARISM:** Students are expected to reference all sources of information.  Any plagiarism will result in failure of the assignment and possible failure of the course.  The information must not be copied from other student’s work, textbook or internet sources.

Please refer to the SLCC Intuitional Syllabus for additional college information.

**STUDENT CODE OF CONDUCT:** Please refer to the Student Code of Conduct regarding student behavior, cheating, plagiarism, sexual harassment, and discrimination found at <http://www.slcc.edu/policies/docs/stdtcode.pdf>.

**ADA/DISABILITY RESOURCES INFORMATION:** Students with medical, psychological, learning or other disabilities desiring accommodations or services under ADA must contact the Disability Resource Center (DRC). Please contact the DRC by phone: (801) 957-4659, TTY: (801) 957-4646, Fax: (801) 957-4947 or by email: linda.bennett@slcc.edu

**ACADEMIC GRIEVANCE POLICY**

In accordance with the Salt Lake Community College Student Code of Conduct, <http://www.slcc.edu/policies/docs/Student_Code_of_Conduct.pdf>, the grievance policy for students with reference to academics can be found in Section III. Students are encouraged to seek resolution with the instructor(s) whenever possible.

It is the goal of the School of Health Sciences to be forthright and consistent with specific academic policies throughout divisions and programs. This policy singularly addresses academic issues and the general principles for disciplinary actions as noted in the Student Code of Conduct Section III. It should be noted it is up to the faculty’s discretion to provide warning (verbal or written), suspension, or dismissal based upon program policy and severity of the issue at hand. It is realized in some health sciences programs a failing grade, as stated in the syllabus and/or policy manual, may result in program dismissal.

**STEP ONE:** A student has the right, as per college policy, to grieve a grade, warning (verbal or written), suspension, or dismissal received within a program of study. A student, as per policy, must make an appointment to meet with the instructor of the class. A meeting, for anything other than a final grade, should be made within ten (10) days of the incident. Final grade disputes require a meeting within 30 days of the student receiving the grade. Every effort should be made to find resolution and provide evidence from both parties with respect to the grade issued.

**STEP TWO:** If a resolution cannot be made, the student must request in writing five (5) business days from the date of meeting with the faculty, a committee review of the grievance to the Associate Dean of the specific division. The grievance will be reviewed by a committee consisting of three (3) to five (5) faculty outside the program in which the student is enrolled. This will include the following members, the Associate Dean and two to four faculty members outside the discipline. The Associate Dean will serve as committee chair. One faculty and the program coordinator of the program involved in the grievance can attend the procedure, as can the student with one representative. Each of these parties will only be allowed to present evidence to the committee and not vote on the issue in question. Legal representation is allowed by either party. The proceedings will be recorded for accuracy. Upon completion of the proceedings, the committee ONLY will vote on the issue(s) noted in the student’s grievance. A formal letter will be provided by the committee chair within ten (10) business days of the end of the proceeding with the committee’s decision regarding the issue.

**STEP THREE:** If the student is not satisfied with the outcome, they may appeal to the Academic Dean of the School of Health Sciences. This must be done in writing within five

1. days of receiving the formal letter from the grievance committee chair. The Dean will review the appeal, all evidence, and render a decision to the student within ten (10) days of receiving the formal letter from the student. The decision of the Dean of the School of Health Sciences is final and cannot be appealed.