Principles of Radiographic Imaging II (RADR 2305)

LAMAR INSTITUTE OF TECHNOLOGY

INSTRUCTOR CONTACT INFORMATION

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Office Hours:	Posted on door and in Starfish

CREDIT

3 Semester Credit Hours (3 hours lecture, 0 hours lab)

MODE OF INSTRUCTION

Face-to-Face: This course will be taught in a multimedia format. Lectures, demonstrations, and discussion will be utilized to enhance the cognitive learning process. Students will have outside reading and out of class homework assignments periodically in the semester. The student will be required to utilize both reading and listening skills.

PREREQUISITE/CO-REQUISITE:

RADR 1313 Principles of Radiographic Imaging I

COURSE DESCRIPTION

Radiographic image quality and the effects of exposure variables, and synthesis of all variables in image production.

COURSE OBJECTIVES

Upon completion of this course, the student will be able to

- Analyze image quality
- Utilize procedures form minimizing patient exposure
- Adapt technical variables to changing conditions
- Demonstrate knowledge of advanced modalities utilized in the diagnostic department, i.e. mobile, fluoroscopy, and computed tomography
- Have a basic understanding of Computed Tomography and Cross-Sectional Anatomy
- Begin ASRT Radiography Roadmap to begin prep for ARRT Registry exam

REQUIRED TEXTBOOK AND MATERIALS

- A computer with internet access. The computer must be able to run current programs and platforms such as Windows 10 and the internet must be reliable and robust. The

course has an online component and will move to a fully online format if necessary. The computer must have a camera and microphone for online conferencing.

- Chrome works best for BlackBoard assignments
- Bushong, Stewart C. *Radiologic Science for Technologists,* 12th edition, ISBN: 978-0-323-66134-8, Elsevier, Mosby Publishing 2021.
- ASRT Student Membership
- Clover Learning Student Plan (RadTechBootCamp)
- #882 Scan-trons and pencils
- Basic calculator

REFERENCE MATERIAL:

- Carlton, Richard. *Principles of Radiographic Imaging, An Art and Science* (Required in RADR 1313 taught in previously required course)
- Notes from RADR 1313 Principles of radiographic Imaging I and RADR 2309 Radiographic Equipment

COURSE POLICIES:

1. No food, drinks, or use of tobacco products in class.
2. Phones, headphones, and any other electronic devices must be turned off while in class.
3. Recording devices may be used except during test reviews and when otherwise stated by the instructor.
4. Lap top computers, I-pad… may be used to take notes during class but may not be used to "surf" the internet, look-up answers, nor anything not directly related to note taking.
5. It shall be considered a breach of academic integrity (cheating) to use or possess on your body any of the following devices during any examination unless it is required for that examination and approved by the instructor: Cell phone, smart watch/watch phone, laptop, tablet, electronic communication devices (including optical), and earphones connected to or used as electronic communication devices.
    - *This is a violation of the Radiologic Technology Student Handbook and will result in dismissal from the program.*

    Students with special needs and/or medical emergencies or situations should communicate with their instructor regarding individual exceptions/provisions. It is the student's responsibility to communicate such needs to the instructor.
6. Do not bring children to class.
7. If you wish to drop a course, the student is responsible for initiating and completing the drop process. If you stop coming to class and fail to drop the course, you will earn an 'F' in the course.
8. **ATTENDANCE POLICY:** Class attendance is important to ensure that a student receives the knowledge and skills necessary to be successful in the Radiologic Technology

program. Students are expected to be in class on time. If a student is tardy they may enter only if they do so quietly.

When it becomes necessary to miss a session, it is the responsibility of the *student* to contact the instructor and to inquire about assignments. I will *not* distribute the PowerPoints missed. The student must get the notes from a classmate. If a major test is missed, the test will be administered at the first day the student returns to class or at a time designated by the instructor. There will be a **ten (10) point** reduction for make-up exams.

To encourage class attendance, students that miss two (2) or more class sessions in a unit will have a five (5) point reduction on that test. Students who are tardy four (4) times will equal one (1) absence.

9. BlackBoard will be utilized for homework assignments. Quizzes will be administered in class. If a student misses an assignment for *any* reason **it may not** be made up. Quiz/homework grades will be averaged for one (1) test grade. Students will be allowed to drop their **lowest** quiz/homework grade at the end of the semester. If more than one quiz is missed a zero (0) will be given. This is already configured in Black Board gradebook
10. Any student who fails to pass a Unit test will be required to attend mandatory tutorial. This may be done before or after class or at lunch break. The tutorial may be individual or in a group session. There will be remediation assignments in Clover Learning Student Plan/RadTechBootCamp. ***These must be successfully completed or the student will not be allowed to take the next unit exam.***

DROP POLICY

If you wish to drop a course, you are responsible for initiating and completing the drop process by the specified drop date as listed on the Academic Calendar. If you stop coming to class and fail to drop the course, you will earn an "F" in the course.

STUDENT EXPECTED TIME REQUIREMENT

For every hour in class (or unit of credit), students should expect to spend at least two to three hours per week studying and completing assignments. For a 3-credit-hour class, students should prepare to allocate approximately six to nine hours per week outside of class in a 16-week session OR approximately twelve to eighteen hours in an 8-week session. Online/Hybrid students should expect to spend at least as much time in this course as in the traditional, face-to-face class.

RADR 2305 COURSE CALENDAR

DATE	TOPIC	READINGS (Due on this Date)	ASSIGNMENTS (Due on this Date)
21 Aug	Introduction to course & Physics review	Chapter 1 – 5	
23 Aug	X-ray Imaging System & X-ray Tube	Chapter 6 & 7	
28 Aug	X-Ray Production & X-Ray Emission	Chapter 8 & 9	
30 Aug	Equipment QC & Artifacts		
4 Sept	***LABOR DAY***		
6 Sept	REVIEW		ASRT Seal Test #14 due
11 Sept	***TEST I Equipment***		
13 Sept	Go over test & Image Acquisition	Chapter 15	
18 Sept	Patient-Image Optimization	Chapter 16	
20 Sept	Medical Image Descriptors	Chapter 21	Homework #1 due
25 Sept	Control of Scatter Radiation (Beam Restrictors)	Chapter 22	
27 Sept	(Grids)		Homework #2 due
2 Oct	REVIEW		*ASRT Roadmap month 6 due*
4 Oct	***TEST II Technique***		
9 Oct	Go over test & Fluoroscopy Bootcamp video		
11 Oct	Fluoroscopy	Chapter 25	
16 Oct	Interventional Radiology	Chapter 26	
18 Oct	Mammography	Chapter 24	Clover Learning Fluoroscopy assignment due
23 Oct	Tomosynthesis	Chapter 28	Homework due
25 Oct	Mobile Radiography & REVIEW		ASRT Seal Test #15 due
30 Oct	***TEST III***		
1 Nov	Go over test & study		
6 Nov	Prep Bowl review		
8 Nov	***COMPREHENSIVE EXAM -- UNITS 1-3***		
13 Nov	Go over test & Cross-Sectional Anatomy Head		*ASRT Roadmap month 5 due*
15 Nov	Cross-Sectional Anatomy Chest, Abdomen, Pelvis		
20 Nov	Computed Tomography	Chapter 27	
22 Nov	*Computed Tomography cont.*		
27 Nov	ASRT CT Basics & REVIEW		Articles Homework due
29 Nov	***TEST IV***		
4 Dec	Go over test		

GRADE SCALE: Numeric to letter grade conversion:

A = 93 - 100
B = 84 - 92
C = 77 - 83
D = 60 - 76
F = 0 - 59

*** A minimum of 77% is required for successful completion of this course!**

COURSE REQUIRMENTS:

Grades will be determined in the following manner:

Written Exams (4)	15% each
Average of Homework and Quizzes	20%
Comprehensive Final Exam	20%

ASRT RADIOGRAPHY ROADMAP

Complete multiple videos, quizzes, and anatomy labeling for modules 6 and 5 months before the Registry and ASRT Seal tests #14 & 15.

ACADEMIC DISHONESTY

Students found to be committing academic dishonesty (cheating, plagiarism, or collusion) may receive disciplinary action. Students need to familiarize themselves with the institution's Academic Dishonesty Policy available in the Student Catalog & Handbook at http://catalog.lit.edu/content.php?catoid=3&navoid=80#academic-dishonesty.

TECHNICAL REQUIREMENTS

The latest technical requirements, including hardware, compatible browsers, operating systems, etc. can be online at https://lit.edu/online-learning/online-learning-minimum-computer-requirements. A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of online technology and resources.

DISABILITIES STATEMENT

The Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. LIT provides reasonable accommodations as defined in the Rehabilitation Act of 1973, Section 504 and the Americans with Disabilities Act of 1990, to students with a diagnosed disability. The Special Populations Office is located in the Eagles' Nest Room 129 and helps foster a supportive and inclusive educational environment by maintaining partnerships with faculty and staff, as well as promoting awareness among all members of the Lamar Institute of Technology community. If you believe you have a disability requiring an accommodation, please

contact the Special Populations Coordinator at (409)-951-5708 or email specialpopulations@lit.edu. You may also visit the online resource at Special Populations - Lamar Institute of Technology (lit.edu).

STUDENT CODE OF CONDUCT STATEMENT

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at www.lit.edu. Please note that the online version of the *LIT Catalog and Student Handbook* supersedes all other versions of the same document.

STARFISH

LIT utilizes an early alert system called Starfish. Throughout the semester, you may receive emails from Starfish regarding your course grades, attendance, or academic performance. Faculty members record student attendance, raise flags and kudos to express concern or give praise, and you can make an appointment with faculty and staff all through the Starfish home page. You can also login to Blackboard or MyLIT and click on the Starfish link to view academic alerts and detailed information. It is the responsibility of the student to pay attention to these emails and information in Starfish and consider taking the recommended actions. Starfish is used to help you be a successful student at LIT.

ADDITIONAL COURSE POLICIES/INFORMATION

COURSE OUTLINE:

RADIOLOGIC PHYSICS

1. Discuss the parts of the Sine Wave
2. Amplitude
3. Frequency
4. Wavelength
5. Velocity

ELECTROMAGNETIC SPECTRUM

Discuss how x-radiation relates to the electromagnetic spectrum

OHM's LAW

Be able to work mathematical problems using Ohm's law

TRANSFORMERS

1. Step-up transformers
2. Step-down transformers
3. Autotransformers

X-RAY PRODUCTION

1. Discuss the types of radiation created in the x-ray tube and how the prime factors affect their production
    a. Characteristic radiation
    b. Bremsstrahlung radiation
2. X-ray Emission Spectrum

THE X-RAY IMAGING SYSTEM

1. Identify the components of the operator's console or control panel
    a. mA
    b. time
    c. kVp
2. Relate important differences between generators
    a. single phase
    b. three phase
    c. high-frequency

THE X-RAY TUBE

1. Describe support designs for the tube
    a. ceiling
    b. floor
    c. c-arm
    d. fluoroscopy
2. Discuss the cathode and filament currents
    a. filament
    b. focusing cup
3. Describe the parts of an anode
    a. target
    b. focal spot/tract
4. Define the line focus principle and the anode heel effect
5. Identify causes of tube failure
    a. rotor too long
    b. pitting of anode
    c. thinning filament
    d. cracked glass envelop
6. Visualize the path traversed by the electron/x-ray photon from the filament to the image receptor

X-RAY EMISSION

1. Discuss the factors that control and affect x-ray quantity/intensity
    a. mA
    b. time
    c. kVp
    d. SID
2. Discuss the factors that control and effect x-ray quality/energy
    a. kVp
    b. HVL
3. Use decision making skills to determine how prime and secondary factors will affect radiographic intensity and energy

IMAGE ACQUISITION

1. List the 4 prime factors and their effect on intensity and energy
    a. mA
    b. time

c. kVp
d. SID

2. Use math skills to work formulas to determine the amount of technique changes required to adjust exposures in different circumstances
   a. Square law/Exposure Maintenance Law
   b. Inverse square law
   c. 15% rule

3. Demonstrate knowledge of automatic exposure controlled devices
   a. back-up timer
   b. minimum response time
   c. exposure control
   d. ionization chamber

4. Use creative thinking skills to determine adjustment of photocells of an AEC for:
   a. pathology
   b. body habitus
   c. trauma
   d. age

5. Describe magnification radiography and its uses
6. Discuss the image quality factors and how they influence radiographic characteristics
   a. image receptor exposure
   b. subject contrast
   differential absorption
7. Describe the various types of technique charts
   a. fixed kVp
   b. variable kVp
   c. AEC
   d. pathology
   e. contrast media

PATIENT-IMAGE OPTIMIZATION

1. List the patient factors and describe their affect radiographic technique
   a. pathology
   b. part composition

MEDICAL IMAGE DESCRIPTORS

1. Define radiographic quality, resolution, and noise
2. Discuss the geometric factors that affect radiographic quality
   a. distortion
   b. magnification
   c. spatial resolution
   d. contrast resolution
3. Discuss the subject factors that affect radiographic quality
   a. tissue composition
   b. tissue thickness
   c. differential absorption
4. Utilize problem solving skills to determine *how* changing equipment, technical

factors, and patient factors will affect the visibility and recognizability functions

QUALITY CONTROL

1. Distinguish between a quality assurance program and a quality control program
2. Describe the steps of quality control
3. Discuss the routine quality control tests and schedule for radiographic systems
   a. tube
   b. generator
   c. imaging accessories

CONTROL OF SCATTER RADIATION

1. List 3 factors that contribute to scatter radiation
   a. KVp
   b. part thickness
   c. beam restriction
2. Discuss the relationship between scatter radiation and image contrast
3. Describe beam restriction and its effect on patient dose and image quality
   a. aperture diaphragm
   b. cone/cylinder
   c. collimator
4. Describe the construction of grids
   a. radiopaque lead strip
   b. radiolucent interspace
   c. linear
      i. unfocused
      ii. focused
5. Discuss common errors in grid usage
   a. off level
   b. off center
   d. off focus
6. Describe the different methods of measuring grid performance
   a. grid ratio
   b. grid frequency
   c. bucky factor
   d. contrast improvement factor

FLUOROSCOPY

1. Discuss the history of fluoroscopy
   a. conventional
   b. image intensified
   c. digital
2. Describe the components and function of the image intensifier tube
   a. input phosphor
   b. photocathode
   c. electrostatic lens
   d. output phosphor

INTERVENTIONAL PROCEDURES

1. Discuss the parts of a digital fluoroscopy system and explain their function
2. Discuss the use of charge couple device instead of TV camera tube
3. Describe the steps for interventional procedures

MOBILE RADIOGRAPHY

1. Understand the importance of communication when doing mobile radiographic exams
2. Describe the methods used to protect the technologist and others in room
    a. shielding
    b. distance
    c. time
3. Distinguish between the several types of mobile radiographic equipment
    a. battery powered unit
    b. digital unit
    c. industrial mobile unit
4. Understand the importance of using a technique chart
5. Describe the important facts to consider when purchasing a mobile unit
    a. hazards
    b. size
    c. output
6. Use critical thinking skills to determine tube/IR/patient manipulations required for bedside and trauma radiography

MAMMOGRAPHY

1. Demonstrate knowledge of the history of mammography
2. Identify anatomical structure and function of the breast
3. Discuss the important characteristics of a mammographic imaging system
    a. long SID
    b. compression
    c. low ratio grid
    d. low kVp
4. Describe the types of image receptors used for mammography
    a. low dose screen/film
    b. digital
5. Explain the differences between types of exams
    a. diagnostic
    b. screening mammography
6. Discuss the basic views
    a. CC
    b. MLO

TOMOSENTESIS

1. Discuss what tomosynthesis is
2. Describe the equipment used
3. Identify artifacts and their cause
4. Compare patient radiation dose with different modalities

COMPUTED TOMOGRAPHY

1. Discuss the history of computed tomography
2. Discuss the parts of a CT unit
    a. tube
    b. detectors
    c. gantry
    d. couch
    e. console
    f. imaging device
3. Identify patient prep for CT procedures
4. Discuss dangers of CT
5. Discuss special types of CT
6. 3D CT
7. Spiral CT

CROSS-SECTIONAL ANATOMY

1. Discuss imaging modalities that utilize cross-sectional anatomy
2. Identify cross-sectional anatomy of the brain
3. Identify cross-sectional anatomy of the neck
4. Identify cross-sectional anatomy of the chest
5. Identify cross-sectional anatomy of the abdomen
6. Identify cross-sectional anatomy of the pelvis