Advanced Medical Imaging (RADR 2333-3A1 & 5A1)

INSTRUCTOR CONTACT INFORMATION

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Office Hours:	Monday/Wednesday 11:15am-12:30pm

CREDIT

3 semester credit hours (2 hours lecture and 2 hours lab)

MODE OF INSTRUCTION

This course will utilize face to face instruction with a multimedia format. The course has an on-line component. If the need arises, the course will move to a fully on-line format. The computer must have a camera and microphone for on-line conferencing.

PREREQUISITE/CO-REQUISITE:

RADR 2401 Intermediate Radiographic Procedures

COURSE DESCRIPTION

An exploration of specialized imaging modalities.

COURSE OBJECTIVES

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

1. Differentiate among the various specialized imaging modalities and associated equipment.
2. Identify and compare anatomy as imaged by different specialty modalities.
3. Differentiate between analog and digital imaging.
4. Identify and discuss the components of computed radiography.
5. Identify and discuss the components of a direct radiography imaging system.

REQUIRED TEXTBOOK AND MATERIALS

- **Digital Radiography and PACS**, 4th Ed., Carter and Veale
  - ISBN# 978-0-323-008644-8
- **Radiographic Positioning and Related Anatomy**, Bontrager, 10th Ed.
  - ISBN# 978-0-323-05410-2

- 882 Scantrons

Suggested Reference Textbooks

- **Radiography in the Digital Age**, Quinn B. Carroll
  - ISBN# 978-0-398-08119-5
- **Radiologic Science for Technologists**, 12th Ed., Bushong
  - ISBN# 978-0-323-08135-1
- **Principles of Radiographic Imaging**, 6th Ed., Carlton and Adler
  - ISBN# 0-7668-1300-2

ATTENDANCE POLICY

- Students who are 10 minutes or later to lab will be counted absent and will be required to make up the lab assignment or video at a later time.
- To encourage class attendance, students that miss two (2) or more class/lab sessions in a unit for a test will have a 5-point reduction on that test.
- Four tardies in class/lab will be counted as one (1) absence.
- Missed Tests: Any student missing a test will be allowed to take a make-up test with a 10-point reduction on their grade for that test.
- Homework Policy: Late homework will be accepted but will result in a reduction of 10 points for each class day it is late.
- If a student wants to drop a course, the student is responsible for initiating and completing the drop process. If a student stops coming to class and fails to drop the course, the student will receive an 'F' in the course.
- Cellphones, headphones and any other noisemakers must be turned off while in class. If one of these devices goes off during class, you will be asked to leave the classroom. Do not bring children or pets to class. If you enter the classroom late, do not walk in front of the instructor or projector.
- Smart watches may not be worn during quizzes or tests.
- 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 else not related to note taking.

COURSE POLICIES:

- **Students should keep electronic devices (Cell phones, ear buds, smartwatches, etc.) off during class. Students must keep these devices at the front of the classroom during tests.**
- **No food, drinks, or use of tobacco products in class.**
- **Do not bring children to class.**
- **Audio recording devices may be used *except* during test reviews and when otherwise stated by the instructor.**
- **A computer with internet access is required for the course. 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 on-line component. If the need arises, the course will move to an on-line format. The computer must have a camera and microphone for online conferencing.**

- **Lap top computers, I-pad…may be used to take notes during class but may <u>not</u> be used to "surf" the internet, look-up answers, nor anything not specifically related to note taking.**

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.

COURSE CALENDAR

Date	Topic	Assignment	Chapter
Aug. 26	**Ch. 1 Introduction to Dig.Rad/PACS**		**Ch. 1**
Aug.28	Ch. 1/Ch. 2 Dig. Image Character.		Ch.1/2
Sept. 2	**Labor Day- NO CLASS**		**Ch. 2**
Sept. 4	Ch. 2 Digital Imaging Characteristics		**Ch. 2**
Sept. 9	Ch. 2 Digital Imaging Characteristics		Ch. 2
Sept. 11	Ch. 3 Digital Image Processing and Manipulation		**Ch. 3**
Sept. 16	Ch. 3 continued		**Ch. 3**
Sept. 18	Ch. 4 PSP Image Capture		**Ch. 4**

Sept. 23	Test 1 Review		
Sept. 25	**Test 1 (Ch. 1-4)**		
Sept. 30	Go over Test 1/More on CR		**BB**
Oct. 2	More on CR/Ch. 5 TFT Flat Panel		**BB/Ch. 5**
Oct. 7	Ch. 5 TFT		**Ch. 5**
Oct. 9	Ch. 6 CCD/CMOS		**Ch. 6**
Oct. 14	Ch. 7 Basic Computer Principles Review for Test 2		**Ch. 7**
Oct. 16	**Test 2 (Ch. 5-7)**		
Oct. 21	Ch. 8 Networking & Communication Basics		**Ch. 8**
Oct. 23	Ch. 9 PACS Fundamentals		**Ch. 9**
Oct. 28	Medical Image Storage and Peripherals Medical Informatics		**Ch. 10/11**
Oct. 30	Ensuring Quality in PACS		**Ch. 12**
Nov. 4	Quality Acceptance Testing in Digital Review for Test 3		**Ch. 13**

Nov. 6	Lines & Tubes Lecture		BB
Nov. 11	**Test 3 (Ch.8-13**)		
Nov.13	Go over Test 3		
Nov. 18	Artifacts Lecture		BB
Nov. 20	Review for Comprehensive Exam		
Nov. 25	**Comprehensive Exam**		
Nov. 27	Digital Article Review		BB
Dec. 2	Technique Chart		
Dec. 4	Technique Chart Due		

COURSE EVALUATION
Grades will be determined from three (3) tests, lab attendance and assignments, quizzes, and a comprehensive exam.

3 tests (15% each)	**= 45%**
ASRT Videos Avg	**= 7.5%**
Technique Chart	**= 7.5%**
Lab experiments and quizzes	**= 15%**
Comprehensive Exam	**= 25%**

Course Requirements

1. There will be three major tests and a comprehensive exam.
2. Students are required to outline material for each major test before they are allowed to take each test. This is called a Ticket to Test. Failure to complete this requirement will result in a 5 point reduction on the test.
3. Any student who fails to pass a test will be required to attend mandatory tutorial. This session may be done before class, after class, or at lunch break. The tutorial may be individual or in a group session.
4. ASRT Essentials of Digital Imaging Videos will be shown during class/lab time. There are 7 hours of videos with review questions at the end of each video. The average of the review questions will count as **7.5% of the course grade**. Missed videos and review questions can be made up by scheduling a time to watch them with the instructor. Missed videos/questions will have a **5-point reduction** and those that are not made up will be given a grade of zero "0". They should be made **up within one week** of the date missed.
5. At the completion of the series, students will receive a certificate of completion which can be added to their resume'.
6. Lab experiments are a completion grade. Missed lab experiments can be made up if arrangements are made with the instructor. Missed experiments that are not made-up will be given a grade of zero "0". Experiments should be rescheduled within one week of the date missed.
7. Missed quizzes cannot be made up and a grade of zero "0" will be given. They are pop quizzes and are not scheduled. The lowest quiz, lab experiment, or assignment grade will be dropped.
8. Lab material will be tested during the lecture component.
9. **Your dosimeter must be worn during lab experiments requiring radiographic exposures.**
10. The videos, experiments, and assignments will need to be completed before the comprehensive exam. Students not completing the assignments for lab will be given an incomplete in the course and will not progress in the radiology program.

GRADING SCALE
Numeric to letter grade conversion:
   A=93-100
   B=84-92
   C=77-83
   D=65-76
   F=64 and below

A MINIMUM OF 77% IS REQUIRED FOR SUCCESSFUL COMPLETION OF THIS COURSE
LIT does not use +/- grading scales

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.

AI Statement

Lamar Institute of Technology (LIT) recognizes the recent advances in Artificial Intelligence (AI), such as ChatGPT, have changed the landscape of many career disciplines and will impact many students in and out of the classroom. To prepare students for their selected careers, LIT desires to guide students in the ethical use of these technologies and incorporate AI into classroom instruction and assignments appropriately. Appropriate use of these technologies is at the discretion of the instructor. Students are reminded that all submitted work must be their own original work unless otherwise specified. Students should contact their instructor with any questions as to the acceptable use of AI / ChatGPT in their courses.

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.

Course Outline

Digital Imaging
1. Define image brightness.
2. Discuss analog vs. digital imaging.

Computed Radiography
1. Identify the components of image plates.
    A. Phosphor layer
    B. Base
    C. Protective layer
2. Describe the read process.
    A. Photostimulable luminescence (PSL)
    B. Laser scanning
    C. Erasure
3. Explain the relative speed of digital systems.

Direct Radiography
1. Define digital radiography.
    A. Collection elements
        1. Photodiodes
        2. Charged-coupled devices (CCD's)
        3. Thin-film transistors
2. Discuss Direct Capture
    A. Advantages
    B. Disadvantages
    C. Flat panel detectors
    D. Pixel Pitch
    E. Fill Factor
    F. Detector Element
3. Discuss Indirect Capture
    A. Advantages
    B. Disadvantages

Digital Image Characteristics
1. Explain image matrix
2. Identify and discuss pixels
3. Explain the pixel size formula

4. Identify and discuss image sampling

5. Explain histograms

6. Discuss the concept of equalization

Spatial Resolution

1. Identify the controlling factors.

A. Matrix size

B. Pixel size

Contrast Resolution

1. Discuss dynamic range

A. Bit depth

B. Pixels

Windowing

1. Explain window level

2. Explain window width

Technique Selection

1. Define ALARA and relate to digital imaging

2. Discuss Kvp selection specific to digital imaging

3. Discuss Mas selection specific to digital imaging

4. Define dose creep

5. Define exposure creep

Exposure Index

1. Describe exposure index for computed radiography and direct radiography

2. Define underexposure and discuss corrections

3. Define overexposure and discuss corrections

4. Define normalization

5. Explain the concept of signal to noise ratio

6. Define dose area product

Viewing Monitors

1. Describe cathode ray tubes (CRT)

2. Describe active matrix liquid crystal display (AMLCD)

3. Describe plasma monitors

4. Discuss the photometric properties

5. Define lumen

6. Define luminance

Pre-processing Modes for the Digital Image

1. Explain flat fielding

2. Describe offset images

3. Describe gain images

4. Explain signal interpolation

5. Explain image lag

6. Describe look up tables (LUT)

7. Explain line noise

8. Describe dark noise.

Post Processing Options for the Digital Image

1. Explain image annotation

2. Explain image magnification

3. Explain image flip/image rotate/inversion

4. Explain digital subtraction (DSA)

5. Explain background shuttering
6. Explain pixel shift
7. Describe and explain the region of interest (ROI)
8. Describe image orientation
9. Describe image stitching
10. Describe edge enhancement

PACS

1. Define the components of image storage.
2. Define picture archiving and communication system (PACS)
3. Explain the system components and functions
4. Define the emergency contingency plan regarding archives
5. Define film digitizers
6. List and define network configurations
7. Define teleradiology

Quality Control and Quality Management

1. Describe quality management in digital imaging.
2. Equipment calibration
3. Plate reader QM
4. Image monitor QC
5. Define performance assessment standards in digital imaging.
    A. SMPTE
    B. AAPM TG18
6. Define the standards in image monitor evaluation.

Digital Imaging Artifacts

1. Define and describe digital image artifacts.
    A. Image receptor
    B. Pixel malfunction
    C. Ghost images
    D. Moire effect/aliasing
    E. Backscatter
    F. Rough handling
    G. Software
    H. Dead pixels
    I. Flatfielding
    J. Image compression
        1. Lossless
        2. Lossy
    K. Patient Considerations
    L. Collimation
    M. Fading
    N. Heat
    O. Banding
    P. Overexposure

Lab Schedule

RADR 2333

Fall 2024

Mondays, 8am-9:55am, Rm. 163

Aug. 26   Intro to lab and course/Ch. 1/Expose intensifying screen

Sept. 2   **Labor Day-NO LAB or CLASS**

Sept. 9   ASRT Video 1, Fundamentals/Discuss Rona Technique Chart

Sept. 16   ASRT Video 2, Processing/Start Tech. Chart/Ch. 3/4 Lecture

Sept. 23   Experiment 1-Manipulating AECs /Technique Chart

Sept. 30   ASRT Video 3/Line Pair Phantoms Exp./Test Patterns

Oct. 7   Technique Chart

Oct. 14   ASRT Video 4, Image Analysis/Technique Chart

Oct. 21   Go over Test 2/ASRT Video 5, PACS/Technique Chart

Oct. 28   Experiment-15% Rule/Tech. chart

Nov. 4   ASRT Video 7/Digital QC Worksheets 20-1 & 23-2 (Bushong Book)

Nov. 11   Technique Chart

Nov. 18   ASRT Video 6-Dose Reduction

Nov. 25   **Comprehensive Exam**

Dec. 2   Experiment-Calibrate flat panel detector /Technique Charts

                       Technique Charts due Dec. 4