



**LAMAR INSTITUTE  
OF TECHNOLOGY**

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

### **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. Describe the various specialized imaging modalities and associated equipment.
2. Differentiate between images produced by different modalities and identify the anatomy demonstrated.
3. Identify and discuss the components of a direct radiography imaging system.
4. Define and discuss digital image characteristics.
5. Define and discuss digital image processing.
6. Define and discuss basic computer principles.

### **INSTRUCTOR CONTACT INFORMATION**

|                  |                                     |
|------------------|-------------------------------------|
| Instructor:      | Sheryl A. Nance, BAAS, R.T. (R)(CT) |
| Email:           | sanance@lit.edu                     |
| Office Phone:    | 409.247.5093                        |
| Office Location: | Multi-Purpose Center, Office 231    |
| Office Hours:    | Monday/Wednesday 11:15am-12:30pm    |

## **REQUIRED TEXTBOOK AND MATERIALS**

- **Digital Radiography and PACS**, 4<sup>th</sup> Ed., Carter and Veale
  - ISBN# 978-0-323-008644-8
- **Radiographic Positioning and Related Anatomy**, Bontrager, 10<sup>th</sup> 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**, 12<sup>th</sup> Ed., Bushong
  - ISBN# 978-0-323-08135-1
- **Principles of Radiographic Imaging**, 6<sup>th</sup> Ed., Carlton and Adler
  - ISBN# 0-7668-1300-2

## **ATTENDANCE POLICY**

- Students who arrive 10 minutes or later in the lab will be counted absent and will be required to make up the lab assignment/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 unless extenuating circumstances exist.
- Assignment Policy: Late assignments 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 must be turned off or be on silent while in class. If a cellphone goes off during class, you will be asked to leave the classroom. Do not bring children or pets to class.
- Smart watches or meta glasses are not allowed to 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.
- Students are allowed to record the audio of the lecture if the instructor is informed.
- Recording devices may be used except during tests and when the instructor is going over a test or otherwise stated by the instructor. This includes all recording devices, i.e. meta glasses, phones, recorders, etc.
- **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 not 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**

| <b>Date</b>     | <b>Topic</b>                                    | <b>Assignment</b> | <b>Chapter</b> |
|-----------------|-------------------------------------------------|-------------------|----------------|
| <b>Aug. 24</b>  | <b>Ch. 1 Introduction to Dig.Rad/PACS</b>       |                   | <b>Ch. 1</b>   |
| Aug.26          | Ch. 1/Ch. 2 Dig. Image Character.               |                   | Ch.1/2         |
| <b>Aug. 31</b>  | Ch. 2 Digital Imaging Characteristics           |                   | <b>Ch. 2</b>   |
| Sept. 2         | Ch. 2 Digital Imaging Characteristics           |                   | <b>Ch. 2</b>   |
| <b>Sept. 7</b>  | <b>Labor Day Holiday</b>                        |                   |                |
| Sept. 9         | Ch. 3 Digital Image Processing and Manipulation |                   | <b>Ch. 3</b>   |
| <b>Sept. 14</b> | Ch. 3 Part 2                                    |                   | <b>Ch. 3</b>   |
| Sept. 16        | Ch. 3 Part 2                                    |                   | <b>Ch. 3</b>   |

|                 |                                                              |  |                  |
|-----------------|--------------------------------------------------------------|--|------------------|
| <b>Sept. 21</b> | Test 1 Review                                                |  |                  |
| Sept. 23        | <b>Test 1 (Ch. 1-3)</b>                                      |  |                  |
| <b>Sept. 28</b> | Go over Test 1/Artifacts & More                              |  | <b>BB</b>        |
| Sept. 30        | Artifacts & More/Ch. 5 TFT Flat Panel                        |  | <b>BB/Ch. 5</b>  |
| <b>Oct. 5</b>   | Ch. 5 TFT                                                    |  | <b>Ch. 5</b>     |
| Oct. 7          | Ch. 6 CCD/CMOS                                               |  | <b>Ch. 6</b>     |
| <b>Oct. 12</b>  | Ch. 7 Basic Computer Principles<br>Review for Test 2         |  | <b>Ch. 7</b>     |
| Oct. 14         | <b>Test 2 (Ch. 5-7)</b>                                      |  |                  |
| <b>Oct. 19</b>  | Ch. 8 Networking & Communication<br>Basics                   |  | <b>Ch. 8</b>     |
| Oct. 21         | Ch. 9 PACS Fundamentals                                      |  | <b>Ch. 9</b>     |
| <b>Oct. 26</b>  | Medical Image Storage and Peripherals<br>Medical Informatics |  | <b>Ch. 10/11</b> |
| Oct. 28         | Ensuring Quality in PACS                                     |  | <b>Ch. 12</b>    |
| <b>Nov. 2</b>   | Quality Acceptance Testing in Digital<br>Review for Test 3   |  | <b>Ch. 13</b>    |
| Nov. 4          | Lines & Tubes Lecture                                        |  | <b>BB</b>        |

|                |                                                              |  |    |
|----------------|--------------------------------------------------------------|--|----|
| <b>Nov. 9</b>  | <b>Test 3 (Ch.8-13)</b>                                      |  |    |
| Nov.11         | Go over Test 3                                               |  |    |
| <b>Nov. 16</b> | Pharmacology                                                 |  | BB |
| Nov. 18        | Review for Comprehensive Exam                                |  |    |
| <b>Nov. 23</b> | <b>Comprehensive Exam</b>                                    |  |    |
| Nov. 25        | <b>Holiday-NO CLASS</b><br>Digital Article Review (optional) |  | BB |
| <b>Nov. 30</b> | Technique Chart Due                                          |  |    |
|                |                                                              |  |    |

### **COURSE EVALUATION**

Grades will be determined from three (3) tests, videos, technique chart, lab experiments & quizzes, and a comprehensive exam.

(3) Unit tests (20% each) = **60%**

ASRT Videos Avg & Technique Chart = **7.5%**

Quizzes & lab experiments = **7.5%**

**Comprehensive Exam** = **25%**

### **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

### **Course Requirements**

1. There will be three (3) unit tests for **60% of course grade** and a comprehensive exam for **25% of course grade**. Lab material is included in major tests.

2. ASRT Essentials of Digital Imaging Videos will be shown during class or lab time. There are 7 videos with review questions at the end of each video. The videos include content for the course. Missed videos and review questions can be made up by scheduling with the instructor. Missed videos/questions 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. At the completion of the series, students will receive a certificate of completion which can be added to their resume'. The Rona technique chart assignment completed during lab time of the course is averaged with the ASRT Video review questions for **7.5% of the course grade**.
3. Lab experiments are pass or fail. 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.
4. Quizzes missed 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. Quizzes and lab experiments will count as **7.5% of the course grade**.

#### **PRE-TEST REVIEW**

5. Assignments will be made in Clover Learning as review for Unit Tests. If the review assignments are not completed with a score of 80 or higher by the scheduled start time of the exam, the student will not be allowed to take the exam and penalty points will be applied for make-up exam.

#### **MANDATORY REMEDIATION**

6. Any student who fails to pass a Unit test with at least a 77 will be required to attend mandatory tutorial. This may be done before or after class. The tutorial may be individual or in a group session. There will be remediation assignments in Clover Learning Student Plan. These must be successfully completed by the due date, or two points will be deducted from the test grade for every class it is late.
7. **Your dosimeter must be worn during lab experiments requiring radiographic exposures. Students without their dosimeters, will be required to reschedule their lab experiments. If they do not schedule within a week, they will be given a zero "0" for the experiment.**
8. The videos, experiments, and assignments will need to be completed before the comprehensive exam. Students who do not complete the assignments for lab will be given an incomplete "I" in the course which will prohibit them from continuing in the program.

## **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](mailto: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](http://www.lit.edu). Please note that the online version of the *LIT Catalog and Student Handbook* supersedes all other versions of the same document.

## **ARTIFICIAL INTELLIGENCE 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.

## **ADDITIONAL COURSE POLICIES AND INFORMATION**

### **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.**
- **Smart glasses can be worn during class but *cannot* be used to video or audio record test material during the review of a test.**
- **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.**

## **Course Outline**

### **Digital Imaging**

#### **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

### **Computed Radiography**

1. CR image plates
2. Image plate reader
3. Contrast Computed Radiography and Direct radiography

### **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. Define brightness.

### **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 direct radiography
2. Define underexposure and discuss corrections
3. Define overexposure and discuss corrections
4. Define normalization/rescaling
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 lumens
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. 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 background shuttering
5. Describe and explain the region of interest (ROI)
6. Describe image orientation
7. Describe image stitching
8. Describe edge enhancement.
9. Describe smoothing.
10. Define equalization.

#### **PACS/MIMPS**

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. List and define network configurations
6. Define teleradiology

#### **Quality Control and Quality Management**

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

#### **Digital Imaging Artifacts**

1. Define and describe digital image artifacts.
  - A. Image receptor
  - B. Pixel malfunction
  - C. Image lag
  - D. Aliasing
  - E. Backscatter
  - F. Dead pixels
  - G. Flatfielding
  - H. Image compression
    1. Lossless
    2. Lossy
  - I. Patient Considerations
  - J. Collimation
  - K. Heat

L. Underexposure  
M Overexposure

## Lab Schedule

RADR 2333

Fall 2026

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

|          |                                                                                         |
|----------|-----------------------------------------------------------------------------------------|
| Aug. 24  | Intro to lab and course/Ch. 1                                                           |
| Aug. 26  | ASRT Video 1, Fundamentals/Calibrate DR Panel/Room Warm-up/Discuss Rona Technique Chart |
| Aug. 31  | ASRT Video 2                                                                            |
| Sept. 7  | <b>Labor Day-NO LAB or CLASS</b>                                                        |
| Sept. 14 | ASRT Video 2, Processing/Tech. Chart/Ch. 3/4 Lecture                                    |
| Sept. 21 | Experiment 1-Manipulating AECs /Technique Chart                                         |
| Sept. 28 | ASRT Video 3/Line Pair Phantoms Exp./Test Patterns                                      |
| Oct. 5   | Technique Chart                                                                         |
| Oct. 12  | ASRT Video 4, Image Analysis/Technique Chart                                            |
| Oct. 19  | Go over Test 2/ASRT Video 5, PACS/Technique Chart                                       |
| Oct. 26  | Experiment-15% Rule/Tech. chart                                                         |
| Nov. 2   | ASRT Video 7/Digital QC Worksheets 20-1 & 23-2 (Bushong Book)                           |
| Nov. 9   | Technique Chart                                                                         |

|         |                             |
|---------|-----------------------------|
| Nov. 16 | ASRT Video 6-Dose Reduction |
| Nov. 23 | Comprehensive Exam          |
| Nov. 30 | Technique Charts Due        |