



Principles of Radiographic Imaging I (RADR 1313)

Credit: 3 semester credit hours (3 hours lecture)

Prerequisite: RADR 1309 Introduction to Radiography and Patient Care

Course Description: Radiographic image quality and the effects of exposure variables.

Textbook:

- 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.
- Carlton, Richard. *Principles of Radiographic Imaging, An Art and Science*, 6th edition, Delmar Publishing, ISBN# 10: 1-337-71106-3
- #882 Scan-trons and pencils
- Basic calculator

Reference Material:

- Use your notes and text book from the previous course RADR 1201 Introduction to Radiography and RADR 1203 Patient Care

Course Objectives:

By the end of the semester of instruction the student will:

1. Apply the basic principles of radiographic image acquisition to image quality.
2. Analyze the effects of exposure variables upon image quality. Demonstrate knowledge of the components necessary to produce an x-ray beam

Course Outline:

At the completion of each chapter the student should be able to...

Ch. 1 Basic Math

1. Brief review of basic math
 - a. Fractions
 - b. Decimals
 - c. Rounding
2. Introduction to Radiology math
 - a. $\text{mA} \times \text{sec} = \text{mAs}$
 - b. Inverse Square Law
 - c. Square Law
 - d. 15% Rule

Ch 5 X-Ray Tube

1. describe the parts and function of the cathode
 - a. filament
 - b. focusing cup
2. describe the parts and function of the anode
 - a. target
 - b. focal spot
3. discuss the function of the glass envelop
4. discuss the function of the tube housing
5. define parts of beam
 - a. primary
 - b. remnant
 - c. off focus
 - d. leakage
6. list recommendations for extending tube life

Ch. 6 X-Ray Equipment

1. list and discuss the different types of x-ray equipment
 - a. diagnostic
 - b. fluoroscopic
 - c. therapeutic
 - d. dedicated units
 - a. chest
 - b. tomography
2. discuss the types of x-ray timers
 - a. synchronous motor driven
 - b. mAs
 - c. AEC

Ch. 7 Automatic Exposure Controls

1. Ionization Chamber configuration
2. Exposure Controls

Ch 8 X-Ray Production

1. explain the process of a Bremsstrahlung interaction
2. explain the process of a Characteristic interaction

Ch 11 Filtration

1. list and discuss the types of filtration
 - a. inherent
 - b. added
 - c. total
2. describe how changes in filtration will affect the tube output
 - a. quantity/intensity
 - b. quality/energy

Ch 12 Prime Factors

1. discuss how each prime factor will affect the radiographic image
 - a. mA
 - b. time
 - c. kVp

- d. SID

Ch 13 X-Ray Interactions

1. explain and diagram a Coherent interaction
2. explain and diagram a Compton interaction
3. explain and diagram a Photoelectric interaction
4. define Pair Production & Photodisintegration
5. discuss how patient interactions with x-ray photons affect image quality and technique selection

Ch 14 Minimizing Patient Exposure

1. discuss how each prime factor will affect the patient exposure
 - a. mA
 - b. time
 - c. kVp
 - d. SID
2. Explain how patient positioning can reduce patient exposure to certain organs
3. Discuss how the following affect patient exposure:
 - a. Focal spot size
 - b. Filtration
 - c. Beam restriction
 - d. Shielding
 - e. Grids
 - f. Image receptors

Ch 15 Beam Restriction

1. describe steps the radiographer can take to reduce the production of scatter
 - a. restrict beam
 - b. reduce kVp
2. describe the various types of beam restrictors
 - a. aperture diaphragm
 - b. cone/cylinder
 - c. collimator
3. discuss the effect beam restriction will have on the radiographic image
 - a. IR exposure
 - b. contrast
 - c. visibility

Ch 17 Patient as a Beam Emitter

1. define attenuation
2. discuss the basic composition of the human body and how it effects attenuation of the x-ray beam
 - a. air
 - b. fat
 - c. muscle
 - d. bone
 - e. metal
3. describe how various pathologies affect the attenuation of the x-ray beam
4. classify pathology as being additive or destructive

Ch 18 Grids

1. explain the purpose of a grid
2. describe the construction of grids
 - a. radiopaque lines
 - b. radiolucent interspaces
3. compare and contrast various grid pattern types
 - a. linear
 - i. parallel
 - ii. focused
 - b. crosshatched
4. discuss proper use of grids and errors that may result from incorrect use
 - a. off focus
 - b. off level
 - c. off center
 - d. inverted
5. calculate new technical factors when changes in grid ratios occur
6. discuss air gap technique

Ch 25 The Imaging Process

Ch 26 IR Exposure

1. define IR Exposure
2. describe the effects of IR exposure changes on the radiographic image in analog image
3. describe how digital image is related to IR exposure
4. discuss the controlling factor of IR exposure (mAs)
5. discuss the factors that influence IR exposure
 - a. mA
 - b. time
 - c. kVp
 - d. SID
 - i. Inverse Square Law
 - ii. Square Law
 - e. grid ratio
 - f. beam restrictor
6. assess radiographs for proper levels of exposure
7. calculate new exposure factors and patient doses using: $\text{mA} \times \text{time} = \text{mAs}$

Ch 27 Contrast

1. define contrast
2. describe the effects of contrast changes on the radiographic image
3. discuss the controlling factor of contrast (kVp)
4. discuss the factors that influence contrast
 - a. kVp
 - b. grid ratio
 - c. beam restrictor
5. assess radiographs for proper levels of contrast
6. distinguish between image contrast and subject contrast

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7. calculate new IR exposure factors using the 15% rule
8. determine changes in contrast using 15% rule

Ch 28 Spatial resolution

1. define spatial resolution
2. discuss the factors that affect spatial resolution
 - a. SID
 - b. OID
 - c. focal spot size
 - d. anode heel effect
3. describe the appropriate techniques used to reduce patient motion
 - a. voluntary
 - b. involuntary

Ch 29 Distortion

1. define distortion
 - a. size distortion
 - b. shape distortion
 - i. elongation
 - ii. foreshortening
2. discuss the factors that affect size distortion
 - a. SID
 - b. OID
 - c. angle tube

Grade Scale: Grades will be posted in Blackboard Grade Center

A	=	93-100
B	=	84-92
C	=	77-83
D	=	65-76
F	=	0-64

*** STUDENTS MUST HAVE A 77 OR ABOVE AVERAGE TO PASS THIS COURSE!**

Course Evaluation:

- Major Exams (4) and Quiz average 75% (15% each)
- Comprehensive Final 25%

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.

9. 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.

Technical Requirements

The latest technical requirements, including hardware, compatible browsers, operating systems, software, Java, etc. can be found online at:

https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support/Browser_Checker A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of the online technology and resources.

Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for

reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the office in Student Services, Cecil Beeson Building. You may also visit the online resource at <https://www.lit.edu/student-success/special-populations>

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 or obtained in print upon request at the Student Services Office. 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.

