

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.

Purpose: This course is designed to acquaint the student technologist with the *basic* principles of radiographic exposure and image formation.

Teaching Methodology:

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.

Instructor: Brenda A. Barrow, M.Ed., R.T., Office 232 Multipurpose Center, office hours posted outside door, phone 880-8848, brenda.barrow@lit.edu

Textbook:

- Carlton, Richard. *Principles of Radiographic Imaging, An Art and Science*, 5th edition, Delmar Publishing, ISBN# 10: 1-4390-5872-5
- #882 Scan-trons and pencils
- Basic calculator

Reference Material:

- Use your notes and text book from the previous course RADR 1309 Introduction to Radiology and Patient Care

Course Evaluation:

- There will be four (4) major tests and a comprehensive final exam
- Quizzes will be utilized in this course. If a student misses a quiz **it may not** be made up. Quiz grades will be averaged for one (1) test grade. Students will be allowed to drop their **lowest** quiz grade at the end of the semester. If more than one quiz is missed a zero (0) will be given.
- Late homework will be accepted but will have a ten (10) point per class deduction.

Grading Policy:

Grades will be determined in the following manner:

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

Grade Scale:

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 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. Do not bring children to class.
4. Recording devices may be used except during test reviews and when otherwise stated by the instructor.
5. 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.
6. **ATTENDANCE POLICY:**
Each student is responsible for attending every class session. When it becomes necessary to miss a session, it is the responsibility of the **STUDENT** to contact the instructor and to inquire about assignments.

When the student has missed sufficient hours to cause a drop in grade points by missing class discussions, participation, quizzes, major test and or assignments, he/she will be notified in writing by the instructor concerning the possibility of failure in the course. The student should respond and meet the instructor for counseling.

If a major test is missed, the student must request a make-up examination from the instructor. This test will be administered at the first day the student returns to class or at a time designated by the instructor. There will be an automatic **10 point reduction** on the make-up exam.

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 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 6 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

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6. list recommendations for extending tube life

Ch 7 X-Ray Production

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

Ch 10 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
 - b. quality

Ch 11 Prime Factors

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

Ch 12 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 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. density
 - b. contrast
 - c. visibility

Ch 16 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

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Ch 17 The Pathology Problem

1. describe how various pathologies affect the attenuation of the x-ray beam
2. 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 19 Radiographic Film

1. describe film construction
 - a. base
 - b. adhesive
 - c. emulsion
 - d. protective coat
2. discuss the process of latent image formation
3. compare and contrast various film types
4. explain the proper storage and handling fundamentals
 - a. temperature
 - b. humidity
 - c. scatter
5. discuss proper radiograph identification

Ch 22 Intensifying Screens

1. explain the use of screens
2. describe the construction of screens
 - a. base
 - b. phosphor
 - c. reflective (optional)
 - d. protective
3. discuss phosphor characteristics
4. classify screens according to their speed
 - a. slow/extremity
 - b. medium/par
 - c. high
 - d. rare earth

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5. calculate new technical factors when changes in screen speeds occur
6. describe the construction of an x-ray cassette
7. describe the proper cleaning procedures for screens and cassettes
8. define and discuss spectral matching
9. describe methods of measuring resolution
 - a. line pair phantom
10. discuss how film/screen combinations affect the radiographic image and patient exposure level

Ch 25 The Imaging Process

Ch 26 Density

1. define density
2. describe the effects of density changes on the radiographic image
3. discuss the controlling factor of density (mAs)
4. discuss the factors that influence density
 - a. mA
 - b. time
 - c. kVp
 - d. SID
 - e. screen/film speed
 - f. grid ratio
 - g. beam restrictor
5. assess radiographs for proper levels of density
6. 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. adding/removing screen
 - d. beam restrictor
5. assess radiographs for proper levels of contrast
6. distinguish between image contrast and subject contrast
7. calculate new exposure factors using the 15% rule
8. determine changes in contrast using 15% rule

Ch 28 Recorded Detail

1. define recorded detail
2. discuss the factors that affect recorded detail
 - a. SID
 - b. OID
 - c. Screen/film speed
 - d. focal spot size
 - e. anode heel effect
3. describe the appropriate techniques used to reduce patient motion
 - a. voluntary

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- 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

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.

RADR 1313
10:15 – 11:30 Tues/Thurs

Course Schedule: all dates are tentative and subject to change

Date	Topic
AUG 20	Introduction to course & CH 1 Basic Math
AUG 25	CH 5 X-Ray Equipment
AUG 27	CH 6 X-Ray Tube
SEP 1	CH 7 X-Ray Production
SEP 3	CH 12 X-Ray Interactions
SEP 8	REVIEW
SEP 10	TEST I CREATING THE BEAM
SEP 15	go over test & CH 25 The Imaging Process
SEP 17	CH 34 Exposure Problems & CH 11 Prime Factors
SEP 22	CH 26 Density
SEP 24	Density cont.
SEP 29	CH 27 Contrast
OCT 1	Contrast cont.
OCT 6	CH 16 The Patient as a Beam Emitter & CH 17 Pathology Problem
OCT 8	SLIDES to review
OCT 13	REVIEW
OCT 15	TEST II PRIME FACTORS
OCT 20	go over test & CH 10 Filtration
OCT 22	CH 15 Beam Restrictors
OCT 27	CH 18 Grids
OCT 29	CH 19 Radiographic Film
NOV 3	CH 22 Intensifying Screens
NOV 5	Film/Screen Combinations
NOV 10	TEST III CREATING THE IMAGE
NOV 12	go over test & CH 28 Recorded Detail
NOV 17	CH 29 Distortion & SID
NOV 19	Fuch's handout
NOV 24	TEST IV GEOMETRIC FACTORS
NOV 26	THANKSGIVING
DEC 1	go over test
DEC 3	review for final
DEC 10 10:00-11:30	<u>FINAL EXAM</u>