



Principles of Radiographic Imaging II (RADR 2305)

Credit: 3 semester credit hours (3 hours lecture)

Pre-Requisite: RADR 1313 Principles of Radiographic Imaging I

Course Description:

Radiographic image quality and the effects of exposure variables.

Purpose:

This course is designed to re-enforce the student technologist's understanding of the basic concepts of radiation and expand that knowledge with in depth study of Image Quality. The student will be introduced to specialized radiographic techniques.

Teaching Methodology:

This course will be taught in a multimedia format. Lectures, demonstrations, lab experiments 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.

Textbook:

- Bushong, Stewart C.: *Radiologic Science for Technologists, 10th edition*, ISBN: 978-0-323-08135-1, Elsevier, Mosby Publishing 2013.
- #882 Scan-trons and pencils
- Basic calculator

Reference Books:

- Carlton, Richard. *Principles of Radiographic Imaging, An Art and Science, 5th edition*, Delmar Publishing, ISBN# 10: 1-4390-5872-5 (Required in RADR 1313 taught in previously required course)
- Notes from RADR 1313 Principles of radiographic Imaging I

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

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
3. Demonstrate knowledge of advanced modalities utilized in the diagnostic department, ie. mobile, fluoroscopy, and computed tomography
4. Develop a technique chart
5. Lab experiments will be done in RADR 2333 to reinforce the material discussed in this course

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Course Syllabus

Course Outline:

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 6 support designs for the tube
 - a. ceiling
 - b. floor
 - c. floor to ceiling
 - d. c-arm
 - e. mobile
 - f. 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 Film

TECHNIQUE CHARTS

1. Discuss the technique manipulation with a fixed kVp chart
2. Discuss the technique manipulation with a variable kVp chart
3. Discuss the use of anatomical charts
4. Discuss the use of high kVp charts

X-RAY EMISSION

1. Discuss the factors that control and affect x-ray quantity
 - a. mA
 - b. time
 - c. kVp
 - d. SID
2. Discuss the factors that control and effect x-ray quality
 - a. kVp
 - b. HVL

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3. Use decision making skills to determine how prime and secondary factors will affect radiographic quantity and quality

RADIOGRAPHIC TECHNIQUE

1. List the 4 prime factors and their effect on quantity and quality
 - 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
 - b. Inverse square law
 - c. 15% rule
3. List the patient factors and describe their affect radiographic technique
 - a. pathology
 - b. part composition
4. Discuss the image quality factors and how they influence radiographic characteristics
 - a. density
 - b. contrast
5. Describe the various types of technique charts
 - a. fixed kVp
 - b. variable kVp
 - c. high kVp
 - d. AEC
6. Develop a technique chart
7. Demonstrate knowledge of automatic exposure controlled devices
 - a. phototimer
 - b. ionization chamber
8. Use creative thinking skills to determine adjustment of photocells of an AEC for:
 - a. pathology
 - b. body habitus
 - c. trauma
 - d. age
9. Discuss the relationship between tomographic angle and section thickness
10. Discuss the extra quality control measurements that must be done on equipment that is capable of doing body section tomography
11. Describe magnification radiography and its uses

IMAGE QUALITY

1. Define radiographic quality, resolution, noise, and speed
2. Discuss the use of a characteristic curve
3. Discuss the geometric factors that affect radiographic quality
 - a. distortion
 - b. magnification
 - c. sharpness of detail
4. Discuss the subject factors that affect radiographic quality

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- a. tissue composition
 - b. tissue thickness
 - c. differential absorption
5. 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. List the 10 step quality assurance model used in hospitals
3. Describe the 3 steps of quality control
 - a. identify the problem
 - b. study the problem
 - c. fix the problem
4. Discuss the routine quality control tests and schedule for radiographic systems
 - a. tube
 - b. generator
 - c. imaging accessories
5. Evaluate results of QC tests. Organize the data. Interpret the results to determine if equipment is in/out of compliance with the regulations
6. Discuss Digital Imaging Quality Control
 - a. acceptance testing
 - b. routine QC
 1. PSP
 2. flat panel detectors
 3. monitors

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
 - e. inverted
6. Describe the different methods of measuring grid performance

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- a. grid ratio
- b. grid frequency
- c. bucky factor
- d. contrast improvement factor

7. Understand how the air gap improves radiographic contrast

SCREEN-FILM RADIOGRAPHY

1. Visualize and describe the layers of radiographic film
 - a. base
 - b. adhesive
 - c. emulsion
 - d. supercoat
2. Discuss the steps involved in the formation of the latent image
3. Distinguish between the many types of radiographic film used
 - a. single emulsed
 - b. duplitized
 - c. non-screen
 - d. screen
 - e. conventional
 - f. rare earth
4. Describe the proper method of storing and handling radiographic film
 - a. temperature
 - b. humidity
 - c. length of time
 - d. protect from light
 - e. protect from scatter
5. Visualize and describe the layers of an intensifying screen
 - a. base
 - b. phosphor
 - c. protective
 - d. reflective (optional)
6. Distinguish types of luminescence
 - a. fluorescence
 - b. phosphorescence
7. Identify the main characteristics of an intensifying screen
 - a. absorption efficiency
 - b. conversion efficiency
 - c. emission efficiency
8. Describe the cassette, which holds the intensifying screens
9. Discuss the importance of spectral matching
 - a. conventional
 - b. rare earth
10. Discuss the advantages and disadvantages of rare earth phosphors
 - a. higher absorption
 - b. higher conversion
 - c. faster speed
 - d. quantum mottle

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11. Describe the proper method of caring for an intensifying screen
12. Discuss the history of film processing
 - a. PAKO
 - b. Kodak
 - c. digital
13. Describe the 4 different stages of film processing
 - a. develop
 - b. fix
 - c. wash
 - d. dry
14. Discuss the chemicals used in each stage of processing
 - a. developer chemicals
 - b. fixer chemicals

IMAGE ARTIFACTS

List and discuss the cause of artifacts

- c. exposure artifacts
- d. processing artifacts
- e. handling artifacts

FLUOROSCOPY

1. Discuss the history of fluoroscopy
 - a. conventional
 - b. image intensified
 - c. digital
2. Discuss the human anatomy of the eye that aids in visualization during fluoroscopy
 - a. photopic vision
 - b. scotopic vision
3. Describe the components and function of the image intensifier tube
 - a. input phosphor
 - b. photocathode
 - c. electrostatic lens
 - d. output phosphor
4. List the advantages of image intensified fluoroscopy
 - a. increased brightness
 - b. no dark adaptation
 - c. TV viewing
5. Discuss the advantages and disadvantages of spot film cameras
 - a. decreased coverage
 - b. decreased dose
 - c. decreased time

DIGITAL FLUOROSCOPY

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

MOBILE RADIOGRAPHY

1. Understand the importance of communication when doing mobile radiographic exams

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2. Describe the methods used to protect the technologist and others in room from the mobile unit
 - 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/film/patient manipulations required for bedside and trauma radiography

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
 - a. 3D CT
 - b. Spiral CT

NON-MEDICAL USES OF X-RAY

1. Discuss the use of x-ray in art
2. Discuss the use of x-ray in forensics
3. Describe historical uses of x-ray

Grading 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!**

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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.
- **TECHNIQUE CHART:**
The student will be given a blank technique chart at the beginning of the semester. This is to be completed by ***Nov. 30.*** This will be a pass/fail assignment. The purpose of this assignment is to provide the student with a better understanding of manual techniques. **Two points will be deducted from the final exam for each class day the Technique Chart is late.** The student will be *unable to take the final exam* until the chart is turned in.

Course Requirements:

Grades will be determined in the following manner:

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

COURSE POLICIES:

- No food, drinks, or use of tobacco products in class.
- Beepers, telephones, headphones, and any other electronic devices must be turned off while in class.
- Do not bring children to class.
- Recording devices may be used except during test reviews and when otherwise stated by the instructor.
- 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.
- **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

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class or at a time designated by the instructor. There will be an automatic **10 point reduction** on the make-up exam.

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.

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11:10 – 12:30 Mon/Wed
All dates are tentative and subject to change.

Course Schedule:

Aug 24	Introduction to course & Pre-test	REFERENCE
Aug 26	Chapter 5 X-ray Imaging System	Carlton 5
Aug 31	Chapter 6 X-ray Tube	Carlton 6
Sept 2	Chapter 20 Screen-Film Quality Control	
Sept 7	LABOR DAY	
Sept 9	Chapter 12 Processing (pages 225 – 234)	Carlton 20
Sept 14	Chapter 19 Screen-Film Artifacts & Review	
Sept 16	TEST I (Equipment Review)	
Sept 21	Go over test & Chapter 11 Control of Scatter Radiation (BEAM RESTRICTORS)	Carlton 15
Sept 23	Cont. Chapter 11 (GRIDS)	Carlton 16
Sept 28	Chapter 12 Screen-Film Radiography (Film)	Carlton 22
Sept 30	Chapter 12 Screen-Film Radiography (Screens)	Carlton 22
Oct 5	Chapter 8 X-ray Emission	
Oct 7	Chapter 10 Concepts of Radiographic Quality	Carlton 26 & 27
Oct 12	Chapter 10 cont.	
Oct 14	Chapter 13 Screen-Film Technique	
Oct 19	REVIEW	
Oct 21	TEST II	
Oct 26	Go over test & Mobile Radiography	Carlton 35
Oct 28	Tomography	Carlton 37
Nov 2	Chapter 25 Fluoroscopy	Carlton 36
Nov 4	Chapter 26 Digital Fluoroscopy	
Nov 9	Non-Medical Uses of Radiation & REVIEW	
Nov 11	TEST III	
Nov 16	go over test & Chapter 28 Computed Tomography	Carlton 41
Nov 18	Computed Tomography cont.	
Nov 23	ASRT CT Basics	
Nov 25	REVIEW	
Nov 30	TEST IV (Technique Chart due)	
Dec 2	go over test & review for final	
Dec 9 11:00 – 12:30	FINAL	