RADR 2305
Course Syllabi - 2018

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.

Textbook & Material:
- Bushong, Stewart C. *Radiologic Science for Technologists*, 11th edition, ISBN: 978-0-323-35377-9, Elsevier, Mosby Publishing 2017.
- ASRT Student Membership
- #882 Scan-trons and pencils
- Basic calculator

Reference Books:
- Carlton, Richard. *Principles of Radiographic Imaging, An Art and Science, 5*th 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

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, i.e. 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
6. Begin ASRT Radiography Roadmap to begin prep for ARRT Registry exam

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Course Outline:

RADIOLOGIC PHYSICS

1. Discuss the parts of the Sine Wave
    a. Amplitude
    b. Frequency
    c. Wavelength
    d. Velocity

ELECTROMAGNETIC SPECTRUM

1. Discuss how x-radiation relates to the electromagnetic spectrum

OHM's LAW

1. Be able to work mathematical problems using Ohm's law

TRANSFORMERS

1. Step-up transformers
2. Step-down transformers
3. Autotransformers

X-RAY PRODUCTION

1. Discuss the types of radiation created in the x-ray tube and how the prime factors affect their production
    a. Characteristic radiation
    b. Bremsstrahlung radiation
    c. X-ray Emission Spectrum

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. 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 image receptor

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
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. image receptor exposure
    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. back-up timer
    b. minimum response timer
    c. exposure control
    d. 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. spatial resolution
4. Discuss the subject factors that affect radiographic quality
    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. Describe the steps of quality control
3. 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

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
   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. Discuss the steps involved in the formation of the latent image
2. Discuss the process of converting the latent image into a manifest image
3. Describe how screen/film speeds affected the patient dose and spatial resolution

IMAGE ARTIFACTS

List and discuss the causes of exposure 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
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
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/IR/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

ASRT RADIOGRAPHY ROADMAP

Watch the 20 modules for 6 and 5 months before the Registry

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!**

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:

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. **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.

Technical Requirements **(for courses using Blackboard)**

The latest technical requirements, including hardware, compatible browsers, operating systems, software, Java, etc. can be found online at: https://help.blackboard.com/en-us/Learn/9.1_2014_04/Student/015_Browser_Support/015_Browser_Support_Policy 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 http://www.lit.edu/depts/stuserv/special/defaults.aspx

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.