RAD-650: RADIOGRAPHY REVIEW I

Effective Term
Fall 2024

BOT Approval Date
12/14/2023

Discipline
RAD - Radiologic Technology

Course Number
650

Course Title
Radiography Review I

Short Title
RAD Review I

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
1.00

Total Units
1

Hours

Lecture Contact Hours
16-18

Out of Class Hours Lecture
32-36

Total Contact Hours
16 - 18

Total Out of Class Hours
32 - 36

Total Student Learning Hours
48 - 54

Distance Education
No

Catalog Description
This course provides a comprehensive review of selected radiologic technology topics to support the student in the clinical internship phase and to prepare the student for the American Registry of Radiologic Technologists examination upon graduation. Topics include radiographic techniques and image quality factors.

Attach Supporting Documents
LMI.pdf

Requisites

Pre or corequisite(s)

Prerequisite or corequisite(s) (must be taken simultaneously if not taken before)
RAD-525 (with a grade of C or better)
and RAD-530 (with a grade of C or better).

Codes

TOP Code (CB 03)
1225.00* - *Radiologic Technology

CIP Code
51.0911 - Radiologic Technology/Science - Radiographer.

Student Accountability Model (SAM) Priority Code (CB 09)
C - Clearly Occupational

Noncredit Category (CB 22)
Y - Credit Course

Repeatability Code
No

Grading Option
Letter grade OR P/NP

Minimum Qualifications

Minimum Qualifications	And/Or
Radiological Technology	End

CSU Area(s)

IGETC Area(s)

Learning Objectives

Learning Objectives

Learning Objective
1. Appraise the geometric factors that affect image quality.
2. Analyze the relationship between exposure factors and their effect on radiation quantity and quality.
3. Compare how patient anatomy and pathology warrants changes in radiographic techniques.
4. Compare how spatial and contrast resolution affect visibility of detail.
5. Evaluate how noise occurs and how it affects spatial resolution.
6. Summarize how image receptors determine resolution.
7. Appraise how automatic exposure control can affect a radiographic image.
8. Apply magnification techniques to practical application and determine how resolution is affected.
9. Analyze how grid factors affect image quality and patient exposure.
10. Summarize the importance of collimation for image quality and patient exposure.
11. Apply effective radiation protection techniques for patients across diverse demographics, encompassing considerations of gender, race, culture, and disabilities in addressing radiation exposure concerns.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will evaluate a radiographic case study for image quality.
2. Students will manipulate technical factors for changes in the source to image distance.
3. Students will calculate the magnification formula to determine the radiographic image size compared to the object size.

Program Learning Outcomes

Learning Outcome
Apply positioning skills in all required radiographic examinations.
Select appropriate technical factors for radiographic examinations.
Practice radiation protection for all radiographic examinations.
Employ proper patient care techniques and effectively provide care for patients from diverse groups/populations.
Demonstrate oral and written communication skills.
Relate to and anticipate the needs of the doctors and technologists.
Adjust to changes, situations, patient conditions, updated evidence-based practice, and deviation from the normal routine.
Demonstrate knowledge of ethical requirements for an entry level radiographer along with ethical practices in a healthcare setting.
Understand professional obligations upon gaining the ARRT status.

Institutional Learning Outcomes

Aesthetic Awareness: The student will identify and evaluate how aesthetic expression leads to an appreciation of social and cultural context as well as the values of art and nature.
Communication: The student will effectively express and exchange ideas through listening, speaking, reading, writing, visual works, and other modes of interpersonal expression.
Critical Thinking: The student will analyze problems, gather and synthesize relevant information, evaluate ideas, information, and evaluate alternative points of view to create, innovate and implement effective solutions.
Cultural Awareness and Humility: The student will demonstrate knowledge of and sensitivity toward individuals of diverse ethnicity, age, gender, sexual orientation, and religious affiliations, as well as toward those individuals with diverse abilities and socio-economic classes to respectfully interact with individuals of diverse perspectives, beliefs and values while being mindful of the limitation of their own cultural frameworks.
Information and Technology Literacy: The student will access, interpret, evaluate, and apply relevant information sources and digital media effectively, and in an ethical and legal manner.
Scientific Awareness: The student will apply the scientific method of inquiry to assess potential solutions for real-life challenges by employing science-based knowledge and methodologies in daily life.
Social Awareness: The student will recognize and analyze the interconnectedness of global, national, and local concerns, analyzing cultural, political, social, and environmental issues from multiple perspectives and appreciate similarities and differences among cultures.
Civic
Personal
and Professional Responsibility

Content

Course Lecture Content

1. Image quality
    a. Geometric factors
        i. Source to image distance
        ii. Source to object distance
        iii. Magnification
        iv. Distortion
        v. Focal-spot blur
        vi. Heel effect
    b. Subject factors
        i. Contrast
        ii. Motion

c. Patient positioning
d. Image receptors
e. Grids
f. Beam restriction

2. Radiographic technique
   a. Kilovoltage
   b. Milliamperes
   c. Exposure time
   d. Distance
   e. Focal-spot size
   f. Patient factors
      i. Thickness
      ii. Composition
      iii. Pathology
   g. Density/brightness
   h. Contrast
   i. Detail
   j. Distortion
      i. Size
      ii. Shape
3. Radiation exposure and protection
   a. Technical factors and patient exposure
   b. Technical factor and pregnancy
   c. Communication
      i. Narrative for addressing patient's fears
      ii. Approaches to diverse demographics
         1. Gender
         2. Race
         3. Culture
         4. Disabilities

Methods of Instruction

Method

Lecture

Integration

The lecture will serve as a comprehensive exploration of radiographic techniques and image quality, encompassing methods for optimizing image quality while minimizing radiation exposure. Effective communication strategies for addressing a diverse population of patients and their concerns regarding radiation exposure will be presented.

Method

Discussion

Integration

Classroom discussions will empower students to remember and apply the key technical and geometric factors essential for creating quality radiographic images while minimizing radiation exposure. Students will have the opportunity to share their clinical experiences that have contributed to a better understanding and application of these factors. Furthermore, the discussions will encompass strategies for effectively communicating with a diverse population of patients to address their concerns regarding radiation exposure, especially with patients who may be pregnant.

Method

In-class Exercises

Integration

In-class exercises will promote student understanding of radiographic techniques and image quality. In-class exercises include, but are not limited to, using critical thinking skills to determine how milliampere- seconds affect image quality and radiation dose and provide examples of situations the mAs setting may need to be adjusted. In-class exercises provide the students an opportunity to determine their retention and application of concepts in clinical training.

Method

Reading

Integration

To complement the lecture material, students are encouraged to study specific chapters from the mandatory textbook authored by S. Bushong, namely Chapter 15, which covers Image Acquisition, and Chapter 21, dedicated to Medical Image Descriptors.

Methods of Evaluation

Method

Exams/Tests

Integration

Exams and tests will be used to measure student's recall and application of geometric factors in producing high quality radiographic images using the least amount of radiation necessary on a diverse population of patients. The exams will be multiple choice to help prepare the students to pass the American Registry of Radiologic Technologists exam which is also in multiple choice format. Exams and tests are graded on accuracy.

Method

Homework

Integration

Homework is assigned to help the students review the material presented in lecture. Homework topics include practice problems for calculating the inverse and direct square law, the 15% rule for kilovoltage, and the milliampere-seconds reciprocity law. Additionally, this homework will provide an opportunity for students to analyze how technical factors affect radiation exposure to the patient and how to minimize the exposure. Patient communication scenarios are devised for students to create a narrative for addressing patient's concerns about the amount of radiation exposure received for the exam.
As an option, the homework can also be done in class in small groups to promote discussion and interactions among the students. The homework assignment is also an opportunity to determine if the student adequately understands the concepts. Homework is graded for accuracy and completion.

Method

Class Participation

Integration

Evaluating class participation on topics like radiography exposure factors and radiation dose is important to encourage engagement and active learning in the classroom. Students will be graded on attendance, engagement and preparation, respectful behavior, knowledge and understanding, and active participation. The instructor will provide constructive feedback to each student based on their performance in each criterion, encourage improvement in areas where the student scored lower, and acknowledge and appreciate their strengths and contributions. The topics covered encompass optimizing exposure factors to generate high quality radiographic images while minimizing radiation dosage, addressing patient apprehensions related to radiation exposure, particularly during pregnancy, and treating patients from diverse backgrounds with respect and empathy to ensure their concerns are effectively addressed.

Assignments

Assignment Type

Reading

In-class and/or outside of class

Outside of class

Formative or Summative

Summative

Assignment

Read the article from the journal of the American Medical Association, titled Patient Perceptions and Knowledge of Ionizing Radiation from Medical Imaging, by Luca Bastiani, PhD., et al.
Reflect on your personal clinical training experiences in addressing patient concerns regarding radiation exposure, dispelling misunderstandings or preconceived ideas, and enhancing radiation protection through manipulation of exposure factors.

Write a 2-3 page paper to respond to the following questions:

1. Does the information and findings presented in the article align with your personal experiences during clinical training? Provide examples to support your answer.

2. How have you, or could you, address a patient's worries regarding radiation exposure during an examination based on the insights from the article?

3. Discuss strategies for dispelling misunderstandings or preconceived ideas about radiation exposure held by patients, particularly those from diverse racial or cultural backgrounds. Give at least one real life example of how you were able to assure the patient the benefits of the exam outweighed the risks.

4. What extra precautions do you take when imaging pregnant patients? Have you performed an exam on a patient that you did not know was pregnant? Have you had a situation where a pregnant patient refused to have the imaging exam performed because of concerns for the fetus? Present one real life example of your experience with imaging a pregnant patient and the outcome of the interaction.

5. How can you enhance radiation protection through the adjustment of exposure factors, and why is this important? How is kV, mAs, and distance manipulated to reduce radiation exposures to the patient? What other radiographic devices can be used to reduce radiation exposure to the patient?

The paper will be assessed for content, alignment with the article, personal experiences, examples, clarity, and writing quality.

Be prepared to discuss your paper with other students in the classroom so that your ideas, experiences, and strategies can be shared.

This assignment aims to integrate academic knowledge with practical experiences, fostering critical thinking and communication skills essential for healthcare professionals. If you have any questions or need clarification, do not hesitate to contact the instructor.

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Complete the exercise that consists of a series of questions and scenarios related to radiographic exposure factors and image quality. Work individually or in small groups to answer these questions and discuss the scenarios. After a suitable discussion period, the correct answers and explanations can be shared with the whole class.
Questions:
1. How does mAs, kV, and distance affect image quality and radiation dose? Provide examples of situations where you might adjust these factors based on the patient's condition. Consider patients who are not able to cooperate due to a disability or pathologic condition.
2. Imagine you're performing a chest X-ray on a pediatric patient. What specific exposure factors (mA, kV, time, and distance) would you choose and why?
3. You're tasked with conducting a lumbar spine X-ray on an elderly patient with osteoporosis who does not speak your language. Discuss the exposure factor choices for this scenario, considering image quality and patient safety, while effectively communicating with a patient who does not understand your instructions.
4. Devise a plan for radiation protection of a patient that is in the 2nd trimester of pregnancy, who has been in a motor vehicle accident and requires shoulder radiographs.

The assignment will be graded based on completion of the assignment, engagement in group discussions, respectful behavior, knowledge and understanding of the questions, and active participation in the overall classroom discussions.

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Complete the homework assignment using information from the textbook, PowerPoint lectures, and class notes.

Assignment: Image Acquisition (Radiographic Techniques) Part 1
kV, mA, time, distance

Directions: Answer the questions in Microsoft Word format (or whatever word processing software you use), then save as a PDF file on your computer. There is no need to re-type the question. Only the answers are needed. There are 10 questions, each worth 1/2 point.
When you are ready to submit the assignment, upload the file you saved and submit through Canvas LMS.

FIFTEEN PERCENT RULE:
1. If 40 mAs at 65 kV produced a satisfactory image, but patient motion was evident, requiring the time to be cut by half. What kV should be used to compensate?
2. 20 mAs at 87 kV produced a satisfactory exposure on a radiograph, but the contrast is too high, so the kV needs to be adjusted. What new exposure factors could be used to maintain the same exposure but lower the contrast?
3. A radiograph was taken using 300 mA, 0.03 second, at 70 kV. It was underexposed so
the exposure needs to be doubled. What is the new kV?
4. A radiograph is taken of a humerus and is overexposed. Technical factors used were 60 kV and 2.5 mAs. What new kV would be required to decrease the exposure by half and produce a diagnostic radiograph?
5. A satisfactory image was produced using 100 mA, 0.025 s, 80 kV. The contrast is too low, and the radiologist prefers a high contrast image. What new technique is needed to produce a higher contrast image?
RECIPROCITY LAW:
6. A certain technique calls for 50 mA and 0.1 second. If we have an uncooperative patient and wish to reduce patient motion by using an exposure time of 0.05 second, what will be the new mA value?
7. A certain technique calls for 25 mA and 200 ms at 80 kV. If we have an uncooperative patient and wish to reduce motion in using an exposure time of 0.01 s, what will be the new mA value?
DIRECT SQUARE LAW:
8. If a satisfactory radiograph is obtained at 40" SID, 30 mAs, and 65 kV, what technical factors will have to be used at 50" to maintain the same exposure?
9. A satisfactory radiograph of the abdomen was made at 40" SID using 200 mA, 0.1 sec., and 80 kV. If the SID is changed to 20", what new mAs would be required?

10. A radiograph was taken using 400 mA, 25 ms, at 90 kV, at 40" SID. What is the new mAs if the distance was changed to 80"?
End of Assignment

Course Materials

Textbooks

Bushong, S., (2021) Radiologic Science for Technologists: Physics, Biology, and Protection, 12th Ed., Elsevier. ISBN#: 978-0323661348

Class Size Information

Class Size

40

Class Size Category

A - Lecture/discussion 40

Diversity and Inclusion

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

This course addresses the crucial aspects of Diversity and Inclusion within the context of radiation protection practices for a diverse patient population, encompassing various cultures, races, disabilities, and pregnant patients. Effective communication with patients who may harbor concerns about radiation exposure is essential to ensure they receive high-quality imaging services. The course structure includes written and reading assignments that encourage students to contemplate strategies for approaching apprehensive patients and finding ways to reduce radiation exposure during exams without compromising image quality.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

The course content is thoughtfully presented through a variety of instructional methods, catering to diverse learning preferences. This includes lectures, class discussions, and written materials. Lectures, which cover exposure factors, image quality, and radiation protection, are delivered verbally and enhanced with PowerPoint presentations to accommodate both auditory and visual learners. In-class discussions foster an engaging environment where students collaborate to explore methods of manipulating exposure factors to generate high-quality radiographic images while minimizing radiation exposure. These discussions encourage peer interaction and the exchange of insights on addressing patient concerns about radiation exposure during imaging procedures. Additionally, reading assignments based on textbook chapters focusing on image acquisition and medical image descriptors offer an extra resource for students who benefit from visual aids to reinforce course content. To assess comprehension and application of concepts, the course includes exams and quizzes that evaluate students' grasp of exposure factors affecting radiation production and protection, providing valuable feedback on their progress.

Interactions

Explain how the course will incorporate student-to-student interaction.

Students will collaborate in small groups to complete in-class assignments that foster meaningful discussions and interactions among them. For example, these group discussions, centered around the assigned article titled "Patient Perceptions and Knowledge of Ionizing Radiation," encourage students to actively engage with their peers, drawing from their clinical experiences. This exchange of ideas empowers them to refine their own strategies for addressing patient concerns related to radiation exposure.

Explain how the course will incorporate instructor-to-student interaction.

Instructors engage with students through in-person lectures, during which students are encouraged to pose questions and seek clarification. Additionally, instructors facilitate in-class discussions related to article assignments and homework, focusing on exposure factors, image quality, and radiation protection for patients. Instructors play a pivotal role in providing feedback on exams and tests, assessing students' comprehension of radiation production and control, as well as their ability to ensure patient safety in radiation protection. In this course, instructors relate real-life experience stories during lectures to enrich student learning. Students, being actively involved in clinical training, contribute their own experiences to these discussions. Instructors actively encourage students to utilize office hours or arrange post-class meetings if they require further assistance or guidance.

Explain how the course will incorporate student-to-content interaction.

This course is well-supported by a comprehensive textbook that complements the lecture material covering exposure factors and image quality. Additionally, the instructor will distribute the article titled "Patient Perceptions and Knowledge of Ionizing Radiation" to students, sparking in-class discussions to delve deeper into how to address patient's concerns about radiation exposure during imaging exams.

Explain how the course will incorporate student-to-self interaction (metacognitive).

This course offers students the chance to explore methods for achieving high-quality radiographic images with minimal radiation exposure, all while ensuring that patient concerns regarding radiation exposure during imaging exams are appropriately addressed. Throughout the course, students will have the opportunity to contemplate the various strategies employed to effectively respond to patient inquiries, and they can also benefit from the insights shared by their peers regarding alternative strategies. Students will gain confidence and competence in communicating with individuals with different gender identities, races, cultures, and disabilities, which adds complexity to the task of addressing patient worries related to radiation exposure.

Key: 3085