



RDT 201 RADIATION PROTECTION AND BIOLOGY

COURSE DESCRIPTION: This course provides students with knowledge of the biologic processes which occur as a result of interaction with ionizing radiation. The fundamentals of radiation protection for personnel, patients and the public are discussed, including structural requirements, personnel monitoring, gonadal shielding and other factors which affect the amount of radiation exposure during diagnostic procedures. *Two lecture hours per week. Prerequisites: RDT 104 and RDT 154 with grades of "C" or better or permission of the department head. Corequisites: RDT 204, RDT 253 and RDT 256 or permission of the department head. Course fee: \$40. Usually offered in the fall.*

CREDIT HOURS: 2 credit hours
Monday: 09:00 – 11:00

PLACEMENT: Fall Semester - Second year of Program (2009)

PREREQUISITES: RDT 154: "C" or better

COREQUISITES: Permission of department head

FACULTY: Karie Solebrino, M.S.,R.T.(R)(CT)(ARRT)
Assistant Professor Radiologic Technology

TEXTBOOK: Radiologic Science for Technologists; Physics, Biology and Protection., Bushong, Stewart. Harcourt (2008)

Radiation Protection in Medical Radiography:
Mary Alice Statkiewicz-Sherer (2008)

WEBSITES: www.radrevieweasy.com

COURSE OBJECTIVES:

Upon completion of this course the student should be able to:

1. Identify and justify the need to minimize unproductive radiation exposure of humans.
2. Distinguish between somatic and genetic radiation effects.
3. Differentiate between the stochastic and non-stochastic (deterministic) effects of radiation exposure.
4. Explain the objectives of a radiation protection program.
5. Define radiation and radioactivity units of measurement.
6. Identify dose equivalent limits (DEL) for occupational and non-occupational radiation exposure.
7. Describe the as low as reasonably achievable (ALARA) concept.
8. Identify the basis for occupational exposure limits.
9. Distinguish between perceived risk and comparable risk.
10. Describe the concept of negligible individual risk level (NIRL).
11. Identify ionizing radiation sources from natural and man-made sources.
12. Comply with legal and ethical radiation protection responsibilities of radiation workers.
13. Calculate dose equivalent limits (DEL) with reference to the latest National Council on Radiation Protection and Measurements (NCRP) reports.
14. Describe the theory and operation of radiation detection devices.
15. Identify appropriate applications and limitations for each radiation detection device.
16. Describe how isoequivalent curves are used for radiation protection.
17. Identify performance standards for beam-directing, -defining and -limiting devices.
18. Describe procedures used to verify performance standards for equipment and indicate potential consequences of performance standards failure.
19. Describe the operation of various interlocking systems for equipment and indicate potential consequences of interlock system failure.
20. Identify conditions and locations evaluated in an area survey for radiation protection.
21. Distinguish between controlled and non-controlled areas and list acceptable exposure levels.
22. Describe "Radiation Area" signs and identify appropriate placement sites.
23. Describe the function of federal, state and local regulations governing radiation protection practices.
24. Describe the requirements for and responsibilities of a radiation safety officer.
25. Express the need and importance of personnel monitoring for radiation workers.
26. Describe personnel monitoring devices, including applications, advantages and limitations for each device.
27. Interpret personnel monitoring reports.
28. Compare values for dose equivalent limits for occupational radiation exposures (annual and lifetime).
29. Identify anatomical structures that are considered critical for potential late effects of whole body irradiation exposure.
30. Identify dose equivalent limits for the embryo and fetus in occupationally exposed women.
31. Distinguish between primary and secondary radiation barriers.
32. Demonstrate how the operation of various x-ray and ancillary equipment influences radiation safety and describe the potential consequences of equipment failure.

33. Perform calculations of exposure with varying time, distance and shielding.
34. Discuss the relationship between HVL and shielding design.
35. Identify emergency procedures to be followed during failures of x-ray equipment.
36. Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
37. Explain the relationship of beam-limiting devices to patient radiation protection.
38. Discuss added and inherent filtration in terms of the effect on patient dosage.
39. Explain the purpose and importance of patient shielding.
40. Use the appropriate method of shielding for a given radiographic procedure.
41. Explain the relationship of exposure factors to patient dosage.
42. Identify the appropriate image receptor that will result in an optimum diagnostic image with the minimum radiation exposure to the patient.
43. Select the immobilization techniques used to eliminate voluntary motion.
44. Describe the minimum source-to-tabletop distances for fixed and mobile fluoroscopic devices.
45. Apply safety factors for the patient (and others) in the room during mobile radiographic procedures.
46. Describe the characteristics of a molecule.
47. Describe principles of cellular biology.
48. Identify sources of electromagnetic and particulate ionizing radiations.
49. Discuss directly and indirectly ionizing radiations.
50. Identify sources of radiation exposure.
51. Describe radiation-induced chemical reactions and potential biologic damage.
52. Evaluate factors influencing radiobiologic/biophysical events at the cellular and subcellular level.
53. Identify methods to measure radiation response.
54. Describe physical, chemical and biologic factors influencing radiation response of cells and tissues.
55. Explain factors influencing radiosensitivity.
56. Recognize the clinical significance of $LD_{50/30}$ and LD_{30} .
57. Examine effects of limited vs. total body exposure.
58. Relate short-term and long-term effects as a consequence of high and low radiation doses.
59. Differentiate between somatic and genetic radiation effects as well as discuss specific diseases or syndromes associated with them.
60. Discuss stochastic and non-stochastic (deterministic) effects.
61. Discuss risk estimates for radiation-induced malignancies.

ACADEMIC HONESTY POLICY:

Students found exhibiting any of the following types of behavior during or in the preparation/performance of any quiz, project, report, test, or final exam will receive a zero "0" for the assignment, and the student conduct violation will be referred to the Student-Faculty Disciplinary Committee. Cheating will not be tolerated in the Radiologic Technology program. Students found cheating will be DISMISSED from the Radiologic Technology program.

- A. Cheating is defined as the act of obtaining information or data improperly or by dishonest or deceitful means; and
- B. Plagiarism is defined as the copying or imitating the language, ideas, or thoughts of another author and presenting them as one's original work, the copying of a theme or section from a book or magazine without giving credit in a footnote or copying from the manuscript of another student.

SUGGESTIONS FOR STUDENT SUCCESS

1. Never hesitate to ask for help. There is no such thing a dumb question. The only dumb question is the one that is never asked. Please communicate with the course instructor any problems that you are having for assistance to be provided.
 - Email the course instructor through WebCT
 - Office: (410) 572-8741
 - Cell: (443) 880-3365
2. Read chapter assignments before coming into class. Being prepared is the first step in becoming a successful student.
3. Take good notes.
4. Tape lectures and rewrite notes when you leave class. Listen to the lectures in the car when you are traveling to class or work.
5. Work in teams. We are all in this together. Develop study teams and collaborate with peers. Many times you can learn more effectively with a study partner or in groups.
6. Set goals for achievement. Use good time management. Purchase a calendar and keep track of assignments, tests, and due dates.
7. Study everyday for every class thirty minutes. Cramming is not a good study plan for comprehensive final exams. Comprehensive finals require studying in short increments for all classes.

CLASSROOM RULES

1. Cell phones or other electronic communicating devices may not be used in the classroom and must be in silent mode.
2. No talking during lectures. It is highly disruptive to your classmates and leads to lower grades due to course material being misunderstood.
3. If you have a question, ask the instructor not the person next to you.
4. Team work is required and expected of all students regardless of how much you dislike working in groups.
5. Arrive to class prior to class start time.
6. Come prepared to class. Complete reading assignments at home and be ready to participate in team-based learning exercises.
7. Sleeping is not permitted in class. Students who are sleeping will be dismissed from class.

ASSIGNMENTS:

1. Students will complete questions concerning radiation protection and radiobiology throughout the semester. Questions will be submitted through the Blackboard assignment's link. **NO LATE CHAPTER QUESTIONS WILL BE ACCEPTED. All assignments are due by 11:00pm EST through Blackboard.**
2. Students will complete registry review workbook assignments. After completing the assigned test, the student is to submit a Microsoft Word document with all of the answers to the questions. Highlight or bold the questions marked incorrect. Document the total number of incorrect answers and at least three areas the student plans to review. Submit the document in blackboard through the assignments link. **NO LATE WORKBOOK ASSIGNMENTS WILL BE ACCEPTED. All assignments are due by 11:00 pm EST through Blackboard. FAILURE TO COMPLETELY FOLLOW THE DIRECTIONS FOR THIS ASSIGNMENT WILL RESULT IN A GRADE OF 0.**
3. Students will complete registry review tests in www.radrevieweasy. The score received is the score earned. Grades will not be rounded. After completing the assigned tests in www.radrevieweasy, the student is to print the results of the test for submission. In addition, the student must show the course instructor the completed test in www.radrevieweasy to receive credit for this assignment. All radrevieweasy assignments are due by 4:30 pm on the due date. Failure to print a report of the test and show the instructor the results on the computer will result in a grade of 0 for the assignment. **NO LATE ASSIGNMENTS WILL BE ACCEPTED.**
4. **Electronic/information literacy Writing Assignment:** Students will select a topic pertaining to radiation safety, radiation protection, radiation dose, or radiobiology. The student will research the topic for electronic resources in the WWCC database and on the World Wide Web. Students will provide a minimum of five resources relevant to this topic and write a five page, double-spaced paper. The paper should include a cover page and a works cited page (this is not part of the five page requirement). Students are to follow APA format for citations which should be included throughout the writing assignment. The grading rubric is provided at the conclusion of the course syllabus. The writing assignment is due November 23, 2009 at 11:00 pm EST in blackboard. **PAPERS SUBMITTED AFTER 11:00 PM EST WILL NOT BE ACCEPTED.**

QUIZZES:

Quizzes will be administered throughout the semester to measure the student's comprehensive knowledge of course concepts and to encourage class attendance. Students are expected to complete chapter reading assignments before scheduled class meetings for quiz preparation. Quizzes will not be announced and will be given at different times throughout the class session. Students who report late or leave early may miss and quiz. **NO MAKE-UP QUIZZES WILL BE ADMINISTERED.**

TESTS:

Chapter tests will be administered throughout the semester. Three tests will be administered in RDT 201. **NO MAKE-UP TESTS WILL BE ADMINISTERED.**

COMPREHENSIVE FINAL EXAMINATION:

The comprehensive final examination will cover all radiation protection/radiobiology topics reviewed throughout the semester. **NO MAKE-UP FINAL WILL BE ADMINISTERED.**

ATTENDANCE

Students are expected to attend every class. Students are expected to arrive before class begins and remain in class for the entire session. Personal appointments should be made for non-class times and will not be excused. **Missing two classes** will result in the student's final grade being deducted by one Letter grade which will equal a 10% deduction. **Missing three classes** will result in the student's final grade being deducted by two Letter grades which will equal a 20% deduction. **Missing four classes will result in a grade of "F"**. Students failing to attend class will not be tolerated in the Radiologic Technology program.

ANY STUDENT ARRIVING 15 MINUTES OR MORE AFTER THE START OF THE CLASS OR WHO LEAVES THE CLASS 15 MINUTES OR MORE EARLY WILL RECEIVE AN UNEXCUSED ABSENCE. MISSING 15 MINUTES OR MORE OF CLASS IS CONSIDERED AN ABSENCE FOR THE ENTIRE CLASS PERIOD.

ONLY EXTREME CIRCUMSTANCES WILL BE CONSIDERED FOR AN EXCUSED ABSENCE AND IS AT THE DISCRETION OF THE COURSE INSTRUCTOR.

COURSE EVALUATION

Quizzes	10% (NO MAKE-UP QUIZZES)
Assignments	10% (NO LATE ASSIGNMENTS ACCEPTED)
Chapter Tests	20% (NO MAKE-UP CHAPTER TESTS)
Comprehensive Final	60% (NO MAKE-UP FINAL)

GRADING SCALE

A	93-100
B	84-92
C	75-83
D	66-74
F	0-65

A FINAL GRADE BELOW A 75.0% RESULTS IN COURSE FAILURE AND DISMISSAL FROM THE RADIOLOGIC TECHNOLOGY PROGRAM. GRADES ARE NOT ROUNDED. A FINAL GRADE OF 74.9% WILL RESULT IN COURSE FAILURE AND DISMISSAL FROM THE RADIOLOGIC TECHNOLOGY PROGRAM.

RDT 201: TENTATIVE LECTURE SCHEDULE

September	14	Introduction to Radiation Protection Interactions of X-Radiation with matter Module 2: Radiation Interactions with matter (online)
	21	Radiation Quantities and Units Module 5: Radiation Detection and Measurement (online)
	28	Cell Biology Module 1: Cell Biology and Body Chemical Composition (online)
October	5	Radiation Biology Module 2 and Module 4
	12	TEST ONE
	19	Radiation Effects on Organ Systems Module 4: Effects of Radiation on the Human Body (online)
	26	Dose Limits for Exposure to Ionizing Radiation Module 3: Systemic Radiation Effects (online)
November	2	Dose Limits for Exposure to Ionizing Radiation Module 3: Systemic Radiation Effects (online)
	9	TEST TWO
	16	Radiation Protection for the Patient Module 6: Patient Protection Practices and Equipment (online)
	23	Radiation Protection for the Radiographer Module 7: Radiographer Protection (online)
	30	Radiation Monitoring Module 5: Radiation Detection and Measurement (online)
December	7	TEST THREE
	14	Comprehensive Final Examination

RDT 201 Assignment Schedule

September	18	Chapter Questions Submit by 11:00 pm EST in blackboard.
	25	Appleton and Lange Radiation Protection Review Submit by 11:00 pm EST in blackboard. Answers recorded in Microsoft Word Document. Highlight in Red the answers marked wrong. Document the total number wrong and three areas the student needs improvement. Chapter Questions Submit by 11:00 pm EST in blackboard
October	2	Radiology Prep Radiation Protection Review Submit by 11:00 pm EST in blackboard. Answers recorded in Microsoft Word Document. Highlight in Red the answers marked wrong. Document the total number wrong and three areas the student needs improvement. Chapter Questions Submit by 11:00 pm EST in blackboard
	9	Mosby's Radiation Protection Review. Submit by 11:00 pm EST in blackboard. Answers recorded in Microsoft Word Document. Highlight in Red the answers marked wrong. Document the total number wrong and three areas the student needs improvement. Chapter Questions Submit by 11:00 pm EST in blackboard.
	16	400 Questions Radiation Protection on Mosby's CD. Submit report through WebCT. Document the number of incorrect answers and five areas the student needs to review. Submit by 11:00 pm EST in Blackboard,
	23	400 Questions Radiation Protection on radrevieweasy.com. Print report and submit to instructor by 4:30 pm EST. Chapter Questions Submit by 11:00 pm EST in blackboard.
	30	400 Questions Radiation Protection on radrevieweasy.com. Print Report and submit to instructor by 4:30 pm EST.
November	6	Chapter Questions Submit by 11:00 pm EST in blackboard.

November	13	Chapter Questions Submit by 11:00 pm EST in blackboard. 400 Questions Radiation Protection on radrevieweasy.com. Print Report and submit to instructor by 4:30 pm EST.
	20	Chapter Questions Submit by 11:00 pm EST in blackboard. Electronic Information Literacy Writing Assignment due by 11:00 PM EST in blackboard
	27	Chapter Questions Submit by 11:00 pm EST in blackboard.

SAMPLE

RDT 201 Electronic Information Literacy Writing Assignment Grading Rubric

Criteria (36 Points)	0 Needs Improvement	2 Meet Expectations	4 Exceptional
Spelling	More than three spelling errors are present throughout the paper.	No more than three spelling errors are present.	Paper is free of spelling errors.
Grammar/Sentence Structure	Does not demonstrate coherent sentence structure or knowledge of grammatical rules as expressed in the English Language.	No more than three Grammatical or Sentence structure errors are noted.	Paper is free of grammatical and sentence structure errors. Language is concise and easily understood by the reader.
Length Requirement	Paper is less than five pages in length and/or does not follow the 12 point Times New Roman Specification.		Paper is five pages in length following the 12 point Times New Roman font with 1 inch margins.
Content	Does not provide enough content regarding patient dose, radiation safety, radiation biology, and radiation protection	Demonstrates a basic understanding of paper topic and provides a minimum of three specific content areas.	Demonstrates an understanding of paper topic by relating information from resources into patient care scenarios. Topic is relevant to the course with a minimum of five examples related to the clinical environment.
Explains Lessons Learned	Does not explain lessons learned.	Explains up to three lessons learned as a result of research.	Explains a minimum of five lessons learned as a result of research.
Explains rationale for choosing topic.	Does not explain rationale for choosing topic.	Provides a basic explanation for choosing topic.	Explains rationale for choosing topic and lessons learned from research.
Works cited in APA Format	Does not provide references in APA format and/or the required minimum number of resources.	Less than four resources are provided in APA format.	A minimum of five resources are provided in APA format.
Entire Paper following APA Style	Does not adhere to APA style throughout paper content	APA format attempted with up to two errors present within paper.	Does adhere to APA style throughout paper content.
Paper Components	Paper does not include a title page, three to five pages of content, and works cited page.	Paper includes some but not all of the required components.	Paper includes a title page, three to five pages of content, and a works cited page.

RDT 201: Introduction to Radiation Protection
Due September 18, 2009 11:00 pm in Blackboard

1. What is ionizing radiation?
2. Define radiation protection.
3. What are biologic effects?
4. Define the ALARA principle. List five ways the technologist practices this concept in the clinical setting.
5. What is diagnostic efficacy? How should it be applied by medical providers?
6. Define occupational and non-occupational dose limits.
7. What are the employer's responsibilities for an effective radiation safety program? What are the technologist's responsibilities?
8. Define BERT. How is this concept applied?
9. What is the electromagnetic spectrum? List four examples on the electromagnetic spectrum. Describe the frequency, wavelength, and energy of each example provided.
10. List five sources of radiation.

RDT 201: Interactions of X-Radiation with Matter
Due September 18, 2009 11:00 pm in Blackboard

1. Define kVp and mAs.
2. Define absorbed dose.
3. What is the difference between primary and secondary radiation?
4. Define beam attenuation. How does beam attenuation differ for bone and air? How does the anatomic number of the part contribute to beam attenuation?
5. What is remnant radiation?
6. Define small-angle scatter.
7. What is radiographic fog? How can radiographic fog be minimized on the image?
8. Define coherent scattering. Explain the coherent scattering process.
9. Define Compton scattering. Explain the Compton scattering process.
10. Define photoelectric absorption. Explain the photoelectric absorption process.
11. Define atomic number, atomic mass, effective atomic number, and mass density.
12. Explain how the effective atomic number, mass density, body part thickness and difference in absorption properties between different body structures effects the occurrence of photoelectric absorption.
13. How does the occurrence of photoelectric absorption affect radiographic contrast? How does this interaction with matter affect patient dose?
14. How does the administration of contrast media affect the attenuation properties of an anatomical structure? What is the atomic number of barium? What is the atomic number of iodine? What kVp is needed for each ROCM? Which ROCM absorbs more x-ray photons and Why?
15. What is negative contrast media? How does negative contrast media attenuate x-ray photons differently than positive contrast media? Why?
16. Define pair production. Explain the process for pair production.

17. Define photodisintegration. Explain the process for photodisintegration.

RDT 201: Radiation Quantities and Units

Due September 25, 2009 11:00 pm in Blackboard

1. Explain the discovery of x-rays.
2. Explain the difference between somatic and genetic damage.
3. Define skin erythema dose.
4. Define somatic and genetic effects of radiation.
5. What are short-term somatic effects of radiation?
6. What are long term or late somatic effects of radiation?
7. What are genetic effects which can occur as a result of radiation exposure?
8. What is a threshold dose?
9. What is effective dose? How does this measurement protect patients and radiographers from excessive radiation exposure?
10. List the three traditional units associated with radiation protection and dosimetry. Explain the purpose of each.
11. List the SI units associated with radiation protection and dosimetry. Explain the purpose of each.
12. What is the difference between equivalent dose and effective dose?
13. What are the quality factors for different types of ionizing radiations?
14. Define linear energy transfer. What is the difference between high-LET and low-LET radiation?
15. What are the radiation weighting factors for different types and energies of ionizing radiation? What dose takes radiation weighting factors into consideration? What is the formula?
16. What are the organ or tissue weighting factors? What dose takes tissue weighting factors into consideration? What is the formula?
17. What is collective effective dose?

RDT 201: Cell Biology

Due October 2, 2009 11:00 pm in Blackboard

1. What is protoplasm? What is contained in protoplasm? What is the difference between organic and inorganic substances? What are the four primary elements which compose protoplasm?
2. Describe proteins, carbohydrates, lipids, and nucleic acids. How much of each of these substances are contained within the cell?
3. Describe DNA and RNA. Where are each contained within the cell? What is transfer RNA and messenger RNA?
4. What is the human genome?
5. What are examples of inorganic compounds?
6. How much of the body is composed of water?
7. Describe the function of each of the following cell structures: cell membrane, cytoplasm, endoplasmic reticulum, golgi apparatus, mitochondria, lysosomes, ribosomes, centrosomes, nucleus, and nucleolus.
8. What is cell division? Describe the stages of mitosis. Describe the stages of meiosis. When do each of these types of cell division occur?

RDT 201: Radiation Biology
Due October 9, 2009 11:00 pm in Blackboard

1. Define linear energy transfer. Describe the difference between low-LET and high-LET. Provide examples of each.
2. Define RBE. What reference radiation is used?
3. Define oxygen enhancement ratio.
4. Describe the difference between direct and indirect action.
5. Explain the radiolysis of water and the production of free radicals.
6. Explain the following effects of ionizing radiation on DNA: Single-strand break, double-strand break, double-strand break in the same rung of DNA, mutation, and covalent cross-links.
7. Explain the following effects of ionizing radiation on chromosomes: radiation-induced chromosome breaks, chromosomal fragments, chromosome anomalies, structural changes in biologic tissue, and consequences to the cell from structural changes in biologic tissue.
8. Describe the target theory.
9. Explain the following cellular effects of irradiation: instant death, reproductive death, apoptosis, mitotic death, mitotic delay, interference of function, and chromosome breakage.
10. How does cell maturity and specialization affect cell radiosensitivity?
11. What is the law of Bergonie' and Tribondeau?
12. What blood cells are the most radiosensitive and why?
13. What is epithelial tissue? What is the effect of radiation exposure to epithelial tissue?
14. What are the effects of radiation exposure to muscle tissue?
15. What are the effects of radiation exposure to nervous tissue?
16. What are spermatogonia? How much radiation exposure will cause temporary sterility? How much radiation exposure will cause permanent sterility?
17. How much radiation exposure will cause temporary sterility to the ova? How much radiation exposure will cause permanent sterility to the ova?

RDT 201: Radiation Effects on Organ Systems
Due October 23, 2009

1. What are radiation dose-response relationships? What is represented on the horizontal axis? What is represented on the vertical axis?
2. Define the terms linear and nonlinear. Define the terms threshold and nonthreshold.
3. Describe the linear, nonthreshold curve. What does this mean? What is represented by this curve?
4. Describe the linear-quadratic, non-threshold curve. What does this mean? What is represented by this curve?
5. Describe the linear, threshold curve. What does this mean? What is represented by this curve?
6. Describe the sigmoid, threshold curve. What does this mean? What is represented by this curve?
7. Define somatic effects. What are nonstochastic somatic effects? What are stochastic

- somatic effects?
8. Describe early nonstochastic somatic effects. Provide examples.
 9. What is ARS? Describe the stages of ARS.
 10. What is the hematopoietic syndrome? Describe what occurs and how much radiation exposure is required for this syndrome.
 11. What is the gastrointestinal syndrome? Describe what occurs and how much radiation exposure is required for this syndrome.
 12. What is the cerebrovascular syndrome? Describe what occurs and how much radiation exposure is required for this syndrome.
 13. Define LD 50/30 and LD 50/60.
 14. What are late somatic effects? What are late nonstochastic somatic effects? Provide examples. What are late stochastic somatic effects? Provide examples.
 15. What are the three major types of late somatic effects? Explain each of these major categories.
 16. What are genetic effects? What are causes of genetic mutations?
 17. What is the doubling dose concept?

RDT 201: Dose Limits for Exposure to Ionizing Radiation
Due October 30, 2009

1. What is radiation-induced malignancy?
2. Define the following radiation protection standards organizations: IRCP, NRCP, UNSCEAR, NAS/NRC-BEIR. Describe the function of each organization.
3. Define the following U.S. Regulatory Agencies: NRC, Agreement states, EPA, FDA, and OSHA. Describe the function of each organization.
4. What are the requirements of a radiation safety program? What is the radiation safety committee and RSO? What are the functions of each?
5. What is the effective dose limiting system?
6. What is the Radiation control for health and safety act of 1968? What purpose does it serve?
7. What is the ALARA concept? What is the model for the ALARA concept?
8. What is the consumer-patient radiation health and safety act of 1981?
9. What is the goal of radiation protection?
10. What are the two categories for radiation-induced responses? Explain each of these and provide examples.
11. What is the annual occupational effective dose limit? What is the cumulative effective dose limit?
12. What is the equivalent dose annual limit for the lens of the eye, for localized areas of the skin, hands, and feet?
13. What is the equivalent dose limit monthly for an embryo-fetus exposure? For the entire gestational period?
14. What is the effective dose limit for education and training exposures annually? What is the equivalent dose limit for the lens of the eye and skin, hands, and feet for education and training exposures annually?
15. What is the annual public exposure effective dose limit for continuous or frequent exposure, effective dose limit for infrequent exposure, the lens of the eye and localized areas of the skin, hands, and feet?

RDT 201: Radiation Protection for the Patient
November 6, 2009

1. What is effective communication? How does effective communication minimize repeated exposures?
2. Define immobilization and restraints. Provide examples of each.
3. What are the two types of patient motion? Provide examples of each. What can the technologist do to minimize the occurrence of motion on the radiograph?
4. What are beam limitation devices? What purpose do they serve? Describe four types of beam limiting devices. Which beam limitation device is the best and why?
5. What is the QA test for beam alignment? What is the range appropriate for this test?
6. What is the PBL? What purpose does it serve?
7. What is filtration? What effect does it have upon the energy of the beam? What effect does it have upon patient dose? What are two types of filtration? Describe each type and provide an example.
8. What is total filtration? What is the total filtration requirement for x-rays tubes operating above 70 kVp? What is the total filtration requirement for x-ray units operating from 50 kVp to 70 kVp?
9. What is the total filtration for mobile diagnostic and fluoroscopic equipment?
10. What energy range do mammography machines operate? What target is used for mammography units?
11. Define HVL. How is HVL determined?
12. List four types of gonadal shielding devices. Describe each of them.
13. What are compensating filters? What purpose do they serve?
14. What information is located on a standardized technique chart?
15. How does the use of film-screen systems affect patient dose?
16. How does kVp and mAs selection affect patient dose?
17. What is a grid? List four types of grid errors and discuss how each occurs.
18. Define grid ratio and grid frequency.
19. How does the use of grids affect patient dose?
20. What is the air gap technique? How does the air gap technique affect radiographic density, radiographic contrast, and recorded detail?
21. What parameters should be recorded on a repeat analysis? What is the benefit of a repeat analysis program?
22. What is SSD? What is the minimal SSD for mobile radiography?
23. Describe the difference between conventional radiography, computed radiography and digital radiography.
24. Describe the difference between indirect and direct capture.
25. How is patient dose affected during fluoroscopy procedures?
26. Describe the image intensification process. Define flux gain, minification gain, and brightness gain. What are three benefits of image intensification fluoroscopy?
27. Describe the difference between photopic and scotopic vision? Which one is used during image intensification? Which one is better for diagnostic interpretation of images? Why?
28. What is the mA used for fluoroscopy procedures?

29. What is multifield or magnification image intensifier tubes? How is image quality affected? How is patient dose affected?
30. What is the different between continuous and pulsed fluoroscopy?
31. What is the SSD for stationary fluoroscopy units? What is the SSD for mobile fluoroscopy units? Why is this important?
32. What is the cumulative timer used in fluoroscopy? What purpose does it serve? When does it sound?
33. What is cinefluorography? How are does rates to the patient changed? What is the filming rate?
34. What is the ESE? What is skin dose? What is the GSD? What is gonadal dose? What is the bone marrow dose?
35. Why is it important to questions patients regarding the possibility of pregnancy? What are ways to prevent the exposure of a pregnant patient?
36. What are consideration for protecting pediatric patients from overexposure?

RDT 201: Radiation Protection for the Radiographer
Due November 27, 2009

1. What are procedures that increase the radiographer's risk of exposure?
2. What is the cumulative effective dose limit? How is it calculated?
3. What is the annual occupational effective dose limit?
4. What are four specific ways the radiographer can limit exposure to him or herself?
5. What is the inverse square law? How is this concept applied by the radiographer?
6. What is the primary protective barrier? Where is it located? What is the lead thickness of the primary protective barrier?
7. What is the secondary protective barrier? Where is it located? What is the lead thickness of the secondary protective barrier?
8. What is the control booth barrier? What is its lead equivalent?
9. What is the lead thickness of aprons, gloves, thyroid shields and protective eyeglasses.
10. What is off-focus radiation? What protects the radiographer from off-focus radiation?
11. What is the limit of leakage radiation coming from the x-ray tube when energized?
12. What is the protective curtain used in fluoroscopy? What purpose does it serve? How much lead does it contain?
13. What is the bucky slot shielding device? What purpose does it serve? How much lead does it contain?
14. How far and in what direction should the technologist stand when completing a mobile radiography procedure?
15. What are four specific ways the technologist practices radiation protection while operating the C-Arm?
16. What is the purpose of extremity monitoring? What technologists use extremity monitoring? What is the annual equivalent dose limit to localized areas of the skin and hands?
17. What are the three categories of radiation sources that are generated in the x-ray room? Describe each of them.
18. Define workload, use factor, and occupancy factor.
19. What are controlled and uncontrolled areas?

RDT 201: Radiation Monitoring
Due December 4, 2009

1. What is the requirement for personal monitoring? What is the purpose of the personnel dosimeter?
2. Where is the dosimeter placed during routine radiographic procedures? Where is the dosimeter placed when wearing the protective lead apron?
3. Where is an embryo-fetus monitor placed?
4. What is the purpose of an extremity monitor?
5. What is a film badge? What are advantages and disadvantages to the film badge?
6. What is the function of the control badge?
7. What is the personnel monitoring report? What is the measurement unit used?
8. What is the OSL? What are advantages and disadvantages to the OSL?
9. What is the pocket ionization chamber? What are advantages and disadvantages for the pocket ionization chamber?
10. What is the TLD? What are advantages and disadvantages to the TLD?
11. What are radiation survey instruments? List three types and describe the use of each.