9-2013

# AHXR 225.01: Radiobiology / Radiation Protection

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# THE UNIVERSITY OF MONTANA – MISSOULA
## Missoula College
## RADIOLOGIC TECHNOLOGY

## COURSE SYLLABUS

**COURSE NUMBER AND TITLE:** AHXR 225 Radiobiology/Radiation Protection

**DATE REVISED:** Fall 2013

**SEMESTER CREDITS:** 2

**PREREQUISITES:** AHXR 100 (Introduction to Radiology); AHXR 140 (Radiographic Methods); AHXR 121 (Radiographic Imaging); AHXR 195 I & II (Radiographic Clinical Education I & II)

**Faculty:** **Dan Funsch**
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**Phone:** 243-7907
**Office:** AD 04A
**Office Hours:** TBD; By Appointment

**RELATIONSHIP TO PROGRAM:** Students will gain a clear understanding of the necessity of high quality radiation protection for every procedure done by a radiographer.

**COURSE DESCRIPTION:** Content is designed to present the principles of radiobiology and radiation protection, including responsibilities of the radiographer to patients, personnel and the public. Students will learn the relationship between x-ray and its interaction with the human body.

**STUDENT PERFORMANCE OUTCOMES:** See outcomes following calendar page.

**PERFORMANCE ASSESSMENT AND GRADING:** Final grades will be determined by total points received for quizzes, paper, class participation, attendance and tests.

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|---|---|---|---|
| **Grading scale:** | **100-90 = A** | **Grade Based on:** | |
| | **89-80 = B** | Quizzes: | 25% |
| | **79-70 = C** | Attendance/Participation: | 15% |
| | **69-60 = D** | Research paper: | 30% |
| | | Tests: | 30% |

**Attendance Policy:** All students are expected to come to class each, on time. Cell phones must be turned off. Constructive participation is expected. Disruptive behavior will not be tolerated.

**Class requirements:** Students should come to class prepared, with all necessary materials and assignments. Students are required to read, and be able to discuss, each assigned chapter during class. A quiz will be given on the weekly assignment at the beginning of each class.

**Instructions for Research Paper:** Chose a topic or related topics from the list of student performance outcomes included in this syllabus, or propose a different topic to the class instructor. Research and expand upon the subject in a type-written paper, double-spaced, 3-5 pages in length, using a 12 pt font and 1 inch margins. The paper must include an abstract and must incorporate at least three scholarly references, sited and listed in APA style. Students should be prepared to present their research to the class.

**Papers will be graded** based on content & quality of research (30%), grammar, spelling & organization (30%), acknowledgements & use of references (20%), and adherence to requirements (20%). Plagiarism will not be tolerated; if you are quoting a source you must reference it. Papers containing plagiarized text will be reduced by 50%.

**ACADEMIC INTEGRITY:**
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by The University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://life.umt.edu/vpsa/student_conduct.php .

**DISABILITY ACCOMODATION:**
Eligible students with disabilities will receive appropriate accommodations in this course when requested in a timely way. Please speak with me after class or in my office. Please be prepared to provide a letter from your DSS Coordinator. For more information, visit the Disabilities Services website at http://www.umt.edu/dss/ or call 406-243-2243 (voice/text)

**Note: Instructor reserves the right to modify syllabi and assignments as needed based on faculty, student, and/or environmental circumstances.**

**REQUIRED TEXT:** Radiologic Science for Technologists, 10th Edition, Stewart C. Bushong

Note: All students must pass this course with at least a "B" (80%). Students will not be allowed to continue with the radiology program if the grade is a "C" (79%) or below.

| DATE | READING ASSIGNMENT DUE | CLASS ACTIVITY |
|---|---|---|
| August 30 | 1st class, no assignment due but in-class assignment will be given! | **Class Overview & Clinical Program Review** |
| September 6 | Chapter 29: Human Biology<br>Chapter 30: Fundamental Principles of Radiobiology | **Quiz on Chapters 29 & 30** |
| September 13 | Chapter 31: Molecular Radiobiology | **Quiz on Chapter 31** |
| September 20 | Chapter 32: Cellular Radiobiology | **Quiz on Chapter 32** |
| September 27 | **TEST on Chapters 29-32** | **TEST on Chapters 29-32** |
| October 4 | Chapter 33: Deterministic Effects of Radiation | **Quiz on Chapter 33** |
| October 11 | Chapter 34: Stochastic Effects of Radiation | **Quiz on Chapter 34** |
| October 18 | **TEST on Chapters 33-34** | **TEST on Chapters 33-34** |
| October 25 | Chapter 35: Health Physics | **NO CLASS**<br>**On line Quiz on Chapter 35** |
| November 1 | Chapter 36: Designing for Radiation Protection | **NO CLASS**<br>**On line Quiz on Chapter 36** |
| November 8 | Chapter 37: Patient Radiation Dose Management | **Quiz on Chapter 37** |
| November 15 | Chapter 38: Occupational Radiation Dose Management | **Quiz on Chapter 38** |
| November 22 | **TEST: Radiation Protection** | **TEST on Chapters 35-38** |
| November 29 | Thanksgiving Break | **No School** |
| December 6 | **Papers Due/Presentations** | **Hand In Papers** |
| December 10-14 | **Finals Week** | **Final Exam Chapters 29-38** |

**STUDENT PERFORMANCE OUTCOMES:** Upon completion of this course, the student will 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 units (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 Units (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 isoexposure 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 units 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 units 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, TVL, use factor 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 distance for fixed and mobile fluoroscopic devices
45. Apply safety factors for the patient and others in the room during mobile radiographic procedures
46. Demonstrate how time, distance, and shielding can be manipulated to keep radiation exposures to a minimum
47. Explain how patient position affects dose to radiosensitive organs
48. Describe the relationship between irradiated area and effected dose