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RAD 131T.01: Radiographic Physics

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THE UNIVERSITY OF MONTANA – MISSOULA
COLLEGE OF TECHNOLOGY
DEPARTMENT OF RADIOLOGY TECHNOLOGY

COURSE SYLLABUS

COURSE NUMBER AND TITLE: RAD131T Radiographic Physics

DATE REVISED: Autumn 2004

SEMESTER CREDITS: Physics 4

CO-REQUISITE: MAT 100T Algebra

Faculty: Allen LaCasse
E-Mail: allen.lacasse@umontana.edu
Phone: 544-2085
Office: Faculty Office
Office Hours: By appointment

RELATIONSHIP TO PROGRAM: Students will gain a clear understanding of how radiological physics directly relates to the production of x-rays and how it is utilized in the day to day operations of an imaging department.

COURSE DESCRIPTION: Content of the class is designed to establish students with a knowledge base in factors that govern and influence the production and recording of radiologic images.

STUDENT PERFORMANCE OUTCOMES:
Upon completion of this course, the student will be able to:

1. Describe the characteristics of matter and energy.
2. Identify the various forms of energy.
3. Define electromagnetic radiation and specifically ionizing radiation.
4. State the relative intensity of ionizing radiation from various sources.
5. Relate the accidental discovery of x-rays by Roentgen
6. Discuss examples of human injury caused by radiation.
7. List the concepts of basic radiation protection.
8. Calculate problems using fractions, decimals, exponents, and algebraic equations.
9. Identify scientific exponential notation and the associated prefixes.
10. List the three systems of measurement.
11. Identify nine categories of mechanics.
12. Relate the history of the atom.
13. Identify the structure of the atom.

14. Describe the electron shells and instability within the atomic structure.
15. Discuss radioactivity and the characteristics of alpha and beta particles.
16. Explain the difference between two forms of ionizing radiation: particulate and electromagnetic.
17. Identify the properties of photons.
18. Explain the inverse square law.
19. Define wave theory and quantum theory.
20. Discuss the electromagnetic spectrum.
21. Define electrification and provide examples.
22. List the laws of electrostatics.
23. Define direct current and alternating current.
24. Identify units of electric potential and electric power.
25. Define magnetic dipole.
26. Identify the interactions between matter and magnetic fields.
27. Discuss the four laws of magnetism.
28. Discuss the development of the battery as a reliable source of electric potential.
29. Relate the experiments of Oersted, Lenz, and Faraday in defining the relationship between magnetism and electricity.
30. Describe the solenoid and the electromagnet.
31. Identify the laws of electromagnetic induction.
32. Explain the design of the electric generator, the electric motor, and the transformer.
33. Identify the components of the operating console positions outside the x-ray examination room.
34. Explain the operation of the high-voltage generator, including the filament transformer and the rectifiers.
35. Relate the important differences among single-phase, three-phase and high-frequency power.
36. Identify the voltage ripple associated with various high-voltage generators.
37. Discuss the importance of voltage ripple to x-ray quantity and quality.
38. Define the power rating of an x-ray imaging system.
39. Describe the general design of an x-ray tube.
40. List the external components that house and protect the x-ray tube.
41. Identify the purpose of the glass or metal enclosure.
42. Discuss the cathode and filament currents.
43. Describe the parts of the anode and the induction motor.
44. Define the line-focus principle and the heel effect.
45. Identify the three causes of x-ray tube failure.
46. Explain and interpret x-ray tube rating charts.
47. Discuss the interactions between projectile electrons and the x-ray tube target.
48. Identify characteristic and bremsstrahlung x-rays..
49. Describe the x-ray emission spectrum.
50. Explain how mAs kVp, added filtration, target material, and voltage ripple affect the x-ray emission spectrum.
51. Define radiation quantity and its relation to x-ray intensity.
52. List and discuss the factors affecting the intensity of the x-ray beam.
53. Explain x-ray quality and penetrability.

54. Describe each of the five x-ray interactions with matter.
55. Define differential absorption and its effect on image contrast.
56. Explain the effect of atomic number and mass density of tissue on the differential absorption.
57. Explain the difference between absorption and attenuation.

STUDENT PERFORMANCE ASSESSMENT METHODS AND GRADING PROCEDURES:

Grading scale:
100-90 A
89-80 B
79-70 C
69-60 D

Total grade will be determined by total points received on homework, tests, final paper and final exam.

Tests:	40%
Paper:	30%
Final Exam:	30%
	100%

Instructions for Semester Paper: Choose a topic or several related topics from the list of student performance outcomes. Give me your topic in writing no later than Thursday, September 30, 2003. Research and expand upon the subject in a type written paper, double spaced and 3 to 4 pages in length. Use 12pt font and one inch top and bottom margins. Students will present these papers to the class during class on Nov. 29 through Dec. 10. The purpose of the presentation is to instruct fellow students, provide opportunity for discussion and to gain confidence in presenting ideas and information. Please send me an electronic copy of your paper prior to the day you are presenting and give me a hardcopy directly following your presentation.

Papers will be graded for content, interest, attention to detail, correct grammar and punctuation. Presentations will not be graded but must be done to receive full credit for your paper.

Note: Students must pass this course with a "B" (80%) in order to continue with the Radiology Technology Program the next semester.

STUDENTS WITH DISABILITIES: 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.

ATTENDANCE POLICY: All students are expected to come to class each day, on time and prepared by having read the required chapters and completed the assigned worksheets. Class participation is expected and may impact grades that are borderline.

REQUIRED TEXT: *Radiologic Science for Technologists;* 8th Edition, Stewart C. Bushong.

Radiologic Science, Workbook and Laboratory Manual; 8th Edition, Stewart C. Bushong.

DATE	READING ASSIGNMENT	ONLINE COURSE
Aug 31-Sep2	Introduction Chapter 1	Module 1 Lessons 1-3
Sep 7-9	Chapter 2	Module 1 Lessons 1-3
Sep 14-16	Chapter 3	Module 1 Lessons 1-3
Sep 21-23 Sep 23	Chapter 4 Test 1	Module 2 Lessons 1-3 Test
Sep 28-Sep 30 Sep 30	Chapter 5 Paper topic due	Module 3 Lessons 1-3
Oct 5-7	Chapter 6	Module 4 Lessons 1-3 Module 5 Lesson 1
Oct 12-14 Oct 14	Chapter 7 review Test 2	Module 5 Lessons 2&3 Test
Oct 19-21	Chapter 8	Module 6 Lessons 1-3
Oct 26-28	Chapter 9	Module 7 Lessons 1-3
Nov 1-4 Nov 9-11	Chapter 10 Nov 2 & 11 Holiday	Module 8 Lessons 1-3
Nov 16-18 Nov 23	Chapter 11& 12 Nov 25 holiday	Module 8 Lessons 1-3 Test
Nov 30-Dec 2	Present papers review	
Dec76-9	Present papers review	
Dec 14-16	Finals Dec 16 3:20-5:20 p.m.	

Revises7-7-04