

University of Arkansas – Fort Smith
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General Syllabus

RISP 24302 Principles of Radiation Biology/Protection

Credit Hours: 2

Lecture Hours: 2

Laboratory Hours:

Prerequisites: RISP 12004 Image Production

Corequisites: RISP 24102 Radiographic Procedures IV and RISP 24205 Clinical Education IV

Effective Catalog: 219-2020

I. Course Information

A. Catalog Description

An overview of the principles of the interaction of radiation and biological systems and effects of radiation on biological molecules and organisms and factors affecting biological response. Provides an overview of principles of radiation protection and the responsibility of the radiographer. Regulatory agencies are identified and agency involvement discussed.

B. Additional Information - None

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Define radiation biology and explain its relevance to the practice of radiography.
2. List the various cellular components and identify their physical characteristics and functions.
3. Distinguish the two types of cell division, mitosis and meiosis, and describe each.
4. State and describe the law of Bergonié and Tribondeau.
5. Explain the target theory.
6. Describe the direct and indirect effects of ionizing radiation upon the molecular and cellular structure of living organisms.
7. List and describe how ionizing radiation produces damage in living systems both biologically and physically.
8. List and explain the types of dose-response curves.
9. Identify diagrams demonstrating the various radiation dose-radiation dose-response relationships.

10. List and describe early somatic effects of ionizing radiation upon living systems.
11. List and describe late somatic effects of ionizing radiation upon living systems.
12. Discuss the concept of radiation-induced genetic defects.
13. Identify and justify the need to minimize unproductive radiation exposure to humans.
14. Define and distinguish between somatic and genetic radiation effects (immediate and latent), and provide examples.
15. Identify the acronym “ALARA” and describe the concept.
16. Identify and define units of radiation, for exposure, absorbed dose, does equivalent and radioactivity.
17. Differentiate between types of ionizing radiation.
18. Describe the five (5) basic effects for x-ray interactions with matter.
19. Distinguish between controlled and non-controlled areas and list acceptable exposure levels.
20. Identify the need and importance of personnel monitoring for radiation workers.
21. Identify, describe and list the advantages and disadvantages of various monitoring devices.
22. List values for maximum permissible dose equivalent limits for occupational radiation exposures (annual and lifetime).
23. Discuss the effects of filtration on patient exposure.
24. Discuss the importance of patient shielding.
25. Distinguish between primary and secondary barriers.
26. List and describe the cardinal principles of radiation protection.
27. Discuss the relationships of beam limiting devices to patient radiation protection.
28. List regulatory agencies involved in making recommendations and setting guidelines for protecting the public and occupational worker from unnecessary exposure to ionizing radiation.

B. University Learning Outcomes

This course enhances student abilities in the following areas:

Analytical Skills

Critical Thinking Skills: Students will generate solutions/analysis to problems associated with radiation protection devices.

Quantitative Reasoning: Students will apply appropriate mathematical formulas in order to limit patient/technologist exposure to radiation. Students will interpret data models in order to draw inferences concerning the biological effects associated with radiation exposure.

III. Major Course Topics

- A. Review of Cell Biology
- B. Types of Ionizing Radiation
- C. Biologic Factors Affecting Radiosensitivity
- D. Physical Factors Influencing Radiation Response
- E. Radiation Dose-Response Relationships

- F. Early Somatic Effects of Radiation
- G. Late Somatic Effects of Radiation
- H. Molecular and Cellular Effects of Radiation
- I. Unit of Detection and Measurements
- J. Personnel Monitoring and Occupational Exposure
- K. Interactions of Radiation with Matter
- L. Practical Radiation Protection
- M. Patient Protection
- N. Regulatory Agencies