RADT 63B Course Outline as of Fall 2019

CATALOG INFORMATION

Dept and Nbr: RADT 63B Title: RADIOBIOLOGY/RAD PROTECT
Full Title: Radiobiology Radiation Protection, and Quality Control
Last Reviewed: 9/25/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
Principles of radiobiology, the short and long-term effects of radiation, health physics, introduction to fluoroscopy, quality control, and radiation protection procedures and design.

Prerequisites/Corequisites:
Course Completion of RADT 63A and Concurrent Enrollment in RADT 71D

Recommended Preparation:

Limits on Enrollment:
Acceptance in program

Schedule of Classes Information:
Description: Principles of radiobiology, the short and long-term effects of radiation, health physics, introduction to fluoroscopy, quality control, and radiation protection procedures and design. (Grade Only)
Prerequisites/Corequisites: Course Completion of RADT 63A and Concurrent Enrollment in RADT 71D
Recommended:
Limits on Enrollment: Acceptance in program

Transfer Credit: CSU;
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:		Effective:		Inactive:

CID:

Certificate/Major Applicable:
Both Certificate and Major Applicable

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Explain the effects of radiation exposure on human tissues.
2. Implement effective measures of radiation protection in any radiology department.
3. Evaluate the performance of radiographic systems in relation to radiation safety.

Objectives:
Upon completion of this course students will be able to:
1. Define quality assurance and quality control.
2. Identify the early and late effects of radiation.
3. Differentiate between early and late effects of radiation.
4. Evaluate the radiosensitivity of tissues and organs.
5. Identify various stages of cell division, proliferation and cancer induction.
6. Describe the processes of mitosis and meiosis.
7. Explain the cardinal principles of radiation protection.
8. List, discuss, and explain the long and short term hazards of radiation to human beings.
9. Explain the cardinal principles of radiation protection.
10. Discuss the ALARA (As Low As Reasonably Achievable) principle.
11. Describe the radiation dose-response relationship.
12. Describe the three acute radiation syndromes.
13. Explain the theories and list the methods for radiation protection of medical personnel and patients.
14. List all of the State and National Radiation Health and Safety regulations for radiologic technology personnel.
15. List the fundamental principles of fluoroscopy and their impact on radiation protection.
16. Explain the design for radiation protection.

Topics and Scope:

I. Human Response to Radiation

- A. Cell theory
- B. Molecular composition
- C. Tissues and organs

II. Biologic Aspects
- A. Law of Bergonie and Tribondeau
- B. Radiation responses
- C. Dose response relationships
- D. Biological factors in radiosensitivity
- E. Genetic impact
- F. Embryonic and fetal risks
- G. Somatic effects

III. Irradiation of Macromolecules
- A. Point lesions
- B. Macromolecular synthesis
- C. Radiation effects on DNA
- D. Cell recovery

IV. Linear Energy Transfer

V. Relative Biological Effectiveness

VI. Acute Radiation Lethality
- A. Prodromal period
- B. Hematologic syndrome
- C. Gastrointestinal syndrome
- D. Central nervous system syndrome
- E. Mean survival time
- F. Local tissue damage
- G. Hematologic effects
- H. Cytogenetic effects
- I. Late effects of radiation exposure
- J. Early effects of radiation exposure

VII. Minimizing Patient Exposure
- A. Exposure factors
- B. Shielding
- C. Beam restriction
- D. Filtration
- E. Patient considerations
- F. Dose documentation
- G. Image receptors
- H. Grids
- I. Fluoroscopy
- J. Dose area product

VIII. Radiation Health Physics
- A. ALARA principle
- B. Pregnancy policy
- C. Occupational dose
- D. Patient exposure dose
- E. General public exposure dose
- F. Ethical considerations

IX. Personnel Protection
- A. Sources of exposure
  1. primary beam
  2. secondary radiation
- B. Methods of protection - time, distance, shielding

C. Protective devices
D. Special considerations
1. mobile units
2. fluoroscopic
E. Radiation exposure and monitoring
F. Handling radioactive materials
G. Designing for radiation protection

X. Quality Control
A. Radiographic
B. Fluoroscopic
C. Computerized tomography

XI. Quality Assurance Procedure Regulations/Dose Limits
A. Federal Regulatory Agency
B. California Department of Public Health
C. California Code of Regulations Title 17

Lab:

XII. Laboratory Experiments
A. Radiographic quality control
1. coincidence of x-ray beam and light field
2. kVp accuracy
3. source image receptor distance indicator
4. timer accuracy
5. focal spot accuracy
6. exposure linearity
7. exposure reproducibility
B. Verification of the new mAs formula
C. Reduction of patient exposure
D. Inverse Square Law
E. Occupational exposure reduction
F. Radiation protection
1. time, distance, shielding
2. protective devices: aprons, gloves, thyroid shields, gonadal shielding
3. collimation
G. Automatic exposure control
H. Digital imaging
1. technical factors
2. image artifacts
3. processing algorithms
4. processing histograms
I. Grids
J. Collimation
K. Control of scatter radiation
L. Fluoroscopy
1. operation
2. radiation protection
a. patient
b. occupational
3. image lag
4. quality control
a. technical factors
b. dead man switch

c. collimation
d. gloves, aprons, thyroid shields

Assignment:

Lecture-Related Assignments:
1. Participation in class discussion
2. Weekly chapter reading (10-40 pages/week)
3. Ten Quizzes, one mid-term and one written final

Lab-Related Assignments:
1. Complete weekly lab reports on x-ray production, x-ray emission, technique factor manipulation, image quality and radiation protection.
2. Completion of one ALARA project
3. One final lab exam
4. Weekly chapter assignments

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab reports, weekly chapter assignments	Writing 0 - 10%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

ALARA project	Problem solving 10 - 20%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab final exam	Skill Demonstrations 10 - 20%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes, mid-term, written final	Exams 70 - 80%

Other: Includes any assessment tools that do not logically fit into the above categories.

Participation	Other Category 0 - 5%

Representative Textbooks and Materials:
Radiologic Science for Technologists. 11th ed. Bushong, Stewart. Mosby. 2017
Instructor-prepared material