Course Number and Title: RAD 150 Radiation Protection and Biology

Campus Location:
Georgetown, Wilmington

Effective Date:
2018-51

Prerequisite:
RAD 140

Co-Requisites:
none

Course Credits and Hours:
2.00 credits
2.00 lecture hours/week
0.00 lab hours/week

Course Description:
This course provides an overview of the principles of radiation protection for the radiographer, patients, other personnel, and the public. Radiation effects on biological molecules and organisms and factors affecting biological response are also presented.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
Radiologic Technology Student Handbook Separate instructor handouts and assignments

Schedule Type:
Classroom Course

Disclaimer:
In order to achieve the maximum benefit from this course of instruction, the student is responsible for attending scheduled classes, completing all readings and instructor assignments, and actively participating in class discussion and activities. The instructor will announce the schedule for written tests.

Core Course Performance Objectives (CCPOs):

1. Explain the need for and concept of effective radiation protection. (CCC 1, 4; PGC 3)
2. Discuss radiation quantities and units. (CCC 1, 2, 6; PGC 4)
3. Discuss management of radiation dose for the patient. (CCC 1, 3, 4; PGC 1, 2, 3, 4)
4. Discuss management of radiation dose for imaging personnel. (CCC 1, 3, 4; PGC 1, 2, 3, 4)
5. Identify methods used to detect and measure radiation exposure. (CCC 2, 5, 6; PGC 1, 3, 4)
6. Analyze the principles of radiobiology including molecular, cellular, and tissue response to radiation. (CCC 1, 2, 6; PGC 1, 2, 3, 4)
7. Compare and contrast somatic and genetic whole body responses to radiation. (CCC 1, 6; PGC 3, 4)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Explain the need for and concept of effective radiation protection.
    1. Identify the consequences of ionization in human cells.
    2. Describe the potential for ionizing radiation to cause biologic damage.
    3. Explain the justification and responsibility for imaging procedures.
    4. State the as low as reasonably achievable (ALARA) principle and discuss its significance in diagnostic imaging.
    5. List the different forms of electromagnetic and particulate radiations, and identify those forms that are classified as ionizing radiation.
    6. List and describe three sources of natural background ionizing radiation and six sources of manmade or artificial ionizing radiation.
    7. Discuss the local or global consequences of radiation exposure resulting from accidents in nuclear power plants.
    8. Discuss the responsibility and need for radiation protection in medical imaging.
    9. List the events that occur when x-radiation passes through matter.
    10. Describe and illustrate the x-ray photon interactions that are important in diagnostic radiology.
2. Discuss radiation quantities and units.

1. Identify and explain the radiation quantities and units of measurement for radiation exposure, absorbed dose, dose equivalent, and radioactivity.
2. Formulate dose equivalents when given the quality factor and absorbed dose for different ionizing radiations.
3. State and apply the effective dose limits as defined by the current National Council on Radiation Protection (NCRP) recommendations to include occupational exposure, public exposure, education/training, and embryo/fetus.

3. Discuss management of radiation dose for the patient.
    1. Explain the need for effective communication between the radiographer and the patient.
    2. Explain the significance of adequate immobilization of the patient during a radiographic exposure.
    3. Explain the function of x-ray beam filtration in diagnostic radiology.
    4. State the reason for and types of shielding used during radiologic examinations.
    5. Discuss the need for using appropriate exposure factors for all radiologic procedures.
    6. Explain how dose is affected by the use of various image receptors.
    7. State the reason for reducing the number of repeat images.
    8. Explain how patient exposure can be reduced during fluoroscopic procedures.
    9. List typical effective doses for common radiologic exams.
    10. Compare and contrast typical effective doses of various modalities.
4. Discuss management of radiation dose for imaging personnel.
    1. Identify the source of x-radiation which poses the greatest hazard for the radiographer.
    2. Explain how various methods and techniques which reduce patient exposure during a diagnostic examination will also reduce the radiographer's exposure.
    3. Explain how the cardinal principles of time, distance, and shielding reduce radiation exposure.
    4. Describe the requirements for protective barriers and structural shielding.
    5. State the lead requirements for protective apparel.
    6. Identify persons and/or methods which can provide patient immobilization during a radiologic procedure.
    7. Explain the various methods and devices which can be used to reduce the radiographer's exposure during fluoroscopic and mobile examinations.
5. Identify methods used to detect and measure radiation exposure.
    1. State the conditions that require personnel monitoring.
    2. Identify the appropriate location on the radiographer's body where the personnel monitoring device should be worn.
    3. Compare and contrast the various types of personnel monitors.
    4. State the requirements and function of radiation survey instruments.
6. Analyze the principles of radiobiology to include molecular, cellular, and tissue response to radiation.
    1. Review basic cell biology.
    2. Define *radiosensitivity*, and discuss the factors that govern human radiosensitivity.
    3. State the law of Bergonie and Tribondeau.
    4. Define and state the equation for *Linear Energy Transfer* (LET), *Relative Biologic Effectiveness* (RBE) and *Oxygen Enhancement Ratio* (OER).
    5. Compare and contrast radiation dose/response curves.
    6. Compare and contrast the direct and indirect effects of cellular irradiation.
    7. Describe the various effects that can occur when the deoxyribonucleic acid (DNA) molecule is irradiated.
    8. Describe the target theory of cellular irradiation.
    9. Describe the potential effects to cells resulting from irradiation.
    10. Compare and contrast the radiosensitivity of various cells and tissues.
7. Compare and contrast somatic and genetic whole body response to radiation.
    1. Describe and give examples of stochastic and non-stochastic effects from ionizing radiation.
    2. Describe and differentiate between short term and long term somatic effects.
    3. List and describe the four stages of acute radiation syndrome.
    4. Discuss the three syndromes by which death can occur as a result of acute radiation syndrome.
    5. List the various factors that affect the potential for biological damage.
    6. Explain the genetic effects of radiation.
    7. Explain the doubling dose concept.
    8. Differentiate somatic and genetic responses to radiation.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	**–**	**100**	**=**	**A**
83	**–**	**91**	**=**	**B**
75	**–**	**82**	**=**	**C**
0	**–**	**74**	**=**	**F**

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Final Course Grade:
Calculated using the following weighted average

Evaluation Measure	Percentage of final grade
Exams	90%
Quizzes / Assignments (formative)	10%
TOTAL	100%

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

1. Demonstrate clinical competence by performing a full range of radiologic procedures on all patient populations.
2. Professionally utilize verbal, nonverbal and written communication in patient care intervention and professional relationships.
3. Demonstrate professional growth and development by practicing the profession's code of ethics and comply with the profession's scope of practice.
4. Demonstrate critical thinking and problem solving skills in the performance of radiographic procedures.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.