York Technical College
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Course Title: **Radiation Biology**
Course Prefix/No.: **RAD 201**
Lecture Hours **1.0**
Lab Hours: **3.0**
Credit Hours: **2.0**

Distance Learning Attendance/VA Statement
Textbook Information

COURSE DESCRIPTION

This course is a study of the principles of radiobiology and protection. It emphasizes procedures that keep radiation exposure to patients, personnel, and the population at large to a minimum.

COURSE COMPETENCIES

Upon successful completion of the course, the student should be competent in the following tasks:

Module I
Introduction to Radiation Protection/X-ray Interaction with Matter

- Identify the various sources of natural background ionizing radiation and the different sources of man-made or artificial ionizing radiation.
- Explain the responsibility for radiation protection in the field of radiology.
- Define the terms Primary, Remnant and Attenuation
- Identify the possible interactions which can occur when x-radiation passes through matter.
- Explain the process of photoelectric effect and how it affects human tissue.
- Describe coherent or unmodified scatter and how it affects human tissue.
- Define Compton Effect and specify the events which result in the impingement of scattered radiation upon the patient, the radiographic image receptor and the radiographer.
- Describe Pair Production and when it would occur.

Module II
Radiation Quantities and Units

- Explain the historical evolution of radiation quantities.
- Define the radiation units of Exposure, Absorbed Dose and Equivalent Dose and Effective Dose.
- Identify and explain the Traditional and System International units for radiation exposure, absorbed dose, equivalent dose, and effective dose.
- Explain the importance of linear energy transfer (LET) as it applies to biological damage resulting from irradiation of human tissue.
- Define the term radiation weighting factor and identify this factor for each of the different ionizing radiations.
- State the formula for determining equivalent dose.
- Determine the equivalent dose in terms of traditional and SI units when given their absorbed dose and their radiation weighting factor.
- Determine the effective dose in traditional and SI units when given their absorbed dose, their radiation weighting factor, and tissue weighting factor.

Module III
Dose Limits

- Identify the various agencies in the United States which share responsibility for evaluating the relationship between radiation absorbed dose and subsequent biological effects of radiation exposure.
- Identify the national agency which has the responsibility to enforce established radiation dose-limiting standards.
- Define the term Equivalent Dose Limits (formerly Dose Equivalent).
- Define the term Effective Dose Limits.
- Explain the ALARA Concept.
- State the maximum permissible dose for whole-body occupational exposure.
- Explain current radiation protection philosophy.
- State in terms of traditional units and also in terms of System International Units, the occupational radiation dose limits for combined whole-body exposure and for selective body area exposure.
- State in terms of traditional units and also in terms of System International Units, the various dose limits which apply to the general population.

Module IV
Cell Biology

- Identify and describe important functions of the major classes of organic and inorganic compounds which exist in the cell.
- Describe the molecular structure of DNA and explain how it functions in the cell.
- Assess the various cellular components and identify their physical characteristics and functions. Distinguish between the two types of cell division, mitosis and meiosis and describe each process.

Module V
Radiation Biology

- Define Radiation Biology and explain its relevance to radiation protection.
- Explain how Linear Energy Transfer affects the amount of biological damage produced in living matter by ionizing radiation.
- Examine the three levels of biological damage which can occur in living systems as a result of exposure to ionizing radiation.
- Differentiate between the direct and indirect effects of ionizing radiation upon the molecular structure of living systems.
- Explain the target theory.
- Identify and describe the various short-term and long-term effects of ionizing radiation upon living systems.
- Evaluate the effects of ionizing radiation upon the cell.
- Clarify the Law of Bergonie and Tribondeau.
- Describe the effects of ionizing radiation upon various types of cells.
- Analyze the significance of organic damage resulting from exposure of living systems to ionizing radiation.
- Identify the factors upon which somatic and genetic damage depend.

Module VI
Protection of the Radiographer

- State the reason why a radiation worker should wear a personnel monitoring device.
- Explain the function of a personnel monitoring device.
- Identify the appropriate location on the radiographer's body where the personnel monitoring device should be placed during:
    a) routine radiographic procedures

    b) fluoroscopic procedures
    c) mobile radiographic procedures
- Distinguish the characteristics of a personnel monitoring device.
- Evaluate the various components of the film badge and explain the use of the device as a personnel monitor.
- Describe the pocket ionization chamber and explain the use of the device as a personnel monitor.
- Analyze the thermoluminescent dosimeter and explain the use of the device as a personnel monitor.
- Examine the optically stimulated luminescence dosimeter and explain the use of the device as a personnel monitor.
- Classify the functions of different types of radiation survey instruments.
- Assess gas-filled radiation detection instruments.
- Evaluate the requirements for radiation survey instruments.
- Distinguish the different functions of the following:
    a) ionization chamber-type survey meter
    b) proportional counter
    c) Geiger Mueller Detector
    d) Victoreen Condensor R-Meter
- Explain why occupational exposure of the radiographer must be limited.
- Identify the type of x-radiation which poses the greatest hazard for the radiographer.
- Classify the various methods and techniques which reduce the radiographer's exposure during an exam.
- Describe the construction of protective structural shielding and identify the factors which govern the selection of appropriate construction materials.
- Relate how distance reduces radiation exposure.
- State and explain the inverse square law.
- Distinguish the protective garments which can be worn to reduce whole-body exposure and identify the circumstances in which such garments would be worn.
- Identify persons and methods which can provide patient restraint during a radiologic procedure.
- Describe the various methods and devices which can be used to reduce the radiographer's exposure during a fluoroscopic examination.
- Breakdown the various methods and devices which can be used to reduce the radiographer's exposure during a mobile radiographic examination.

Module VII
Protection of the Patient

- Describe the need for effective communication between the radiographer and the patient.
- Analyze the significance of adequate immobilization of the patient during a radiographic exposure.
- Evaluate the various beam limiting devices.
- Explain the function of x-ray beam filtration in diagnostic radiology.
- State the reason for using gonadal shielding during radiologic examinations and identify the types of shields.
- Analyze the need for using appropriate exposure factors for all radiologic procedures.
- Relate the value of good radiographic processing techniques to reducing radiographic exposure for the patient.
- Evaluate the reasons for reducing the number of repeat radiographs.
- Describe how patient exposure can be reduced during fluoroscopic procedures.

METHODS OF INSTRUCTION

This course is offered in a “hybrid” format. This means that the course is an internet course, but there will be some “on-campus” activities that are required. A CD Rom will accompany the course syllabus and required text(s) that you purchase at the York Tech Bookstore. Quizzes, course calendar, email and bulletin board messages are accessed via the internet in D2L.

Principles will be introduced by PowerPoint presentations and by the instructor through some lecture, viewing video tapes and computer-based lessons, laboratory activities, and demonstration.

COURSE REQUIREMENTS

All students are responsible for attaining competencies through completion of the following course requirements:

-Participating in class/lab activities as scheduled in the calendar
-Reading all assigned materials as listed in syllabus
-Completing all tests as scheduled as listed in the syllabus and scheduled in the calendar
-Completing all CAI assignments
-Completing all videotape viewing assignments
-Participating in all electronic bulletin board discussions/assignments as required.
-Completing one research assignment

ACADEMIC INTEGRITY

The policies stated in the ***YTC Catalog and Handbook*** and ***Radiologic Technology Student Manual*** will be enforced. Any student violating the policy may be subject to academic discipline as stated.

ATTENDANCE

The attendance policy as stated in the ***Radiologic Technology Student Manual*** will be enforced. Absences in excess of 10% of the number of class meetings in a semester may result in a grade of F.

GRADING PROCEDURES

Approximately six unit tests will be given as outlined in the syllabus. These tests will be administered in D2L in the Assessment Center in A Building. CAI grades will also be averaged together at the end of the semester to be given the weight of one unit test. A student that makes a failing grade (below 80) on any unit test will be required to take the comprehensive final exam at the end of the semester and average the grade into their overall grade unless an "A" average is maintained at the time that the final exam is scheduled. The final exam will count 1/3 of the final grade. If student is exempt, final grade will only be used if higher than current average as outlined in the Radiography Student Manual.

GRADE	SCORE
A	93-100
B	86-92
C	80-85
D	70-79
F	BELOW 70

MAKE-UP TESTS

All tests will be administered in the Assessment Center in A Building. Test deadlines will be listed in the online course calendar. Students should report 10 minutes before the scheduled test time. A picture ID is required at the time of the test - NO EXCEPTIONS.

PERFORMANCE OBJECTIVES/MINIMAL STANDARDS

Performance objectives for each topic (unit) are included in this syllabus. A minimum grade of 80% is required to pass the course (See Grading Procedures).

ENTRY-LEVEL SKILLS

A student entering this course must be enrolled in the Radiologic Technology Program as a second year student.

PREREQUISITES

RAD 102, RAD 101, RAD 152, RAD 110, RAD 130, RAD 165, RAD 105, RAD 136, RAD 115, RAD 121, RAD 175, RAD 230, RAD 256, BIO 210, BIO 211

COREQUISITES

RAD 210, RAD 268

Disabilities Statement: Any student who feels s/he may need an accommodation based on the impact of a disability should contact the Special Resources Offices (SR) at 803-327-8007 in the 300 area of Student Services. The SRO coordinates reasonable accommodations for students with documented disabilities.

Fall 2010