



BROWARD COLLEGE COURSE OUTLINE

LAST REVIEW: 2010-2011 **NEXT REVIEW:** 2015-2016 **STATUS:** A

COURSE TITLE: Radiation Biology & Protection

COMMON COURSE NUMBER: RTE 2385

CREDIT HOURS: 2

CONTACT HOUR BREAKDOWN

CLOCK HOURS:

Lecture: 32 Lab:

Clinic: Other:

PREREQUISITE(S): RTE 1523, RTE 1523L, RTE 1824

COREQUISITE(S):

PRE/COREQUISITE(S): RTE 2457, RTE 2457L, RTE 2533, RTE 2834

COURSE DESCRIPTION: Study of the biological effects associated with exposure to ionizing radiation and accepted radiation protection principles and practices. Topics will include: radiation sources, radiation/matter interaction modes, cellular, tissue and total body biological response patterns, radiation detection and measurement, and Federal and State radiation protection guidelines relating to equipment and personnel.

UNIT TITLES

1. Basis for Radiation Protection
2. Radiation and Matter Interactions
3. Cellular Biological Response
4. Tissue Biological Response
5. Principles of Radiation Biology
6. Early Effects of Radiation Exposure
7. Late Effects of Radiation Exposure
8. Radiation Safety/Protection and Health Physics
9. Radiation Protection
Radiographers/Others/Patients

EVALUATION: Assessment includes Assignments, Comprehensive Unit Exams, Comprehensive Final Exam.

Common Course Number: RTE 2385

UNITS

Unit 1 Basis For Radiation Protection

General Outcome:

- 1.0 The student shall be able to accurately describe: somatic and germ cell structure, function, and reproduction, evolution of radiation biology as a discipline, and sources of radiation exposure to the population and occupational workers.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1** Describe the anatomy of a human somatic cell.
- 1.2** Describe the anatomy of a human germ cell.
- 1.3** Describe cell division for somatic and germ cells.
- 1.4** Discuss the history of radiation biology from the discovery of radiation to the present.
- 1.5** Identify radiation exposure sources for the population and occupational employees.

Common Course Number: RTE 2385

UNITS

Unit 2 Radiation & Matter Interactions

General Outcome:

2.0 The student shall be able to accurately describe radiation and matter interaction types occurring with x-ray energies employed for diagnostic imaging.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Describe the unmodified Compton type photon and matter interaction type and illustrate it with a diagram.
- 2.2 Describe the photoelectric type photon and matter interaction type and illustrate it with a diagram.
- 2.3 Describe the modified Compton type photon and matter interaction type and illustrate it with a diagram.
- 2.4 Describe the pair-production type photon and matter interaction type and illustrate it with a diagram.
- 2.5 Describe photodisintegration type photon and matter interactions and identify the parameters for their occurrence.
- 2.6 Describe the radiolysis of water.
- 2.7 Describe *direct* and *indirect* type ionizing events.
- 2.8 Discuss target theory.
- 2.9 Identify factors affecting biological response.

Common Course Number: RTE 2385

UNITS

Unit 3 Cellular Biological Response

General Outcome:

3.0 The student shall be able to accurately describe cellular response patterns resulting from exposure to ionizing radiation.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1** Describe division delay, interphase death and reproductive failure as they relate to irradiated cells.
- 3.2** Interpret mammalian cell radiation exposure survival curves.
- 3.3** Differentiate between shouldered and non-shouldered survival curves.
- 3.4** Define D_0 , D_q , & D_{37} doses and describe how they are employed to describe cellular response to radiation.
- 3.5** Define N number as it relates to survival curve use.
- 3.6** Compare sub-lethal damage (SLD) and potentially lethal damage (PLD) with respect to repair potential.

Common Course Number: RTE 2385

UNITS

Unit 4 Tissue Biological Response

General Outcome:

4.0 The student shall be able to accurately describe: the response of various tissue types to radiation exposure; the factors impacting tissue response; and the methods for measuring amount of radiation damage in tissue.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1** Identify the contribution of Bergoigne & Tribondeau to our knowledge relating to cellular & tissue response to radiation exposure.
- 4.2** Identify three different types of cell populations.
- 4.3** Describe 5 different types of cellular radiation response.
- 4.4** Discuss tissue response to radiation in terms of tissue organization and damage mechanisms.
- 4.5** Describe methods of measuring radiation damage in tissues.
- 4.6** Describe factors that may modify cell and tissue response to radiation.

Common Course Number: RTE 2385

UNITS

Unit 5 Principles of Radiation Biology

General Outcome:

5.0 The student shall be able to describe the pathological changes that occur following irradiation of specific organs.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1** Differentiate between acute (early) and chronic (late) type radiation effects.
- 5.2** Compare healing by regeneration with healing by repair.
- 5.3** Describe the clinical factors influencing radiation response in an organism.
- 5.4** Describe specific organ response to radiation exposure for the following: hemopoietic system, skin, digestive system, reproductive system, cardiovascular system, growing bone and cartilage, liver, respiratory system, urinary system and central nervous system.

Common Course Number: RTE 2385

UNITS

Unit 6 Early Effects of Radiation Exposure

General Outcome:

6.0 The student shall be able to describe the response of an organism to total body radiation exposure.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1** Describe the acute radiation syndrome in mammals, including normal survival times, dose vs. response, and stages of response.
- 6.2** Describe the acute radiation syndrome in humans including bone marrow, gastrointestinal and CNS stages.
- 6.3** Identify the three general effects of radiation exposure of an embryo or fetus.
- 6.4** Discuss the observed effects of radiation on human embryos.
- 6.5** Compare the radiosensitivity of an embryo or fetus to that of the organism at any other period of its development.

Common Course Number: RTE 2385

UNITS

Unit 7 Late Effects of Radiation Exposure

General Outcome:

7.0 The student shall be able to describe late effects related to radiation exposure.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Describe how late effects differ from early effects.
- 7.2 Differentiate between stochastic and deterministic (non-stochastic) effects.
- 7.3 Identify the single, most important, late somatic effect of radiation exposure.
- 7.4 Discuss risk estimates as they apply to carcinogenesis following low-dose radiation exposure.
- 7.5 Identify the methods of studying radiation induced malignancies.
- 7.6 Describe how radiation induces cancer.
- 7.7 Discuss late genetic effects of radiation exposure.
- 7.8 Identify the methods of studying radiation-induced mutations.
- 7.9 Discuss the conclusions that may be drawn from current data regarding mutations and radiation exposure.

Common Course Number: RTE 2385

UNITS

Unit 8 Radiation Safety/Protection & Health Physics

General Outcome:

8.0 The student shall be able to describe the basis of operation and use of various types of radiation detection instruments.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1** Describe the principle of operation for any radiation measurement device.
- 8.2** Differentiate between radiation detection and radiation measurement devices.
- 8.3** Discuss construction and use of the following radiation measurement-detection devices: GM detectors, proportional counters, ionization chambers, scintillation detectors, OSLDs and TLDS.
- 8.4** Identify the units employed to measure radiation exposure, dose and dose equivalence.
- 8.5** Discuss the construction and principle of operation of personnel radiation exposure monitoring/measurement devices.

Common Course Number: RTE 2385

UNITS

Unit 9 Radiation Protection: Radiographers/Others/Patients

General Outcome:

9.0 The student shall be able to describe the principles of radiation protection and enumerate the various State and Federal guidelines relating to specific exposure limitations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1** Discuss **ALARA** as a radiation protection practice.
- 9.2** Differentiate between occupational and non-occupational exposure.
- 9.3** Describe mean marrow dose, genetically significant dose (GSD) and glandular dose.
- 9.4** Identify the three cardinal principles of radiation protection.
- 9.5** Define DL and Effective dose and describe their use.
- 9.6** Identify the recommended annual and cumulative DL exposure levels for occupational workers.
- 9.7** Compare DLs for occupational workers with DLs for the public.
- 9.8** Discuss public law 97-35.
- 9.9** Describe the use of personnel radiation monitors.