BROWARD COMMUNITY COLLEGE
COURSE OUTLINE

LAST REVIEW: 2008-2009 *(i.e. 2003-2004)* **NEXT REVIEW:2013-2014** *(i.e. 2008-2009)* **STATUS: A** *(A, I, D)*

COURSE TITLE: Advanced Radiation Therapy Physics II

COMMON COURSE NUMBER: RAT2618

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN 2 *(per 16 week term)*

CLOCK HOURS: *(Voc. Course ONLY)*

Lecture: *48* Lab:

Clinic: Other:

PREREQISITE(S): **RAT2617**

PRE/COREQUISITE(S): **RAT2241**

COURSE DESCRIPTION *(750 character smaximum)*: Course Description: Advanced physics of ionizing radiation including measurements, dosage, absorption, isodose curves, filters, radioactive materials, treatment planning, properties of radionuclides, radiation safety and health physics.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area
General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area
General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

UNIT TITLES

1. **Photon Beam Geometry**
2. **Photon Beam Dosimetry**
3. **Electron Beam Dosimetry**
4. **Radiation Treatment Planning**
5. **Clinical Treatment Planning Applications**
6. **Radionuclides and their properties**
7. **Brachytherapy and Radioactive Decay**
8. **Radiopharmaceutical Therapy**
9. **Radiation Safety and Health Physics**

ASSESSMENT:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.
Assignments, comprehensive/cumulative unit exams, comprehensive/cumulative final exams

Common Course Number: RAT2618

UNITS

Unit 1 Photon Beam Geometry

General Outcome:

1.0 The student shall: The students should be able to discuss geometric principles involved in Radiation Therapy treatment delivery.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

1.1 Discuss theory of similar triangles and its application to beam divergence.

1.2 Calculate magnification factors on films

1.3 Describe simple beam arrangements

1.4 Define isocentricity and its usefulness in Radiation Therapy.

1.5 Discuss blocking construction and use.

1.6 Calculate surface gap and explain its use.

1.7 Compare photon isodose curves for clinically relevant photon beams

1.8 Describe the general influencing factors that distinguish various isodose curves

Common Course Number: RAT2618

UNITS

Unit 2 Photon Beam Dosimetry

General Outcome:

2.0 The student shall be able to discuss the factors involved in central axis dose distribution of photon beams.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

2.1 Describe the incident or given dose.

2.2 Define backscatter and peak scatter factors.

2.3 Calculate and understand the significance of equivalent square fields.

2.4 Discuss percent depth dose.

2.5 Compare tissue air ratios, tissue phantom ratios, and tissue maximum ratios.

2.6 Explain isodose curve determination.

2.7 Determine internal and external patient factors that influence a beam's distribution and apply isodose correction method

2.8 Describe methods of determining a patient's external contour, definition of internal structures and volumes of interest used in treatment planning

2.9 Define the effect of asymmetric beam collimation on dose distribution

2.10 Compare various methods of tissue compensation and the dosimetric impact

Common Course Number: RAT2618

UNITS

Unit 3 Electron Beam Dosimetry

General Outcome:

3.0 The student shall be able to explain dose distribution and calculation with electron beams.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

3.1 Discuss electron energy distribution and range.

3.2 Compare depth dose profiles to those of photon beams.

3.3 Compare cross plane profiles to those of photon beams.

3.4 Calculate dose from electron beams along beam central axis.

3.5 Discuss why equivalent squares used with photon beams are inappropriate with electron beams

3.6 Describe how inhomogeneities influence electron beam path

3.7 Discuss the considerations of matching an electron field to other adjacent photon or electron fields

3.8 Analyze what shielding materials and what thickness would be needed to attenuate electron beams to appropriate levels in given situations

3.9 Describe and determine the virtual source position

Common Course Number: RAT2618

UNITS

Unit 4 Radiation Treatment Planning

General Outcome:

4.0 The student shall be able to discuss radiation treatment planning techniques and effects of beam weighting, tissue inhomogeneities, beam modifiers, and patient positioning and immobilization.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

4.1 Define Cross Tumor Volume, Clinical Target Volume, and Planning Target Volume.

4.2 List the three aims of treatment planning.

4.3 List alignment and positioning aids.

4.4 Discuss isodose shift correction for oblique beam incidence.

4.5 Describe the treatment planning process including visualization, localization, selection and placement of beam and verification.

4.6 Explain the use of wedges, bolus, and compensators in Radiation Therapy treatments.

4.7 Calculate beam-on time or monitor units to deliver a prescribed dose.

4.8 Determine why specific isodose lines are prescribed for various clinical situations involving critical and non-critical structures

Common Course Number: RAT2618

UNITS

Unit 5 Clinical treatment planning applications

General Outcome:

5.0 The student shall be able to explain the dosimetry techniques employed in the overall treatment of Radiation Therapy patients.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

5.1 Describe the use of reduced and conedown/boost fields.

5.2 Discuss the effects of mixed mode beams and non-coplanar fields.

5.3 Describe conformal therapy and Stereo tactic Radiosurgery.

5.4 Explain the difference between two- and three-dimensional treatment planning.

5.5 Interpret a Dose-Volume Histogram.

5.6 Discuss considerations to be taken when using multileaf collimators

5.7 Review the differences between static and dynamic multileaf collimation systems

5.8 Discuss isocenter localizations for Radiosurgery

5.9 Determine clinical usefulness of various beam types and the clinical implications involved

Common Course Number: RAT2618

UNITS

Unit 6 Radionuclides and their properties

General Outcome:

6.0 The student shall: The student should be able to discuss the use of radioactive materials in the management of disease.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

6.1 Explain the historical background of the discovery and use of radioactive materials.

6.2 Define and compare radioactivity, decay constant, activity and half-life

6.3 Differentiate between artificially produced and naturally occurring therapeutic nuclides

6.4 Examine the radioactive series and the decay schemes for commonly used radiation therapy nuclides

6.5 Differentiate between the commonly used radiation therapy nuclides

6.6 Explain the various forms of radioactive equilibrium

6.7 Calculate rate of decay, change in activity, average half life and attenuation requirements for a given isotope

Common Course Number: RAT2618

UNITS

Unit 7 Brachytherapy and Radioactive Decay

General Outcome:

7.0 The student shall be able to discuss the use of radioactive materials in the management of disease

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

7.1 Explain the historical background of the discovery and use of radioactive materials

7.2 Compare historical implant calculation methods

7.3 Identify appropriate clinical applications for brachytherapy

7.4 Discuss the current use of radioisotopes and list their half life

7.5 Understand the difference between intracavity and interstitial applications

7.6 Discuss the objective of treatment planning for brachytherapy procedures

7.7 Describe common brachytherapy applicators

7.8 Discuss the advantage of afterloading

7.9 Calculate the exposure rate at some distance from a point source

7.10 Summarize dose specifications and prescription techniques for different types of implants

Common Course Number: RAT2618

UNITS

Unit 8 Radiopharmaceutical Therapy

General Outcome:

8.0 The student shall be able to describe radiopharmaceutical patient therapy and associated concerns.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

8.1 Discuss the difference in diagnostic and therapeutic administrations.

8.2 Describe the detectors used.

8.3 Calculate effective half-life based physical and biological half-lives.

8.4 List the factors considered when dosing a patient

8.5 Calculate the dose from beta emitters

8.6 Discuss the use of Iodine-131 and Phosphorous-32

Common Course Number: RAT2618

UNITS

Unit 9 Radiation Safety and Health Physics

General Outcome:

9.0 The student shall be able to discuss the factors of time, distance and shielding as they relate to radiation safety.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

9.1 Discuss the history of radiation safety organizations

9.2 Convert absorbed dose to dose equivalent.

9.3 Describe Maximum Permissible Dose Equivalence

9.4 Describe the biological effects of radiation exposure and associated risks.

9.5 Employ the principles of time, distance, and shielding to protect against excessive exposure

9.6 Name the sources of radiation in the workplace.

9.7 Describe the procedures to follow in the event of a radioactive spill

9.8 Recognize and understand the radiation safety signs used in the workplace