



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

LAST REVIEW: 2008-2009

NEXT REVIEW: 2013-2014

STATUS: A

(i.e. 2003-2004)

(i.e. 2008-2009)

(A, I, D)

COURSE TITLE: Introduction to Radiation Therapy Physics

COMMON COURSE NUMBER: RAT 1614

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN

(per 16 week term)

CLOCK HOURS:

(Voc. Course ONLY)

Lecture: **48**

Lab:

Clinic:

Other:

PREREQUISITE(S): Admission to program

COREQUISITE(S):

PRE/COREQUISITE(S):

COURSE DESCRIPTION: Introduction to the fundamentals of physics involved in the production of x-radiation to include mathematics, mechanics, atomic structure, electricity, magnetism, electromagnetism, x-ray interactions, and the radiographic tube.

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. Mathematical Principles | 8. Magnetism |
| 2. Radiation Concepts | 9. Electromagnetism |
| 3. Units of Measurement | 10. Radiographic Equipment |
| 4. Mechanics | 11. The X-ray Tube |
| 5. The Atom | 12. X-ray Production |
| 6. Electromagnetic Radiation | 13. X-ray Emission |
| 7. Electricity | 14. X-ray Interactions |

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

Assessment includes examinations, assignments, and online posts.



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Common Course Number: RAT 1614

UNITS

Unit 1 Mathematical Principles

General Outcome:

- 1.0 The student shall be able to accurately employ arithmetical and algebraic principles to problems that relate to radiologic physics.

Specific Measurable Learning Outcomes:

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

- 1.1 Perform functions with fractions and decimals.
- 1.2 Perform calculations using scientific notation.
- 1.3 Perform calculations with signed numbers & exponents.
- 1.4 Simplify algebraic expressions.
- 1.5 Differentiate between types of proportion/variation.
- 1.6 Utilize graphic charts to demonstrate relationships between quantities.



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UNITS

Unit 2 Radiation Concepts

General Outcome:

- 2.0 The student shall be able to accurately describe the nature of matter & electromagnetic energy.**

Specific Measurable Learning Outcomes:

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

- 2.1 Differentiate between matter & energy.**
- 2.2 Describe the properties of matter.**
- 2.3 Identify various types of energy.**
- 2.4 Describe the properties of electromagnetic & ionizing radiations.**
- 2.5 Identify sources of natural & man-made ionizing radiation.**
- 2.6 Discuss the discovery of x-rays.**



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UNITS

Unit 3 Units of Measurement

General Outcome:

3.0 The student shall be able to accurately describe the use of various measurement systems & units for radiation physics.

Specific Measurable Learning Outcomes:

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

- 3.1** Discuss the derivation of scientific systems of measurement.
- 3.2** Identify base & derived units of measurement for various quantities.
- 3.4** Utilize applicable units of measurement when solving mathematical problems.
- 3.5** Define radiation exposure, absorbed dose, dose equivalent, & radioactivity.
- 3.6** Convert units from one measurement system to another.
- 3.7** Identify numeric prefixes used to denote magnitude of measurement.



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UNITS

Unit 4 Mechanics

General Outcome:

4.0 The student shall be able to accurately describe the basic principles of mechanics.

Specific Measurable Learning Outcomes:

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

- 4.1 Quantify the speed of light.**
- 4.2 Define & calculate velocity, acceleration, force, weight, momentum, work, & power.**
- 4.3 Discuss the three fundamental laws of motion.**
- 4.4 Define & calculate kinetic & potential energy.**
- 4.5 Describe the various means of thermal energy transfer.**
- 4.6 Describe temperature & identify various scales for its measurement.**



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UNITS

Unit 5 The Atom

General Outcome:

5.0 The student shall be able to accurately describe the structure of matter at the molecular, atomic, & subatomic levels.

Specific Measurable Learning Outcomes:

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

- 5.1** Describe the hierarchy of matter.
- 5.2** Identify the various states of matter.
- 5.3** Discuss the history of investigation into the atom.
- 5.4** Describe the structure, configuration, & properties of atoms.
- 5.5** Identify & describe subatomic particles.
- 5.6** Discuss the combining ability of atoms.
- 5.7** Describe & interpret atomic nomenclature.
- 5.8** Describe the periodic table of the elements.
- 5.9** Describe the process of ionization.
- 5.10** Describe radioactivity & calculate radioactive half-life.
- 5.11** Differentiate between particulate & electromagnetic radiations.



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Unit 6 Electromagnetic Radiation

General Outcome:

6.0 The student shall be able to accurately describe the nature of electromagnetic radiations.

Specific Measurable Learning Outcomes:

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

- 6.1** Identify the properties of photons.
- 6.2** Describe the relationship between frequency & wavelength.
- 6.3** Calculate frequency, wavelength, & energy of electromagnetic radiations.
- 6.4** Discuss the electromagnetic spectrum.
- 6.5** Describe the interactions between electromagnetic radiations & matter.
- 6.6** Describe radiation intensity & employ the inverse square law.
- 6.7** Discuss the quantum theory of electromagnetic radiation.
- 6.8** Discuss the theory of relativity & calculate energy/mass equivalence.



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Unit 7 Electricity

General Outcome:

7.0 The student shall be able to accurately describe the nature of electricity through electrostatics and electrodynamics.

Specific Measurable Learning Outcomes:

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

- 7.1 Explain the atomic theory of electricity.**
- 7.2 Define electrostatics & discuss its fundamental laws.**
- 7.3 Identify methods of electrification.**
- 7.4 Define electrodynamics & discuss its fundamental laws.**
- 7.5 Differentiate between conductors & insulators.**
- 7.6 Describe an electric circuit & differentiate between circuit types.**
- 7.7 Describe voltage, amperage, & resistance.**
- 7.8 Differentiate between types of current.**



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Unit 8 Magnetism

General Outcome:

8.0 The student shall be able to accurately describe the nature of magnetism.

Specific Measurable Learning Outcomes:

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

- 8.1** Explain the atomic nature of magnetism.
- 8.2** Classify materials according to their magnetic properties.
- 8.3** Explain the fundamental laws of magnetism.
- 8.4** Differentiate between types of magnets.
- 8.5** Describe magnetic induction.



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Unit 9 Electromagnetism

General Outcome:

9.0 The student shall be able to accurately describe the principles of electromagnetism.

Specific Measurable Learning Outcomes:

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

- 9.1 Describe the interrelationship between electricity & magnetism.**
- 9.2 Discuss the invention of the battery & explain its use.**
- 9.3 Describe the components & functions of solenoids & electromagnets.**
- 9.4 Describe the laws of electromagnetic induction.**
- 9.5 Differentiate between various electromechanical & electronic devices.**



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Unit 10 Radiographic Equipment

General Outcome:

10.0 The student shall be able to describe the basic components of a radiographic unit.

Specific Measurable Learning Outcomes:

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

- 10.1** Identify types of radiographic equipment.
- 10.2** Describe the components & purpose of an operating console & high voltage generator.
- 10.3** Describe the various electrical circuits found in radiographic equipment.
- 10.4** Discuss the relationship between radiation output & adjustments of mAs & kVp.
- 10.5** Describe the process of voltage rectification.
- 10.6** Differentiate between single-phase, three-phase, & high-frequency power generators.



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Unit 11 The X-ray Tube

General Outcome:

11.0 The student shall be able to describe the components of an x-ray tube & their related functions.

Specific Measurable Learning Outcomes:

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

- 11.1** Discuss the conditions necessary for x-ray production inside a radiographic tube.
- 11.2** Identify & describe the internal & external components of an x-ray tube.
- 11.3** Differentiate between anode types.
- 11.4** Describe the operation of an induction motor.
- 11.5** Explain the anode-heel effects & line-focus principle.
- 11.6** Describe the various methods of heat dissipation inside an x-ray tube.
- 11.7** Identify the causes of x-ray tube failure & discuss preventative measures.



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Unit 12 X-ray Production

General Outcome:

12.0 The student shall be able to accurately describe the production of x-radiation.

Specific Measurable Learning Outcomes:

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

- 12.1** Describe the relationship between electron mass & kinetic energy.
- 12.2** State the % of electron energy converted into photon energy.
- 12.3** Describe characteristic & bremsstrahlung target interactions.
- 12.4** Describe characteristics of an x-ray emission spectrum.
- 12.5** Identify factors affecting the x-ray emission spectrum.



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UNITS

Unit 13 X-ray Emission

General Outcome:

13.0 The student shall be able to accurately describe the process of x-ray emission.

Specific Measurable Learning Outcomes:

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

- 13.1** Describe the factors that affect x-ray quantity & quality.
- 13.2** Calculate the quantity of radiation when mAs, kVp, distance, or filtration are changed.
- 13.3** Explain the determination of half-value layer in terms of radiation quality.
- 13.4** Calculate half-value layer graphically when filtration is changed.
- 13.5** Differentiate between inherent & added filtration.
- 13.6** Calculate x-ray quantity when filtration is changed.



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Unit 14 X-ray Interactions

General Outcome:

14.0 The student shall be able to accurately describe the interactions between x-rays & matter.

Specific Measurable Learning Outcomes:

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

- 14.1** Describe the five basic interactions between x-rays & matter.
- 14.2** Define & discuss differential absorption & attenuation of x-rays in matter.
- 14.3** Describe image density & contrast.
- 14.4** Discuss the properties & use of contrast media.