BROWARD COLLEGE
COURSE OUTLINE

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

COURSE TITLE: Radiographic Physics

COMMON COURSE NUMBER: RTE 1613

CREDIT HOURS: 2 **CONTACT HOUR BREAKDOWN**

CLOCK HOURS: Lecture: 32 Lab:

Clinic: Other:

PREREQISITE(S): RTE 1000, RTE 1111, RTE 1503, RTE 1503L, RTE 1804

COREQUISITE(S):

PRE/COREQUISITE(S): RTE 1418, RTE 1418L, RTE 1513, RTE 1513L, RTE 1814

COURSE DESCRIPTION: Introduction to the fundamentals of physics involved in the operation of radiographic equipment to include: units of measurement, matter, energy, mechanics, magnetism, electrostatics, and electromagnetism.

UNIT TITLES

1. Mathematical and Algebraic Principles
2. Units of Measurement
3. Mechanics
4. Atom (Matter)
5. Electromagnetic Radiation
6. Electrostatics
7. Electrodynamics
8. Magnetism
9. Electromagnetism

EVALUATION: Assessment includes Workbook assignments, comprehensive unit and final exams.

Common Course Number: RTE 1613

UNITS

Unit 1 Mathematical & Algebraic Principles

General Outcome:

1.0 The student shall be able to accurately employ mathematical and algebraic principles to solve problems that relate to radiography.

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

1.1 Solve problems employing fractions and decimals.

1.2 Employ a calculator to solve problems.

1.3 Solve simple algebraic equations.

1.4 Employ ratios and proportions to solve radiography problems.

1.5 Differentiate between direct, inverse, inverse square and direct square relationships.

1.6 Compare area and volume.

1.7 Employ principles of similar triangles to solve radiography problems.

1.8 Employ charts and graphs to solve problems.

1.9 Employ exponential numbers in solving problems.

Common Course Number: RTE 1613

UNITS

Unit 2 Units of Measurement

General Outcome:

2.0 The student shall be able to describe various measurement systems and convert units from one system to another.

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

2.1 Describe the three primary systems of measurement.

2.2 Differentiate between fundamental and derived units of measurement.

2.3 Use appropriate fundamental or derived units when solving problems.

2.4 Convert units from one measurement system to another.

Common Course Number: RTE 1613

UNITS

Unit 3 Mechanics

General Outcome:

3.0 The student shall be able to accurately describe the basic principles of mechanics including: inertia, mass, force, work, energy momentum & power.

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

3.1 Define and describe: mass, inertia and motion.

3.2 Identify the relationship between mass and inertia.

3.3 Define force.

3.4 Describe Newton's laws of motion and force.

3.5 Apply the formula F = ma.

3.6 Discriminate between mass and weight.

3.7 Apply the formula W = mg.

3.8 Describe the relationship between work, force and distance.

3.9 Define energy.

3.10 Describe the various forms of energy.

3.11 Explain the law of conservation of energy and give examples.

3.12 Explain the law of conservation of mass and give examples.

3.13 Discriminate between kinetic and potential energy.

3.14 Discuss the relationship between mass and velocity.

3.15 Define momentum and give examples.

3.16 Define power and compare it to work.

3.17 Employ the power formula to solve problems.

3.18 Describe the relationship between energy, work and power.

Common Course Number: RTE 1613

UNITS

Unit 4 Atom (Matter)

General Outcome:

4.0 The student shall be able to describe the structure of matter at the molecular, atomic and subatomic levels.

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

4.1 Describe Bohr theory of atomic structure.

4.2 Describe the nucleus of an atom and identify its components.

4.3 Identify & describe the orbitals surrounding the nucleus of an atom.

4.4 Calculate maximum number of electrons allowed in any atomic orbital.

4.5 Describe and differentiate between atomic binding and kinetic energy.

4.6 Describe an electrically neutral atom.

4.7 Discuss Z #, A #, and N #, as they relate to the structure of an atom.

4.8 Determine the Z # of an element if the A # and N # are known.

4.9 Define element & discuss relationship of elements on the periodic table.

4.10 Employ periodic table of elements to describe properties of elements.

4.11 Discriminate between isotopes, isotones, isobars and isomers.

4.12 Explain concept of valence number as it relates to the periodic table.

4.13 Define compound and mixture and compare the two.

4.14 Describe the process of ionization and give examples of how materials may be ionized.

4.15 Discuss radioactivity & describe types of radiation emitted.

4.16 Define half-life and work problems relating to half-life.

4.17 Define units of radioactivity and convert among them.

Common Course Number: RTE 1613

UNITS

Unit 5 Electromagnetic Radiation

General Outcome:

5.0 The student shall be able to describe basic principles relating to the properties of electromagnetic radiation including the wave & quantum theories and the electromagnetic spectrum.

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

5.1 Define photon and describe photon velocity, frequency, amplitude and wavelength.

5.2 Describe the relationship between photon velocity, wavelength &.frequency.

5.3 Describe the physical basis for the inverse square law.

5.4 Identify the speed of light in SI & British system units.

5.5 Solve problems relating to the formula $C = \lambda\nu$ or $v = f\lambda$.

5.6 Solve problems using the inverse square law.

5.7 Discuss the radiographically important regions of the electromagnetic spectrum.

5.8 Identify the units of wavelength, frequency and velocity.

5.9 Discuss the wave & particle (duality) modes of electromagnetic radiation.

5.10 Differentiate between radiation transmission, absorption, and attenuation.

5.11 Identify the energy equivalence of a single electron.

5.12 Discuss the formula $E_{eV} = hf$.

Common Course Number: RTE 1613

UNITS

Unit 6 Electrostatics

General Outcome:

6.0 The student shall be able to describe the basic principles of electrostatics, including: charges, electric fields, charge distribution and transfer and detection instruments.

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

6.1 Define electrostatics.

6.2 Explain the laws of electrostatics.

6.3 Describe methods of electrification.

6.4 Describe static discharge and give examples.

6.5 Identify the unit of electric charge.

6.6 Describe the electric field surrounding a charged object.

6.7 Identify symbols relating to electric charge.

6.8 Describe an electroscope, discuss its' operation and explain its' uses.

Common Course Number: RTE 1613

UNITS

Unit 7 Electrodynamics

General Outcome:

7.0 The student shall be able to describe the basic principles of electrodynamics including: direct and alternating current, simple and complex circuits, Ohm's law, electrical current and voltage measuring devices, and electrical safety.

Specific Measurable Learning Outcomes:

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

7.1 Define electrodynamics and compare to electrostatics.

7.2 Describe a simple electrical circuit.

7.3 Describe potential difference and electromotive force.

7.4 Identify the unit of electromotive force (emf).

7.5 Identify the unit of quantity of electricity.

7.6 Discriminate between Amperes and Coulombs.

7.7 Describe electrical resistance & the unit used to measure it.

7.8 Describe the essential part of a simple resistance circuit.

7.9 Identify symbols used to represent electrical components in a circuit.

7.10 Describe electrical polarity and give examples.

7.11 Employ Ohm's law to solve electrical circuit problems.

7.12 Differentiate between DC & AC type circuits.

7.13 Define voltage, IR drop and voltage drop.

7.14 Solve problems relating to electrical power using the formula P = VI.

7.15 Identify and describe AC & DC waveforms.

7.16 Describe characteristics of pulsating and constant potential AC & DC.

7.17 Define and describe the terms frequency and cycle as they relate to AC.

7.18 Compare effective and maximum (peak) current or voltage.

7.19 Describe and calculate RMS current or voltage.

7.20 Define and describe: inductance, inductive reactance, capacitive reactance and impedance.

7.21 Compare single and multiple phase current waveforms.

7.22 Identify several advantages of multiple phase current supply.

7.23 Employ the power loss formula.

7.24 Describe voltmeters and their appropriate connection in a circuit.

7.25 Describe ammeters and their appropriate connection in a circuit.

7.26 Explain how circuit breakers and fuses act as protective devices.

7.27 Describe the concept of electrical grounding and give examples.

7.28 Identify dangers associated with improper electrical grounding.

Common Course Number: RTE 1613

UNITS

Unit 8 Magnetism

General Outcome:

8.0 The student shall be able to describe the fundamental principles underlying magnetism, including: magnetic poles, magnetic fields, magnetic induction, domain theory and magnetic properties of carious materials.

Specific Measurable Learning Outcomes:

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

8.1 Define magnetism.

8.2 Describe the different types of magnets.

8.3 Explain the laws of magnetism and give examples to demonstrate each.

8.4 Employ the law of magnetic forces to solve problems.

8.5 Describe what is meant by magnetic poles.

8.6 Determine the polarity of any magnet.

8.7 Describe and demonstrate the magnetic field of a bar magnet.

8.8 Describe magnetic induction, including various methods employed.

8.9 Describe the domain theory of magnetism.

8.10 Categorize materials according to their magnetic properties.

8.11 Discuss uses of magnetism in the radiology.

Common Course Number: RTE 1613

UNITS

Unit 9 Electromagnetism

General Outcome:

9.0 The student shall be able to explain the fundamental principles of electromagnetism and describe the applications of those principles in the operation of generators, motors and transformers.

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

9.1 Discuss the relationship between electricity and magnetism.

9.2 Employ the right-hand thumb rule to determine magnetic field development.

9.3 Describe the process of electromagnetic induction of current flow.

9.4 Describe the conditions necessary for self-induction.

9.5 Describe and compare a: helix, solenoid, and electromagnet.

9.6 Employ the right-hand rule to determine the direction of current flow in a moving conductor.

9.7 Describe back-emf and give examples of its production.

9.8 Describe the operation of DC & AC generators.

9.9 Identify the components of DC & AC generators.

9.10 Differentiate between slip rings and split ring commutators.

9.11 Relate armature position in a generator with output waveform position.

9.12 Employ the left-hand rule to determine the direction of movement of an armature in a motor.

9.13 Diagram the output waveforms of DC & AC generator.

9.14 Describe the different type of electrical motors.

9.15 Describe the operation of analog type meters.

9.16 Describe the operation of a transformer.

9.17 Identify different types of transformers and discuss their efficiency.

9.18 Employ the transformer law to solve transformer problems.

9.19 Identify sources of energy loss in a transformer and methods of reducing such losses.

9.20 Differentiate between auto transformers and fixed-ratio transformers.

9.21 Describe methods of controlling voltage and amperage in a circuit.

9.22 Describe the relationship between voltage and amperage input and output in a transformer.

9.23 Describe the primary purpose of a transformer.

9.24 Describe AC rectification methods.

9.25 Discuss the operation of rectification devices, including NP diodes.