COURSE INFORMATION

Course Prefix/No: **RAD 121**
Course Title: **RADIOGRAPHIC PHYSICS**
Credit Hours: 4.0
Lecture Hours: 4.0
Lab Hours: 0.0

Distance Learning Attendance/VA Statement
Textbook Information

COURSE DESCRIPTION

This course introduces the principles of radiographic physics, incorporating theory and application of basic principles underlying the operation and maintenance of x-ray equipment.

COURSE COMPETENCIES

Upon successful completion of this course, the student should be able to demonstrate basic knowledge of the following:

- Discuss the basic principles of electrostatics
- Discuss the basic principles of electrodynamics
- Describe the basic principles of magnetism
- Describe the basic principles of electromagnetism
- Describe the basic features and the operation of simple motors and generators
- Demonstrate an understanding of the production and control of high voltage and the regulation of current
- Explain rectification of alternating current
- Discuss the construction and operation of x-ray tubes and rectifiers
- Demonstrate an understanding of the x-ray circuit
- Describe three-phase generation of x-rays
- Describe x-ray production
- Recognize the physical characteristics of the x-ray beam

Module I: Electrostatics/Electrodynamics

-Define "electrostatics"
-List the laws of electrostatics
-Define "static discharge"
-List the three methods of electrification
-Describe the value of the electroscope in radiology and how it works.
-Define "electrodynamics"
-Define "electric circuit"
-Describe potential difference and give the other names used to describe it
-Describe possible sources of electricity
-Define "current" and "resistance"
-List and describe the essential factors in a simple circuit
-List the factors which affect the resistance of a conductor
-Describe Ohm's Law
-Identify the differences between a series circuit and a parallel circuit.
-Given series and parallel circuit problems, calculate potential difference, current and resistance as required.
-Describe a voltmeter, ammeter.

-Define "voltage drop"
-Define the "power rule"
-Given a circuit problem, calculate the power used or lost as required.
-Describe an electric capacitor.

Module II: Magnetism, electromagnetism, motors, and generators

-Define "magnetism"
-Discriminate between the types of magnets
-State the laws of magnetism
-Describe the magnetic properties of magnets
-Define the domain theory of magnetism
-Define "magnetic flux"
-List the characteristics of the lines of force
-Explain "magnetic induction"
-Define and discriminate between magnetic permeability and retentivity
-List the magnetic classifications of matter.
-Define "electromagnetism"
-Describe the relationship between electricity and magnetism
-Describe the left thumb rule
-Define and discriminate between helix, solenoid and an electromagnet
-Define "electromagnetic induction"
-List the factors that affect the magnitude of an induced emf
-Describe the left hand rule
-Define "self-induction"
-Define "mutual induction"
-List examples of where electromagnets may be used in x-ray equipment
-Describe "back emf"
-Define "electric generator" or "dynamo"
-Describe the function of the electromagnet in a generator
-Define "armature", and describe its function
-Identify possible power sources that can supply a generator
-Define "slip ring" and "split ring commutator" and describe the function of each.
-Show by diagram, the different positions of the armature in a magnet as they relate to the sine wave of current produced by a DC and AC generator.
-Describe the differences between DC and AC current
-Define "inductive and capacitive reactance" and "impedance" as applied to AC circuits
-Describe the main differences between AC and DC generators.
-Define "motor"
-Describe how an electromagnet applies to motor operation
-Describe the "right hand rule"
-Describe the essential parts of a motor
-Identify the different types of motors
-Identify locations of motors that may be found in x-ray equipment.

Module III: Transformers and the Production/Control of Hi Voltage/Current

-Define "transformer"
-Describe the principle of operation of a transformer
-Identify and be able to draw the different types of transformers
-Identify forms of energy loss
-Calculate the voltage, current or turns ratio of a transformer when given a transformer problem to solve.
-Calculate the efficiency of a given transformer
-Define "autotransformer"

-Describe the difference between the construction and application of a transformer and an autotransformer
-Describe what lamination does for a transformer
-Define "transformer loss", "copper losses", "current losses", "hysteresis losses".
-Describe how to minimize the above
-Define and identify a diagram of a "rheostat"
-Define and identify a diagram of a "choke coil"
-Define and identify a diagram of a "saturable reactor"

Module IV: X-Ray Tubes and Rectifiers

-Define "rectification"
-Describe the direction of current flow in a thermionic tube
-Describe the methods of rectifying AC circuit
-Define the reasons for the necessity of rectifying AC current
-Describe the differences between self, half and full wave rectification
-Identify disadvantages of self-rectification
-Identify the proper configuration of valve tube rectification for full wave rectification
-Describe a method of detecting the malfunction of the rectifier in an x-ray circuit.
-Calculate the number of dots on a spinning top test that should be counted at various exposure times when various types of rectifiers are operating properly.
-Define "thermionic diode"
-Describe the main features of a thermionic diode tube
-Compare the structural details of radiographic, therapy and valve tubes.
-Define "space charge compensation"
-Describe types of tube cooling
-Define the major purpose of tube cooling
-Describe x-ray tube housing
-Identify factors governing tube life
-Describe the purpose of a tube rating chart
-Determine appropriate exposure factors given a tube rating chart
-Define and calculate "Heat Units" for single and three phase x-ray generators
-Outline steps to extend tube life
-Describe a solid state rectifier
-Discuss advantages of the solid state rectifier over the valve tube rectifier.
-Describe x-ray production within the tube.
-Identify physical characteristics of the x-ray beam.

Module V: X-Ray Circuit

-Describe where each of the above components are located in the physical facility (ie: control panel, x-ray room etc.)
-Identify each of the controls on the x-ray control panel and describe the function of each.
-Discuss the three different types of three-phase generation
-Describe the difference in the physical configuration of the three phase transformer and rectifiers.
-Demonstrate (by diagram of sine wave) the differences between the three types of three-phase generation and high frequency generation.
-List the pulses/cycle and pulses/second of each of the above.
-State the percent ripple of each of the above.

METHODS OF INSTRUCTION

This course is offered in a “hybrid” format. This means that the course has lectures delivered on CD Rom, but there will be “on-campus” activities that are required. A CD Rom will accompany the course syllabus and required text(s) that students purchase at the York Technical College bookstore. Additional methods of

instruction include CAI (computer-assisted instruction) and laboratory experience. Quizzes, course calendar, e-mail, and bulletin board messages are accessed via the internet and Web CT.

COURSE REQUIREMENTS

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

- Participating in class and laboratory activities as scheduled in the calendar
- Completing CAI assignments
- Completing assigned presentations/projects
- Reading all assigned materials as listed in syllabus addendum
- Completing all tests as scheduled as listed in the syllabus addendum and scheduled in the course calendar
- Participating in all electronic bulletin board discussions/assignments as required

ACADEMIC INTEGRITY

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

ATTENDANCE POLICY

The attendance policy as stated in the ***YTC Student Catalog*** and ***Radiologic Technology Student Policy Manual*** will be enforced. Absences in excess of 10% of the number of class meetings in a semester will result in a grade of F and removal from the program.

GRADING PROCEDURES

Approximately six unit tests will be given. These tests will be administered on Web CT in the Assessment Center in B building. CAI grades will be averaged together at the end of the semester to be given the weight of one unit test. All students are required to sit for a comprehensive final examination. Any student scoring below 80 on any unit test (unless an "A" average is maintained) will be required to take the comprehensive final exam at the end of the semester and it will be averaged in their course grade. The final exam will count 1/3 of the final grade. If the student is exempt, final exam grade will only be used if higher than current average as outlined in the Radiography Student Manual.

6 Unit tests and 1 project = 66% of the final grade, (Presentation/Project will count as a unit test)

Final exam = 33% of the final grade as required

The following grading scale applies:

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

MAKE-UP TESTS

All tests for this course will be taken in the Assessment Center located in B Building. Test deadlines will be listed in the online course calendar. Students should report 10 minutes before scheduled test time. A picture ID is required at the time of the test - **no exceptions**.

PERFORMANCE OBJECTIVES/MINIMAL STANDARDS

Performance objectives for each module are included in the syllabus. A minimum grade of 80% is required to successfully complete the course (See Grading Procedures in the Radiography Student Manual).

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 176

CO-REQUISITES

RAD 230, RAD 256

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

Effective: SU2007