**ESSEX COUNTY COLLEGE**

**Nursing and Allied Health Division**

**RTC 104 – Radiation Protection**

**Course Outline**

**Course Number & Name:**  RTC 104 Radiation Protection

**Credit Hours:** 2.0 **Contact Hours:**  2.0 **Lecture:** 2.0 **Lab:**  N/A **Other:**  N/A

**Prerequisites**:  None

**Co-requisites:** RTC 100, RTC 101, RTC 102 and RTC 103 **Concurrent Courses:** None

**Course Outline Revision Date:**  Fall 2011

**Course Description**: This course develops students’ knowledge of safety standards in operating radiation equipment.  Students learn the principles of radiation protection and practical skills to ensure maximum safety for both patients and the equipment operator. Lecture is supplemented with demonstrations and opportunities for students to practice the skills in the radiographic room. Critiques of radiographic films are conducted in the classroom/laboratory.

**Course Goals:** Upon successful completion of this course, students should be able to do the following:

1. discuss the discovery and properties of x-radiation;

2. demonstrate knowledge of the dangers of x-radiation;

3. identify methods of measuring and reducing doses of x-radiation; and

4. discuss and/or demonstrate industry standards for radiation protection and monitoring.

**Measurable Course Performance Objectives (MPOs)**: Upon successful completion of this course, students should specifically be able to do the following:

1. Discuss the discovery and properties of x-radiation:

1.1 *identify x-radiation on the electromagnetic spectrum in relation to wavelength and frequency*;

1.2 *differentiate between non-ionizing and ionizing radiation;*

1.3 *explain the difference between wave and particulate radiation;*

1.4 *identify sources of radiation both naturally occurring and manmade;*

1.5 *demonstrate the properties of beam characterizations;*

1.6 *define and contrast the five different types of radiation interaction;* and

1.7 *explain the accidental discovery of x-radiation*

**Measurable Course Performance Objectives (MPOs)** (continued):

2. Demonstrate knowledge of the dangers of x-radiation:

2.1 *identify the dangers of ionizing radiation to cells and organ tissue;*

2.2 *describe the damaging effects of x-radiation;* and

2.3 *determine the biological effects radiation has on living tissues and cells*

3. Identify methods of measuring and reducing doses of x-radiation:

3.1 *describe effective methods of reducing radiation exposure;*

3.2 *identify the four measures of radiation units;*

3.3 *differentiate between effective dose and equivalent dose;*

3.4 *discuss the reasons for increased medical radiation doses;*

3.5 *define mAs and kVp;* and

3.6 *discuss radiation measurements and quantities*

4. Discuss and/or demonstrate industry standards for radiation protection and monitoring:

4.1 *demonstrate proper placement of personnel radiation dosimeters;*

4.2 *identify components of a radiation exposure report;*

4.3 *determine proper reporting requirements of radiation reports;*

4.4 *describe the types of personnel radiation detectors available and list the advantages and disadvantages of each;*

4.5 *identify the active portion of each personnel detector;* and

4.6 *explain the requirements of survey instruments and types available*

**Methods of Instruction**: Instruction will consist of lectures, class discussions/participation, PowerPoint slide shows, class activities, radiograph review, and laboratory activities.

**Outcomes Assessment:** Test and exam questions are blueprinted to the course objectives which are based on the minimum standards required by the American Radiology of Radiologic Technologists (ARRT) and the American Society of Radiologic Technologists (ASRT) suggested course curriculum. Note: Tests and exams are primarily structured in multiple-choice formats in conjunction with the ARRT exam. Also, checklist rubrics may be used to evaluate students for the level of mastery of course objectives.

**Course Requirements:** All students are required to:

1. Read the textbook and do the suggested homework problems in a timely manner.

2. Attend and be an active participant in all classes.

3. Take tests/exams in class and adhere to the test/exam schedule.

4. Turn off cell phones while in class.

5. Remain in the classroom during the entire class period.

6. Earn a “C” or better to pass this class. Students who do not earn a “C” or better will be required to withdraw from the Radiography Program as per program policy.

**Methods of Evaluation:** Final course grades will be computed as follows:

**% of**

**Grading Components final course grade**

* 4 or more Tests (dates specified by the instructor)  50%

Tests will be administered regularly throughout the semester to test student mastery of course objectives.

* **Midterm Exam** (date specified by the instructor)  **20%**

The midterm exam format may consist of multiple choice, short answer, and true/false questions and will include material from the readings, homework, lectures, and labs covered throughout the semester. The midterm exam will test the students’ mastery of course objectives and synthesis of course material covered from the beginning through the first half of the semester.

* **Final Exam** **30%**

The final exam format may consist of multiple choice, short answer, and true/false questions and will include material from the readings, homework, lectures, and labs covered throughout the semester. The final exam will test the students’ mastery of course objectives and synthesis of course material covered throughout the entire semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

* plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
* cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
* interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
* fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.

**Course Content Outline:** based on the texts **Radiation Protection in Medical Radiography**, 6th edition, by Mary Alice Statkiewiez Sherer; ISBN #: 978-0-323-0661; the **Radiation Protection in Medical Radiography Workbook**, 6th edition, by Mary Alice Stakiewiez Sherer; and **Radiologic Science for Technologists**, 9th edition, by Stewart Carlyle Bushong; ISBN #: 978-0-323-04838-5

**Week Topics covered**

1 – 3 Sherer Chapter 1

Introduction to radiation protection, important radiation protection measures

ALARA

Time – distance – shielding – benefit outweighing the risk, BERT

Electromagnetic radiation, Electromagnetic spectrum – frequency & wavelength

Non-ionizing radiation, x-radiation, ionizing radiation, particulate radiation – alpha, beta, neutrons, protons

Radiation measurements, RAD/Gray, REM/Sievert, Roentgen, Curie/Becquerel

Equivalent dose, radiation quantity, calculation of effective dose

Biologic damage, cellular damage – genetic, somatic

Organ damage

**Sources of Radiation**

Natural radiation/background radiation; terrestrial radiation – radon, radium, thoron; cosmic radiation; manmade radiation – consumer products, air travel, nuclear fuel, atmospheric fallout from nuclear weapon testing, nuclear power plants, medical radiation

Data on medical radiation exposure

4 **Test 1**

kVp and mAs

Voltage versus current

Calculation and patient dose

5 – 7 **Test 2**

Sherer Chapter 2 supplemented with Bushong

Beam characteristics – attenuation, absorption, primary radiation, secondary radiation, remnant radiation, scatter radiation/radiographic fog

Probability of x-ray interaction with matter

Coherent scatter – alternative names, interaction process, significance

Compton scatter – alternative names, interaction process, significance

Photoelctric absorption – interaction process, significance, probability of occurrence

Pair production – interaction process, significance

Photodisintegration – interaction process, significance

**Midterm Exam**

8 – 10 **Test 3**

Sherer Chapter 3

**Radiation Quantities and Units**

Historical evolution, discovery of x-rays – Wilhelm Conrad Roentgen, Crookes tube

Reports of injury – somatic effects, genetic effects, occupational exposure, general population exposure, reducing exposure

Biologic effects – short-term early somatic effects, long-term late somatic effects, genetic effects/heritable, stochastic/probabilistic, non-stochastic/deterministic

Quantities and units – early measurements, current measurements

Radiation quantities; exposure – definition, measurement of; absorbed dose – and Z number, SI unit; equivalent dose – in relation to radiation weighting factor, mathematical calculation; effective dose – in relation to radiation weighting factor, mathematical calculation; linear energy transfer – high LET, low LET; collective effective dose

11 – 14 **Test 4**

**Radiation Monitoring**

Personnel monitoring requirements, proper placement of monitors – with a lead apron, without a lead apron, fetal monitors, extremities

Exposure records – report retention, information contained in the report

Types of personnel monitors – control badge; film badge – advantages, disadvantages, method of recording exposure; optically stimulated luminescence dosimeter – advantages, disadvantages, method of recording exposure; pocket ionization chamber – advantages, disadvantages, method of recording exposure; thermoluminescent dosimeter – advantages, disadvantages, method of recording exposure

Survey instruments, instruments for area monitoring, requirements for area monitoring – advantages, disadvantages

Types of instruments – ionization chamber/cutie pie, Geiger-Muller detector

Review for Final Exam

15 **Final Exam**