

A POLYTECHNIC INSTITUTION

School of Health Sciences

Program: Medical Radiography

Option:

**MRAD 2222**  
**Image Recording, Equipment and Quality Control 2****Start Date:** September, 2005**End Date:****Total Hours:** 14   **Total Weeks:** 7**Term/Level:** 2**Course Credits:****Hours/Week:** 2   **Lecture:** 2   **Lab:****Shop:****Seminar:****Other:****Prerequisites****Course No.**   **Course Name**MRAD 1101   Image Recording, Equipment and  
Quality Control 1**MRAD 2222 is a Prerequisite for:****Course No.**   **Course Name**MRAD 3322   Image Recording, Equipment and  
Quality Control 3**Course Description**

Through lectures and readings, this course will deal with x-ray tubes and generators as well as fluoroscopic principles and equipment. In particular, x-ray tubes will be described in terms of recent technical advances, followed by a description of x-ray exposure timers and a detailed discussion of the principles and instrumentation for fluoroscopy.

**Detailed Course Description**

The goals of this course are to provide students with knowledge of the fundamental principles of x-ray tubes, generators and timing circuits needed for effective utilization and operation of radiographic equipment and to describe the characteristic features of fluoroscopic equipment.

**Evaluation**

Final Examination	50%
Midterm Examination	30%
Report	10%
Quiz (1)	10%
<b>TOTAL</b>	<b>100%</b>

*60% FS*

- A grade of 65% is required to pass this course.
- Both examinations are of the multiple choice format.
- The format of the report will be discussed in class.

**Course Learning Outcomes/Competencies**

Upon successful completion, the student will be able to:

1. describe the major components of the x-ray generator and its associated circuitry.
2. differentiate between different types of x-ray tubes.
3. explain how x-ray exposure timers work.
4. describe the principles of fluoroscopy and outline the characteristic features of fluoroscopic equipment.
5. explain the concepts of digital image processing as applied specifically to digital medical imaging

**Course Learning Outcomes/Competencies (cont'd.)**

On successful completion of these outcomes, students will be prepared to meet the requirements of the following competencies as listed in the CAMRT "Competency Profile" for Radiography.

**A2 Prepare the room for fluoroscopic imaging procedures.**

- A2.5 Obtain accessory imaging equipment.
- A2.6 Select the correct image receptor system (conventional vs digital).

**A4 Position the patient.**

- A4.10 Collimate to the area of interest only to maximize image quality.

**A5 Operate imaging equipment.**

- A5.1 Select and use apparatus and accessory equipment safely.
- A5.2 Perform the initial set-up of the equipment.
- A5.3 Select the computer protocol for digital imaging.
- A5.4 Select the source-image distance.
- A5.5 Use radiographic markers.
- A5.6 Select the fastest film/screen/grid combination for optimum image quality appropriate for the examination.
- A5.7 Select appropriate kV, mA and time or automatic exposure control parameters.
- A5.8 Modify exposure factors on the basis of the patient's age, physique and condition.
- A5.9 Take the exposure.

**A6 Process images.**

- A6.1 Imprint ID information.
- A6.2 Manipulate computer data, if applicable.
- A6.3 Unload the film cassette/magazine and process exposed film.
- A6.4 Reload the cassette/magazine.

**A7 Critique images and implement corrective measures.**

- A7.8 Manipulate the digital image.

**D2 Monitor radiographic/fluoroscopic equipment.**

- D2.1 Perform visual inspection of cables and equipment.
- D2.2 Recognize improper functioning of imaging and accessory equipment/devices.
- D2.3 Ensure the proper operation of safety devices.
- D2.4 Record and report equipment malfunctions to the appropriate person.

**D3 Perform quality control tasks.**

- D3.1 Perform quality control tests on imaging and accessory equipment.
- D3.2 Use test results to initiate corrective action.
- D3.3 Record and maintain records/charts of all tests.
- D3.4 Test lead aprons and shields.
- D3.5 Report test results to appropriate person.
- D3.6 Conduct repeat/reject analysis.

**Verification**

I verify that the content of this course outline is current.

Euclid Seear  
Authoring Instructor

August 2005  
Date

I verify that this course outline has been reviewed.

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Program Head/Chief Instructor

Date

I verify that this course outline complies with BCIT policy.

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Dean/Associate Dean

Date

Note: Should changes be required to the content of this course outline, students will be given reasonable notice.

**Instructor(s)**

Euclid Seeram, RTR, BSc, MSc., FCAMRT      Office Location: SW3 4084      Office Phone: 8231  
Office Hrs.: As posted      E-mail Address: euclid\_seeram@bcit.ca

**Learning Resources**

*Required:*

- Seeram, E., *Rad Tech's Guide to Equipment Operation and Maintenance*, Blackwell Science, Inc. 2002

*Recommended:*

- Bushong, S., *Radiologic Science for Technologists*. Mosby-Year Book, Inc. 8th Edition, 2004.

**Information for Students**

*(Information below can be adapted and supplemented as necessary.)*

**Assignments:** Assignments must be done on an individual basis unless otherwise specified by the instructor.

**Makeup Tests, Exams or Quizzes:** There will be **no** makeup tests, exams or quizzes. If you miss a test, exam or quiz, you will receive zero marks. Exceptions may be made for **documented** medical reasons or extenuating circumstances. In such a case, it is the responsibility of the student to inform the instructor **immediately**.

**Ethics:** BCIT assumes that all students attending the Institute will follow a high standard of ethics. Incidents of cheating or plagiarism may, therefore, result in a grade of zero for the assignment, quiz, test, exam, or project for all parties involved and/or expulsion from the course.

**Attendance:** The attendance policy as outlined in the current BCIT Calendar will be enforced. Attendance will be taken at the beginning of each session. Students not present at that time will be recorded as absent.

**Illness:** A doctor's note is required for any illness causing you to miss assignments, quizzes, tests, projects, or exam. At the discretion of the instructor, you may complete the work missed or have the work prorated.

**Course Outline Changes:** The material or schedule specified in this course outline may be changed by the instructor. If changes are required, they will be announced in class.

### Assignment Details

#### Project Description

(10%)

This project requires that you do a literature search for an article relating to any of the topics or subtopics cover in this course MRAD 2222. Only articles from Journals will be accepted.

The following is a guide to help you complete this project:

1. Visit the BCIT or Hospital Library
2. Locate an article from a Radiologic Technology/Radiology Journal. Examples of journals include :
  - *Radiology*
  - *Radiographics*
  - *Applied Radiology*
  - *Diagnostic Imaging*
  - *Journal of the Canadian Association of Radiologists*
  - *Seminars in Radiologic Technology*
3. Remember that the article must deal with a topic on equipment or Quality Control
4. Make one copy of the article if necessary. You may want to submit the article with your summary
5. Write a summary of the article based on the following format :
  - Title of the Article
  - Author(s)
  - Journal and Date of Publication
  - Purpose of the Paper (or Study if one was done)
  - Summary of major points presented in the paper
6. Include a copy of the paper if you wish (not mandatory)

**Hand this in to Euclid during the last week of class or earlier**

**Schedule**

Week	Material Covered	Reference/Reading
1 and 2 (Both Groups)	<p><b>Course Introduction: Welcome and Discussion of the Course Outline</b></p> <ul style="list-style-type: none"> <li>• Learning Outcomes</li> <li>• References</li> <li>• Evaluation</li> </ul> <p><b>The X-Ray Generator &amp; Associated Circuitry</b></p> <ul style="list-style-type: none"> <li>• What is an X-Ray Generator?</li> <li>• Purpose of X-Ray Generators</li> <li>• Types of Generators</li> <li>• Associated Circuitry <ul style="list-style-type: none"> <li>- X-Ray Tube</li> <li>- X-Ray Exposure Timers</li> </ul> </li> </ul>	<p>Seeram, E. Course Outline</p> <p>Seeram, Chapter 3 Seeram, Chapter 6 Bushong, Chapter 8 <ul style="list-style-type: none"> <li>• Page 126</li> </ul> </p> <p>Bushong, Chapter 8 <ul style="list-style-type: none"> <li>• Pages 115-117</li> </ul> </p>
3 and 4 (Both Groups)	<p><b>X-Ray Tubes</b></p> <ul style="list-style-type: none"> <li>• Types of X-Ray Tubes</li> <li>• The Rotating Anode X-Ray Tube</li> <li>• Recent Developments in X-Ray Tubes</li> <li>• Specialized X-Ray Tubes <ul style="list-style-type: none"> <li>- Grid-Controlled X-Ray Tube</li> <li>- Mammography X-Ray Tube</li> </ul> </li> </ul>	<p>Seeram, Chapter 4 Bushong, Chapter 9</p>

Week	Material Covered	Reference/Reading
<p>5 and 6 Groups Alternating</p> <p><b>1.BD at BCIT from October 3-Nov 4<sup>th</sup></b></p> <p><b>2. AC at BCIT from Nov 7<sup>th</sup> -Dec 9<sup>th</sup></b></p>	<p><b>Digital Imaging Concepts</b></p> <ul style="list-style-type: none"> <li>• Film-Based Imaging: Limitation</li> <li>• What is Digital Imaging?</li> <li>• A Rationale for Understanding Digital Image Processing in Radiology</li> <li>• A Generic Digital Image Processing System for Radiology</li> <li>• Image Representation</li> <li>• Digital Image Processing Fundamentals <ul style="list-style-type: none"> <li>- Image Digitization</li> <li>- Digital Image Quality</li> <li>- Classes of Digital Image Processing <ul style="list-style-type: none"> <li>*Widnowing</li> </ul> </li> <li>- Advantages of Digital Image Processing</li> </ul> </li> <li>• Anatomy of a Digital Image</li> <li>• Digital Image Processing Techniques: General Concepts <ul style="list-style-type: none"> <li>- Why Digital Image Processing?</li> <li>- Image Processing Operations</li> <li>- Image Processing Hardware</li> <li>- Image Processing in (CR)</li> </ul> </li> </ul>	<p>Seeram, E.: Digital Image Processing. <i>Radiologic Technology</i>. 2004</p> <p>Bushong, Chapter 27</p> <ul style="list-style-type: none"> <li>• Pages 396-401</li> </ul>
<p>7 (1 hour)</p>	<p><b>MID-TERM EXAMINATION</b></p> <p>The exam is based on all materials covered up to Week 3 (first half of topics listed above) and will be held on the first hour of class.</p>	<p>Seeram, E.</p>
<p>7 (1 hour)</p>	<p><b>Fluoroscopy</b></p> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Special Demands</li> <li>• Fluoroscopic Technique</li> </ul>	<p>Seeram, Chapter 8 Bushong, Chapter 24</p> <ul style="list-style-type: none"> <li>• Pages 360-369</li> </ul>
<p>8</p>	<p><b>Fluoroscopy</b></p> <ul style="list-style-type: none"> <li>• Image Intensification</li> <li>• The Image Intensifier Tube</li> <li>• Multi-field Image Intensification</li> </ul>	<p>Seeram, Chapter 8 Bushong, Chapter 24</p> <ul style="list-style-type: none"> <li>• Pages 360-369</li> </ul>

Week	Material Covered	Reference/Reading
9	<b>Fluoroscopy</b> <ul style="list-style-type: none"> <li>• Television Monitoring</li> <li>• Charge Coupled Device</li> <li>• Image Recording</li> <li>• Introduction to Digital Fluoroscopy</li> <li>• Radiation Protection Considerations</li> </ul>	Seeram, Chapter 8 Bushong, Chapter 24 <ul style="list-style-type: none"> <li>• Pages 360-369</li> </ul>
Week of December 12	<b>FINAL EXAMINATION</b>  The final examination is based on the entire course, however, the exam will be heavily weighted on topics after the mid-term.  <b>Best wishes.</b>	Seeram, E.