BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

Operating Unit: Health Sciences
Program: Medical Radiography
Option:

Course Outline

MRAD 3312
Image Recording, Equipment, and Quality Control

Start Date: January, 2000 **End Date:** April, 2000

Course Credits: 3 **Term/Level:** 3

Total Hours: 20
Total Weeks: 10

Hours/Week: 2 **Lecture:** Yes **Lab:** **Shop:** **Seminar:** **Other:**

Prerequisites

Course No.	Course Name
MRAD 2212	Image Recording, Equipment, and Quality Control

MRAD 3312 is a Prerequisite for:

Course No.	Course Name
None.	

Course Calendar Description

Through lectures and laboratory exercises, this course will address quality assurance/quality control/continuous quality improvement concepts and equipment for radiographic and fluoroscopic imaging systems. Selected quality control tests will be described. In addition, mobile radiographic and fluoroscopic imaging systems will be discussed. The course concludes with a description of computer applications in radiology including digital imaging concepts, computed tomography, digital radiography and fluoroscopy and picture archiving and communications systems (PACS).

Course Goals

This course will provide students with the essential theory of quality assurance and quality control in radiology; mobile imaging systems; and computer applications in radiology. This fundamental background will allow students to accomplish the CAMRT competencies for radiographic fluoroscopic, and computer-aided equipment, for entry to radiological practice.

Evaluation

Laboratory	10%	• A grade of 60% is required to pass this course.
Project	15%	
Mid-term Exam	25%	• The final examination is cumulative and is based on the entire course.
Final Exam	50%	
TOTAL	100%	

Course Learning Outcomes/Competencies

Upon successful completion of this course, the student will be able to:

1. Differentiate between the terms quality assurance (QA) and quality control (QC) and list the advantages of a QA program.

   Describe the elements of QC in terms of:
   a. equipment for QC
   b. parameters for QC monitoring
   c. QC test procedures
   d. image quality standards
   e. tolerance limits
   f. error correction

2. Explain the following QC tests and carry out **selected** tests:
   a. level accuracy, section thickness, exposure and tube movement in conventional tomography
   b. exposure timer accuracy
   c. collimator test
   d. focal spot assessment
   e. screen-film contact test
   f. mA linearity
   g. repeatability and mR/mAs output
   h. inspection procedures for radiographic equipment

3. Explain each of the following QC tests for fluoroscopic equipment:
   a. overload protective circuitry
   b. radiation leakage
   c. fluoroscopic resolution
   d. maximum exposure rate
   e. fluoroscopic timer accuracy
   f. inspection procedures for fluoroscopic procedures

4. Outline the essential features of a repeat/reject analysis.

5. Describe the major features of mobile radiographic and fluoroscopic imaging systems.

6. Describe the fundamental principles of each of the following computer-assisted imaging techniques:
   a. computed tomography (CT)
   b. digital fluoroscopy (DF)
   c. digital radiography (DR)
   d. magnetic resonance imaging (MRI)
   e. radiology information system (RIS)
   f. picture archiving and communication systems (PACS)

CAMRT COMPETENCY PROFILE
(Equipment Operation)

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 radiographic/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.

Course Content Verification

I verify that the content of this course outline is current, accurate, and complies with BCIT Policy.

M. Dilapelle
Program Head/Chief Instructor

Dec 22/99
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

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Learning Resources

Required:

- Bushong, S. Radiologic Science for Technologists. Mosby-Year Book, Inc. 1997.

Additional References:

- Gray, J. et al. Quality Control in Diagnostic Imaging. Aspen Publishers Inc. 1983.
- Moores, B.M. et al. Practical Guide to Quality Assurance in Medical Imaging. John Wiley and Sons. 1987.
- Thompson, M.A. et al. Principles of Imaging Science and Protection. W.B. Saunders Co. 1994.
- Safety Code 20A: X-ray Equipment in Medical Diagnosis. Ottawa.1990.

BCIT Policy Information for Students

Assignment Details

There are two assignments in this course:

1. Laboratory: Conduct and write a brief report on ONE QC test (to be discussed in detail during lectures).
2. Quality Assurance Project: Prepare a report on the elements of a QA program in your hospital. This project to be done in groups (see next page for details).

HOSPITAL QUALITY ASSURANCE REPORT

The report should include a discussion of the following:

a. Dept's definition of QA and QC.
b. A brief account on the history of the development of the Dept's QC Program.
c. Define staff responsibilities.
d. Discuss the Dept's philosophy on QC. 10 Marks

e. What parameters are monitored?
f. The format of a QC test.
g. List equipment available in the Dept (for QC test procedures). 10 Marks

h. Give examples of QC forms available. 3 Marks

i. Discuss the Dept's image quality standards. 5 Marks

j. Comment on the following:
- Record keeping
- Education and resources
- Policy and/or Procedural Manual. 4 Marks

k. Benefits of a QA Program.
l. Conclusion: This should include a statement of your own perceptions of the QA Program (e.g., recommendations). 4 Marks

m. References. 2 Marks

n. List of names of students and topics covered. 2 Marks

TOTAL 40 Marks

Week	Outcome/Material Covered	Week
AC	Predicted Order of Coverage	BD
Jan. 4	**Quality Assurance/Quality Control/Continuous Quality Improvement** • Concepts and Equipment	Jan. 17
Jan. 10	**Quality Control Tests – Radiography** • Screen Film Contact • Collimation • Inspection Procedures • Focal Spot Assessment NB: Several QC tests were done with Richard Saunders as part of his Physics course. These include: • kVp accuracy • mA linearity • exposure timer accuracy • HVL assessment	Jan. 24
Jan. 31	**Quality Control Tests – Conventional Tomography** • Review of Tomography • QC Tests – Level Accuracy – Section Thickness	Feb. 14
Feb. 7	**Quality Control Tests – Fluoroscopy** • Fluoroscopic Resolution • Maximum Exposure Rate • Fluoro Timer • Scatter Radiation • Inspection Procedures	Feb. 21
Feb. 28	**Repeat-Reject Analysis** • Purpose • Equipment • Procedure • Tolerance Limits • Action	Mar.6
	MID-TERM EXAMINATION	
	This exam is scheduled for the second hour of this week.	
Mar. 13	SPRING BREAK	Mar. 13

Week	Outcome/Material Covered	Week
AC	**Predicted Order of Coverage**	**BD**
Mar. 20	**Mobile X-ray Imaging Systems** • Radiography • Fluoroscopy • CT	Mar. 20
Mar. 27	**Computer Applications in Radiology** • Digital Imaging Concepts • Computed Tomography	Apr. 10
Apr. 3	**Computer Applications in Radiology** • Digital Fluoroscopy • Digital Radiology • RIS/HIS/PACS	Apr. 17
Apr. 24	**FINAL EXAMINATION**	**Apr. 24**
	The final exam is cumulative and is weighted on topics covered after the mid-term examination.	