

 <p><b>CAMOSUN</b> COLLEGE</p>	<p><b>School of Health &amp; Human Services</b> <b>Medical Radiography Technology</b></p> <p><b>MRAD 249 - X01</b> <b>CT Physical Principles</b> <b>2015W</b></p>
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## **COURSE OUTLINE**

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**The Approved Course Description is available on the web:**

<http://camosun.ca/learn/calendar/current/web/mrad.html#MRAD249>

*Please note:*

- *This outline will be electronically stored for five (5) years only. It is strongly recommended students keep this outline for your records.*
- *This course is only open to students in the Medical Radiography program.*

### **Introduction:**

This course deals with the physical principles and technological aspects of Computer Tomography (CT). First the physical principles are described followed by a description of data acquisition concepts, and the fundamentals of image reconstruction. In addition, the major components of a CT scanner will be outlined and image manipulation of the CT image will be described.

Secondly, the technical principles of multi-slice CT (MSCT) systems including evolution of MSCT systems, physical principles and equipment will be explained. In particular, important concepts such as multi-row detector technology and associated electronics and pitch will be elaborated. Furthermore, the major considerations in addressing the connection of the CT scanner to a Picture Archiving and Communication System (PACS) will be highlighted. Finally, the course will conclude with an overview of image quality, radiation dose and quality control (QC) aspects and specific quality tests for CT.

*Students must achieve a minimum of a C+ (65%) to use this course as a prerequisite.*

## Instructor Information

(a)	Instructor:	Brent Mekelburg B.Sc. RT (R)(MR)/Stephen Kapuvari	
(b)	Office Hours:	Wednesday 1230-1320	
(c)	Location:	WT 212C	
(d)	Phone:	250-370-3992	
(e)	Email:	<a href="mailto:mekelburgb@camosun.bc.ca">mekelburgb@camosun.bc.ca</a>	
(f)	Website:	<a href="http://online.camosun.ca/">http://online.camosun.ca/</a>	

## 2. Intended Learning Outcomes/Competencies:

Letters and numbers following certain learning outcomes indicate the specific competencies covered from the CAMRT Medical Radiography Competency Profile.

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

1. Outline the significant events in the history of Computed Tomography scanning (CT scan).
2. Assess CT concepts of digital image processing and connectivity elements of the CT scanner to PACS. (E3.1)
3. Apply physics knowledge for an understanding of problems with respect to data collection and image reconstruction. (A1.1, E2.4, K1.15)
4. Describe components of a CT scanner with respect to data acquisition, data processing and image display, recording, storage and communication systems. (E3.2, E3.3, E3.4, K1.15)
5. Outline the principles and concepts of three-dimensional CT imaging. (A4.2)
6. Evaluate the factors affecting image quality in CT and radiation dose to the patient. (A1.1, C1.7, C3.2, E1.5, E2.1, K1.14)
7. Analyze the types of CT artifacts and methods to eliminate or reduce artifact production. (A1.1, E2.3, K1.14)
8. Describe the concepts of quality control in CT with respect to the Canadian Radiation Safety Code standards. (C1.7)
9. Outline the principles of multi-slice CT scanning including data acquisition and image reconstruction concepts. (K1.15)

10. Describe other technical applications including CT Angiography, CT Fluoroscopy, Flat-Detector CT, Breast CT, CT Screening, Quantitative CT, and Mobile CT Scanning. (A4.2)
11. Outline the basic concepts and software tools for virtual reality imaging with specific applications in CT. (A4.2)
12. Outline the technical applications of CT principles in Radiation Therapy. (A4.2)
13. Outline the fundamental concepts of PET/CT. (A4.2, K1.3)
14. Describe the essential physical principles and technological aspects of cardiac CT scanners. (A4.2)
15. Describe several CT image manipulation techniques. (A4.2,E2.4)
16. Discuss the advantages of MSCT systems that have an impact on clinical practice. (A4.2)
17. Explain the concepts of quality control in CT. (D2.3)
18. Describe selected QC tests for CT scanners. (D2.3)

### 3. Learning Resources

#### a. Required:

**Seeram, E.** (2009). *Computed Tomography: Physical Principles, Clinical Applications and Quality Control*, (3rd ed.). W.B. Saunders Co.

**Romans, Lois** (2011). *Computed Tomography for Technologists*. Wolters Kluwer/Lippincott Williams & Wilkins

#### b. Recommended (on reserve in library):

**Bushong, S.C. (2013).** *Radiologic Science for Technologists: Physics, Biology and Protection*, 10th edition, Mosby

### 4. Evaluation:

Attendance/Participation	10%
Mini-Quizzes	10%
Tests (4@12.5%each)	50%
Cumulative Final Exam	30%
<b>TOTAL</b>	<b>100%</b>

**5. Course Schedule (Wed 9:30 AM – 10:20 AM; Thurs 10:30 AM – 11:20 AM)**

Week	Date	Module	Topic	Reading	Quizzes/Assignments
1	Jan 7, 8	1	Intro and Overview	S: Ch. 1	
2	Jan 14, 15	2	Components	S: Ch. 7 R: Ch. 2	
3	Jan 21, 22	3	Physical Principles and Data Acquisition	S: Ch. 4 S: Ch. 5 R: Ch. 4 R: Ch. 5	
4	Jan 28, 29	3, 4			
5	Feb 4, 5	4			
6	Feb 11		Review 1-4 Online		
7	Feb 18, 19	5	Image Reconstruction	S: Ch. 6 R: Ch. 3	<b>Test 1 Mod 1-4</b>
8	Feb 25, 26	5			
9	Mar 4, 5	6	Image Post-Processing	S: Ch. 8	
10	Mar 11, 12	6			
11	Mar 18, 19		Review 5-6		<b>Test 2 Mod 5+6</b>
12	Mar 25, 26	7	SSCT + MSCT	S: Ch. 11+12	
13	Apr 1, 2	8			<b>Test 3 Mod 7+8</b>
14	Apr 8, 9	9	Advanced and Specialty Applications	S: Ch. 13+14 R: Ch. 13, (23+ 24)	
15	Apr 15, 16	9			
16	Apr 22, 23	9			<b>Test 4 Mod 9</b>
17	Apr 29, 30	10	Radiation Dose	S: Ch. 10 R: Ch. 14	
18	May 6, 7	11	QC and Image Quality	S: Ch. 20 R: Ch. 6+7	
19	May 13, 14		Review week		
20	Date TBA	1-11	Exam Week		<b>Final Exam</b>

***Do not book trips until the final exam schedule is posted by the registrar.***

## 6. Grading System

### Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+	Minimum level of achievement to use the course as a prerequisite.	3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted.	1
0-49	F	Minimum level has not been achieved.	0

### Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy E-1.5 at [camosun.ca](http://camosun.ca) for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
<b>I</b>	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
<b>IP</b>	<i>In progress:</i> A temporary grade assigned for courses that, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. (For these courses a final grade will be assigned to either the 3 <sup>rd</sup> course attempt or at the point of course completion.)
<b>CW</b>	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

## 7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

### CONDUCT POLICIES

It is the student's responsibility to become familiar with the content of these policies. The policies are available in each School Administration Office, Registration, and on the College web site in the Policy Section.

[Academic Policies and Procedures](#)  
[Student Conduct Policy](#)

### LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Registrar's Office or the College web site at <http://www.camosun.bc.ca>

### MRT PROFESSIONAL CODE OF ETHICS

Camosun College Medical Radiography Technology students are expected to abide by the Canadian Association of Medical Radiation Technologist (CAMRT) Code of Ethics inasmuch as it applies to them in the learning and clinical environments. This information is available on the CAMRT website at:

[CAMRT Code of Ethics](#)

### MRT Department Policies & Procedures

Camosun College Medical Radiography Technology students are responsible for knowing all of the MRT Department Policies and must abide by them, including dress codes & lab safety procedures.

<http://camosun.ca/learn/programs/mrt/documents/handbook.pdf>

## 8. GENERAL INFORMATION

### Desire-to-Learn (D2L):

- D2L – the Camosun College online learning portal contains the remainder of the learning materials for this course. Students are expected to familiarize themselves with the online learning environment and all the features it has to make this course experience enriching. Login at <https://online.camosun.ca/> to access these materials.
- Additional resources may include, but are not limited to: lecture notes, PowerPoint slides, Laboratory Manuals, and hyperlinks. You may prefer to download lectures notes ahead of time (when available) and then write your notes directly onto copies of the slides.
- D2L materials **must not** be considered your sole source of information! They merely summarize the main points and provide direction for your learning experiences. You may need to write down additional information in each lecture. Additionally, not all details can be covered in a lecture, and you will be required to refer to textbook material that is not discussed specifically in class.

### Attendance

- You are expected to attend all classes, and be on time. It is your responsibility to acquire *all* information given during a missed class, including notes, hand-outs, assignments, changed exam dates, etc. Missed exams or quizzes cannot be made up except in case of documented illness (doctor's note required).
- In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with his/her instructor indicating the reason for the absence. Prolonged illness of three or more consecutive days must have a medical certificate sent to the department.

*The Medical Radiography Technology program is committed to promoting competence, professionalism and integrity in our students and developing their core skills to succeed throughout their academic programs and in their careers. The purpose of Academic Honesty Guidelines is to provide clear expectations of appropriate academic conduct and to establish processes for discipline in appropriate circumstances. It is the student's responsibility to become familiar with the content and the consequences of academic dishonesty. Before you begin your assignments, review the Academic Policies on the Camosun College website: <http://camosun.ca/learn/becoming/policies.html>*