COURSE SYLLABUS

COURSE TITLE: PHYS-165: Physics of Medical Imaging & Radiation

CLASS SECTION: BX01

TERM: S2024

COURSE CREDITS: 3

DELIVERY METHOD(S): Blended, Synchronous

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.
Learn more about Camosun's Territorial Acknowledgement.

INSTRUCTOR DETAILS

NAME: Stephanie Ingraham

EMAIL: IngrahamS@camosun.ca

OFFICE: Fisher 340C (Lansdowne) / Tech 222 (Interurban)

HOURS: Wednesday, Friday: 12:30-1:20 pm (Tech 222)

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

In this course, students examine the interactions of physical phenomena to understand the fundamental principles of radiation
used for imaging and therapy. Students explore the differences between various imaging modalities such as sonography,
conventional x-ray, computed tomography, nuclear imaging, and magnetic resonance imaging. Students experiment with
theoretical knowledge during laboratory activities and examine the practical applications of medical imaging physics.

PREREQUISITE(S):

One of:

- C in Physics 12
- C in Camosun Alternative

Or one of:

- C in Physics 11
- C in Camosun Alternative

And one of:

- C in Math 11
- C in MATH 073
- C in MATH 137
- C in MATH 139

- C in MATH 173
  CO-REQUISITE(S):
  EQUIVALENCIES:

COURSE LEARNING OUTCOMES / OBJECTIVES

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

- Solve problems and perform calculations with relevant equations for matter, electricity, magnetism, radiation, and waves using the correct units, measures, and notations.
- Explain and apply the fundamental principles of matter, electricity, magnetism, radiation, and waves as they pertain to medical imaging and radiation therapy.
- Compare and contrast the appropriate use of radiographic imaging, nuclear imaging, magnetic resonance imaging, and sonographic imaging as determined by physical and biologic effects.
- Describe the fundamental principles of radiation therapy as a treatment option for a variety of diseases.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

- Scientific Calculator, Ruler
- Access to a computer with Microsoft Excel. Excel is available as part of the Office 365 Suite provided free to all Camosun students. See: http://camosun.ca/services/its/other-services.html for details.
- Access to a cellphone, camera or scanner capable of generating pdf documents for submission of homework and labs.

COURSE OBJECTIVES AND MAPPED PROFESSIONAL COMPETENCIES
(also known as “sub-outcomes” or “learning objectives”)

Canadian Association of Medical Radiation Technologists:

1. solve problems and perform calculations with relevant equations for matter, electricity, magnetism, radiation, and waves using the correct units, measures, and notations. **(RTR.2.1)**
2. explain and apply the fundamental principles of matter, electricity, magnetism, radiation, and waves as they pertain to medical imaging and radiation therapy. **(RTR.2.1)**
3. compare and contrast the appropriate use of radiographic imaging, nuclear imaging, magnetic resonance imaging, and sonographic imaging as determined by physical and biologic effects. (**RTR.1.6, RTR.2.1, RTR.3.4, 4.5.1)**
4. describe the fundamental principles of radiation therapy as a treatment option for a variety of diseases. (**RTR.3.4)**

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

Tuesday: 1:30 PM -3:20 PM, Online Zoom Lecture
Wednesday: 1:30 PM- 3:20 PM, TEC 222 Lecture
Thursday: 3:30 PM – 5:20 PM, TEC 222 Lecture
Friday: 1:30 PM – 3:20 PM, TECH 222 Lab

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Date	Lecture Topic	Due Dates
Week 1		
Monday, May 6th		
Tuesday, May 7th	Course Info, 1.1 Scientific Notation, 1.2 SI system, Unit Conversions	Quiz 1 (Intro)
Wednesday, May 8th	2.1 Wave Characteristics, 2.2 EM Waves	
Thursday, May 9th	3.1 Periodic Table, Bohr Model, 3.2 Electron Energy Levels	
Friday, May 10th	**Lab 1- Balmer Series**	Homework 1 (1.1-1.2) Due
Week 2		
Monday, May 13th		
Tuesday, May 14th	4.1 Electric Charge, Coulomb's Law, 4.2 Electric Field and Field Lines, 4.3 Electric Potential Energy and Electric Potential	Homework 2 (2.1-3.2) Due Quiz 2 (Module 1) Quiz 3 (Modules 2.1, 2.2, 3.1, 3.2)
Wednesday, May 15th	4.3 Electric Potential Energy and Electric Potential 4.4 Current and Ohm's Law	
Thursday, May 16th	4.5 Magnetism, 4.6 Electromagnetic Induction 5.1 Basic Circuitry of an X Ray Machine	Lab 1 Due
Friday, May 17th	**Lab 2- Electric Field Mapping (with X-ray tube anode/cathode set up)**	Homework 3 (4.1-4.3) Due
Week 3		
Monday, May 20th		
Tuesday, May 21st	5.2 X Ray Production Mechanisms, 5.3 X Ray Spectra	Homework 4 (4.3-4.6) Due Quiz 4 (Modules 4.1-4.3) Quiz 5 (Modules 4.4-4.6)
Wednesday, May 22nd	6.1 Coherent and Compton Scatter, 6.2 The Photoelectric Effect	
Thursday, May 23rd	6.3, 6.4 Pair Production, Photodisintegration, Summary of Attenuation Mechanisms	
Friday, May 24th	**Test #1- Modules 1-4**	
Week 4		

Monday, May 27th	College Closed	
Tuesday, May 28th	6.5 Attenuation of a Mono-energetic X-Ray Beam, 6.6 Heterogeneous Material and Sub Contrast	Homework 5 (5) Due Quiz 6 (Modules 5.1-5.3) Quiz 7 (Modules 6.1-6.3)
Wednesday, May 29th	6.7 Attenuation of a Poly-energetic X Ray Beam, 6.8 Summary of Radiographic Imaging, 6.9 Intro to Computed Tomography	
Thursday, May 30th	7.1 Atomic Notation and Nuclides, 7.2 Nuclear Stability and Binding Energy	Lab 2 Due
Friday, May 31st	Lab 3- Simple Circuits and Ohm's Law (with new larger light bulbs, diodes)	Homework 6 (6.1-6.4) Due
Week 5		
Monday, June 3rd		
Tuesday, June 4th	7.3 Decay Processes	Homework 7 (6.5-6.7) Due Quiz 8 (Modules 6.4-6.6) Quiz 9 (Modules 6.7, 6.8, 7.1, 7.2)
Wednesday, June 5th	7.4 Interaction of Charged Particles with Matter, 7.5 Half Life and Activity	
Thursday, June 6th	7.6 Radionuclide and Radiopharmaceutical Production, 7.7 Nuclear Imaging	Lab 3 Due
Friday, June 7th	Lab 4- Ultrasonic Waves	Homework 8 (6.8-7.4) Due
Week 6		
Monday, June 10th		
Tuesday, June 11th	8.1 Biological Effects of Radiation, 8.2 Radiation Dosimetry, 8.3 Radiation Therapy	Quiz 10 (Modules 7.3, 7.4, 7.5)
Wednesday, June 12th	Test #2- Modules 5, 6, 7.1-7.4	
Thursday, June 13th	9.1 Wave Interactions, 9.2 Sound Waves, 9.3 Physical Principles of Ultrasound Scans	Lab 4 Due
Friday, June 14th	Lab 5- Attenuation of Radiation	Homework 9 (7.5-7.7) Due
Week 7		
Monday, June 17th		
Tuesday, June 18th	9.4 Physical Principles of Ultrasound Scans, Equipment and Other Considerations, 10.1 Physical Principles of Magnetic Resonance Imaging	Homework 10 (8 and 9) Due Quiz 11 (Module 8)
Wednesday, June 19th	10.2 MRI Equipment and Images, 10.3 Image Characteristics and Other Considerations	

Thursday, June 20th	Exam Review	Lab 5 Due Quiz 12 (Module 9)
Friday, June 21st	**Final Exam**	

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines can be reviewed on the CAL exams page. https://camosun.ca/services/academic-supports/accessible-learning/academic-accommodations-exams

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Homework	30
Quizzes	10
Labs	20
Midterms (Friday May 24th and Wednesday June 12th)	20
Final Exam (Friday June 21st)	20
TOTAL	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the Grade Review and Appeals policy for more information. https://camosun.ca/sites/default/files/2021-05/e-1.14.pdf

COURSE GUIDELINES & EXPECTATIONS

- Course content, announcements, and important class information will be posted on d2L. Students must check d2L regularly.
- Homework assignments are available are d2L and are due on Tuesdays and Fridays according to the schedule.
- Students requiring an extension to labs or homework due to illness or other extenuating circumstances **must contact me prior** to the due dates. Otherwise, late penalties will apply as described below.
- For overdue labs or assignments, a late penalty of 10% per day will be assessed each day following the due date.
- Two midterm tests will occur at the dates and times listed in the schedule. You will have 2 hours to complete each test. Tests will be written in person.
- Quizzes are meant to be formative and may be completed at anytime up until the last day of classes.

- Homework and Lab work must be submitted through the d2L Assignments tool. Questions or pages that are missing due to scanning errors will not be accepted at a later time.

- Any changes in due dates or timelines will be posted on the D2L calendar.

- There will be a two-hour, cumulative final exam written on the last day of class, in-person on campus.

PHYSICS DEPARTMENT GUIDELINES REGARDING TESTING AND GRADING:

- As stated in the current college calendar, "students are expected to write tests and final exams at the scheduled time and place." Exceptions will only be considered due to emergency circumstances as outlined in the calendar. Holidays or scheduled flights are not considered to be emergencies.

- Students must write quizzes, tests, midterm tests, etc., on the date and time assigned by the instructor. Missed exams normally receive a zero grade. Instructors are not required to provide make-up tests. At their discretion, instructors may waive a test in exceptional circumstances such as medical issues or a documented illness.

Any outstanding homework or labs must be submitted by the final exam and will be graded according to the late protocols outlined by the instructor.

Missed Labs Guidelines:

- Laboratory activities are in-person activities; attendance and participation are required. Reports will not be accepted from students who did not attend the lab period.
- If you arrive more than 30 minutes late to the lab, you may be recorded as absent.
- Students who will miss a laboratory session have an obligation to seek out concessions directly from their instructor in a timely manner, BEFORE the lab period occurs. In the event of unforeseen circumstances, lab instructors must be notified within 24 hours of the missed lab period, or concessions will not be available.
- Please note that if you are suffering from a serious medical illness that prevents you from participating in this course, Camosun College has a Compassionate Medical Withdrawal Policy (https://camosun.ca/services/forms#medical

GENERAL IN-PERSON ASSESSMENT RULES FOR STUDENTS – PHYSICS AND ASTRONOMY DEPARTMENT:

The rules are used for on-campus quizzes, tests, and exams in the Physics and Astronomy department. A Faculty member will actively supervise throughout the examination. The instructor may move around the room or sit at the front or back of the room.

By entering the exam room, students agree to abide by the following rules:

- Turn off all electronic communication devices (including, but not limited to: cellphones, smartwatches, laptops, tablets) before entering and place them on a designated table at the front of the exam room.
- All bags, must be on the sides, back, or front of the room – the instructor will identify the appropriate place.
- Students are not permitted to wear brimmed hats or hoodies during in-person assessments.
- Students may bring pens, pencils, calculator, highlighters, erasers, ruler, protractor, and a drink in a closed container. If permitted in the room, students may have a snack in its original packaging or a clear container.

- Calculators must be scientific, non-textual calculators, with no notes of any kind in the case.
- Items brought into the room may be inspected by the Faculty member.
- If you arrive late for the examination, no additional time will be provided. Students arriving more than 30 minutes late may not be allowed to enter the room.
- For biological breaks, permission to leave the exam room must be obtained. Only one student at a time may leave the room, and biological breaks must be as brief as possible.
- Access to any online materials during exams is prohibited.
- Any work submitted on an examination must be entirely your own.
- Students found communicating with one another in any way or under any pretext; having unauthorized books, papers, electronic computing devices, data storage, or communication devices in view, even if their use is not proved; or found cheating in any way may receive a zero grade. All incidents will be recorded and managed according to the College's Academic Integrity Policy.

SCHOOL OR DEPARTMENTAL INFORMATION

Health & Human Services Student Handbook: http://camosun.ca/learn/school/health-human-services/student-info/index.html

General Practicum Information: http://camosun.ca/learn/school/health-human-services/student-info/practicum-info.html

Allied Health & Technologies Department Handbooks:

- Certified Medical Laboratory Assistant: http://camosun.ca/learn/school/health-human-services/student-info/program-info/cmla.html
- Diagnostic Medical Sonography: http://camosun.ca/learn/school/health-human-services/student-info/program-info/sono.html
- Medical Radiography: http://camosun.ca/learn/school/health-human-services/student-info/program-info/mrad.html

Students enrolled in Allied Health & Technologies Programs must achieve a minimum of 65% or a "COM" in each of their courses in order to use their course as a pre-requisite and progress in their program.

Students enrolled in Allied Health & Technologies Programs must participate in learning activities that include intimate and direct personal contact with their classmates during supervised practice. Students are training to perform the duties of a healthcare professional. These duties usually require constant, close physical contact with patients and clients. Students may be required to simulate and perform these activities on one another during this course. Students may also be required to use special hygiene practices and protective gear to protect themselves from the transmission of communicable diseases (like COVID-19). Risks associated with learning and performing the physical duties of a healthcare profession cannot be entirely eliminated by any amount of caution or protection. Students who refuse, or are incapable of participating and performing these activities due to personal or medical limitations, may only continue to participate in their course work when supported by officially registered accommodations or temporary medical advisory.

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies;

demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit camosun.ca/services.

Support Service	Website
Academic Advising	camosun.ca/services/academic-supports/academic-advising
Accessible Learning	camosun.ca/services/academic-supports/accessible-learning
Counselling	camosun.ca/services/health-and-wellness/counselling-centre
Career Services	camosun.ca/services/co-operative-education-and-career-services
Financial Aid and Awards	camosun.ca/registration-records/financial-aid-awards
Help Centres (Math/English/Science)	camosun.ca/services/academic-supports/help-centres
Indigenous Student Support	camosun.ca/programs-courses/iecc/indigenous-student-services
International Student Support	camosun.ca/international
Learning Skills	camosun.ca/services/academic-supports/help-centres/writing-centre-learning-skills
Library	camosun.ca/services/library
Office of Student Support	camosun.ca/services/office-student-support
Ombudsperson	camosun.ca/services/ombudsperson
Registration	camosun.ca/registration-records/registration
Technology Support	camosun.ca/services/its
Writing Centre	camosun.ca/services/academic-supports/help-centres/writing-centre-learning-skills

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Integrity

Students are expected to comply with all College policy regarding academic integrity; which is about honest and ethical behaviour in your education journey. The following guide is designed to help you understand your responsibilities: https://camosun.libguides.com/academicintegrity/welcome
Please visit https://camosun.ca/sites/default/files/2021-05/e-1.13.pdf for Camosun's Academic Integrity policy and details for addressing and resolving matters of academic misconduct.

Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc.). If you have a disability, the Centre for Accessible Learning (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started: https://camosun.ca/services/academic-supports/accessible-learning

Academic Progress

Please visit https://camosun.ca/sites/default/files/2023-02/e-1.1.pdf for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit https://camosun.ca/sites/default/files/2021-05/e-2.2.pdf for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit https://camosun.ca/registration-records/tuition-fees#deadlines.

Grading Policy

Please visit https://camosun.ca/sites/default/files/2021-05/e-1.5.pdf for further details about grading.

Grade Review and Appeals

Please visit https://camosun.ca/sites/default/files/2021-05/e-1.14.pdf for policy relating to requests for review and appeal of grades.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit https://camosun.ca/sites/default/files/2021-07/e-2.8.pdf to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them

understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence and Misconduct Policy: https://camosun.ca/sites/default/files/2021-05/e-2.9.pdf and camosun.ca/services/sexual-violence-support-and-education. To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-370-3841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at https://camosun.ca/sites/default/files/2021-05/e-2.5.pdf to understand the College's expectations of academic integrity and student behavioural conduct.

Looking for other policies?

The full suite of College policies and directives can be found here: https://camosun.ca/about/camosun-college-policies-and-directives

Changes to this Syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.