

# COURSE SYLLABUS



COURSE TITLE: PHYS-141: Physics for Scientists and Engineers 2

CLASS SECTION: 001

TERM: 2024W

COURSE CREDITS: 3

DELIVERY METHOD(S): Face-to-Face Lecture and Lab

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](#).

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## INSTRUCTOR DETAILS

NAME: Stephanie Ingraham

EMAIL: [IngrahamS@camosun.ca](mailto:IngrahamS@camosun.ca)

OFFICE: F340C

HOURS: Mon/Tues/Thurs 9:30-10:20 am Wed 11:30 am- 12:20 pm \*or by appointment

*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.*

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## CALENDAR DESCRIPTION

This calculus-based course is intended for students in Science or Engineering. Students will study periodic motion, travelling and standing waves, thermal physics, geometric optics, physical optics. Students will explore fundamental concepts modern physics, including relativity, the structure of matter and radioactivity. Students will explore how these fundamental principles apply in laboratory settings.

### PREREQUISITE(S):

All of:

- C in PHYS 140

### CO-REQUISITE(S):

All of:

- C in MATH 100

### EXCLUSION(S):

Not Applicable

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## COURSE LEARNING OUTCOMES / OBJECTIVES

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

1. Examine common physical systems subject to periodic motion and study the propagation of waves on

strings and in air columns.

- a. Identify defining features of systems undergoing Simple Harmonic Motion and solve technical problems for such systems.
- b. Define and describe the following properties of waves: period, frequency, wave speed, and amplitude.
- c. State the principle of superposition and understand the properties of waves undergoing constructive and destructive interference.
- d. Compare and contrast wave propagation on strings and in air columns including wave speed dependence on medium characteristics.
- e. Solve problems involving the Doppler effect.
- f. State the conditions for standing waves and identify nodes and anti-nodes. Solve problems of vibrating strings and air columns, including fundamental nodes and harmonics.

2. Investigate laws of geometric optics and use them to understand and characterize image formation in mirrors and lenses.

- a. State laws of reflection and refraction and apply laws to calculate paths of light rays at interfaces between materials.
- b. Solve technical problems involving dispersion and total internal reflection as special applications of refraction.
- c. Solve technical problems involving image formation with spherical mirrors, lenses and simple optical devices, including ray diagrams.

3. Apply the wave model of light to study and describe physics optics experiments involving interference and diffraction of light.

- a. Solve technical problems associated with the effects of light interference.
- b. Study experiments and applications that rely on interference of light including Young's double-slit, diffraction gratings, thin film interference and the Michelson Interferometer.

4. State and explore the First and Second Laws of Thermodynamics through investigations into heat transfer, calorimetry and analyses of heat engines.

- a. Solve technical problems involving linear and volume expansion of solids and liquids in response to temperature changes.
- b. Apply concepts of specific and latent heat to solve technical calorimetry problems including systems undergoing phase changes.
- c. Describe fundamental mechanisms of heat transfer.
- d. Apply the Ideal Gas Law and the First Law of Thermodynamics to analyze simple heat engines.
- e. Apply the concept of entropy and the Second Law of Thermodynamics to describe limits to the efficiency of heat engines.

5. Examine and solve problems using key theories of modern physics including relativity, the structure of matter, and radioactivity.

- a. Outline the key principles of Einstein's Theory of Special Relativity. Solve technical problems involving coordinate transformations, relativity of length and time intervals, relativistic energy and momentum.
- b. Outline key ideas of quantum theory including wave-particle duality and the Heisenberg uncertainty principle.
- c. Solve technical problems involving the photoelectric effect, Compton scattering and pair production and the

Heisenberg Uncertainty Principle.

d. Describe the Bohr model of the atom and the nature of radioactivity.

6. Examine the validity of key physical principles through the use of practical experimental techniques.

a. Assemble experimental apparatus using written instructions.

b. Observe and record data including sources of error and estimate the range of uncertainty in results.

c. Interpret meaning of experimental results in the context of the experimental objectives.

d. Write scientific reports in correct format.

## REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

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### Required materials:

- Scientific calculator
- Ruler
- Access to a computer with Microsoft Excel. (Students can access Excel through the Microsoft Office Suite available free to students here: <https://legacy.camosun.ca/services/its/other-services.html>.)

### Optional material:

- Physics for Scientists and Engineers, 4th Edition, Knight, R.D (Copies available in Lansdowne Campus Library and the Bookstore)
- Physics 140/141 Lab Manual (Available on d2L as a pdf and as a hardcopy in the Bookstore)

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

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Lectures:      Monday 3:30- 4:20pm      F316  
                    Tuesday 1:30- 2:20pm      F316  
                    Thursday 4:30- 5:20pm      F316  
                    Friday 1:30- 2:20pm      F316

Lab:              Wednesday 9:30am – 11:20am      F316

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

### **Tentative Class Schedule**

Note that the lecture topics may vary by one or two days. Any changes to scheduled labs will be posted on D2L.

Date	Lecture Topic: P141-001
<b>WEEK #1</b>	
Monday, Jan. 8 <sup>th</sup>	1.1: Mathematical Description of SHM
Tuesday, Jan. 9 <sup>th</sup>	1.1: Mathematical Description of SHM
Wednesday, Jan. 10 <sup>th</sup>	<b>LAB 1: Uncertainties with Repeated Measurements</b>
Thursday, Jan. 11 <sup>th</sup>	1.2: Energy in SHM

Friday Jan. 12 <sup>th</sup>	1.3: Other Examples of SHM 1.4 Damping, Forced HM, Resonance
<b>WEEK #2</b>	
Monday, Jan. 15 <sup>th</sup>	2.1: Types of Wave Motion
Tuesday, Jan. 16 <sup>th</sup>	2.2: Mathematical Description of a Wave
Wednesday, Jan. 17 <sup>th</sup>	<b>LAB 2: Simple Harmonic Motion</b>
Thursday, Jan. 18 <sup>th</sup>	2.3: Speed of Waves
Friday, Jan. 19 <sup>th</sup>	2.4: Reflection, Transmission & Interference
<b>WEEK #3</b>	
Monday, Jan. 22 <sup>nd</sup>	2.5: Standing Waves on a String.
Tuesday, Jan. 23 <sup>rd</sup>	2.5: Standing Waves on a String.
Wednesday, Jan. 24 <sup>th</sup>	<b>LAB 3: Standing Waves on a String</b>
Thursday, Jan. 25 <sup>th</sup>	3.1: Sound Waves
Friday, Jan. 26 <sup>th</sup>	3.2: Standing Sound Waves
<b>WEEK #4</b>	
Monday, Jan. 29 <sup>th</sup>	3.2: Standing Sound Waves
Tuesday, Jan. 30 <sup>th</sup>	3.3: Beats and the Doppler Effect
Wednesday, Jan. 31 <sup>st</sup>	<b>Test 1- Modules 1 and 2</b>
Thursday, Feb. 1 <sup>st</sup>	4.1: Nature of Light / 4.2: Reflection & Refraction
Friday, Feb. 2 <sup>nd</sup>	4.2: Reflection and Refraction of Light
<b>WEEK #5</b>	
Monday, Feb. 5 <sup>th</sup>	4.3: Total Internal Reflection
Tuesday, Feb. 6 <sup>th</sup>	5.1: Plane Mirrors
Wednesday, Feb. 7 <sup>th</sup>	<b>LAB 4: Standing Waves in an Air Column</b>
Thursday, Feb. 8 <sup>th</sup>	5.2: Images formed by Spherical Mirrors
Friday, Feb. 9 <sup>th</sup>	5.2: Images formed by Spherical Mirrors
<b>WEEK #6</b>	
Monday, Feb. 12 <sup>th</sup>	5.3: Images formed by Thin Lenses
Tuesday, Feb. 13 <sup>th</sup>	5.4: Selected Lens Combinations
Wednesday, Feb. 14 <sup>th</sup>	<b>LAB 5: Properties of Refraction</b>
Thursday, Feb. 15 <sup>th</sup>	6.1: Interference & Young's Double Slit Experiment
Friday, Feb. 16 <sup>th</sup>	6.1: Interference & Young's Double Slit Experiment
<b>WEEK #7</b>	
Monday, Feb. 19 <sup>th</sup>	No Class- Family Day
Tuesday, Feb. 20 <sup>th</sup>	Reading Break
Wednesday, Feb. 21 <sup>st</sup>	Reading Break
Thursday, Feb. 22 <sup>nd</sup>	Reading Break
Friday, Feb. 23 <sup>rd</sup>	Reading Break
<b>WEEK #8</b>	
Monday, Feb. 26 <sup>th</sup>	6.2: Diffraction Gratings
Tuesday, Feb. 27 <sup>th</sup>	6.3: Single-Slit Diffraction
Wednesday, Feb. 28 <sup>th</sup>	<b>LAB 6: Image Formation in a Single Lens or Mirror</b>
Thursday, Feb. 29 <sup>th</sup>	6.3: Single-Slit Diffraction
Friday, Mar. 1 <sup>st</sup>	6.4: Thin Film Interference
<b>WEEK #9</b>	
Monday, Mar. 4 <sup>th</sup>	6.4: Thin Film Interference
Tuesday, Mar. 5 <sup>th</sup>	6.5: The Michelson Interferometer
Wednesday, Mar. 6 <sup>th</sup>	<b>Test 2- Modules 3, 4, and 5</b>
Thursday, Mar. 7 <sup>th</sup>	7.1: Temperature, Internal Energy and Heat
Friday, Mar. 8 <sup>th</sup>	7.2: Specific Heat and Calorimetry
<b>WEEK #10</b>	
Monday, Mar. 11 <sup>th</sup>	7.3: Latent Heat; 7.4: Thermal Expansion
Tuesday, Mar. 12 <sup>th</sup>	7.4: The Ideal Gas Law

Wednesday, Mar. 13 <sup>th</sup>	<b>LAB 7: Electrical Energy and the Specific Heat of Water</b>
Thursday, Mar. 14 <sup>th</sup>	7.5: Ideal Gas Processes
Friday, Mar. 15 <sup>th</sup>	7.6: The First Law of Thermodynamics
<b>WEEK #11</b>	
Monday, Mar. 18 <sup>th</sup>	7.7: Work and Heat in Ideal Gas Processes
Tuesday, Mar. 19 <sup>th</sup>	7.8: Heat Engines
Wednesday, Mar. 20 <sup>th</sup>	<b>LAB 8: Interference of Sound Waves</b>
Thursday, Mar. 21 <sup>st</sup>	7.8: Heat Engines / 7.9: Refrigerators
Friday Mar. 22 <sup>nd</sup>	7.10: Entropy and the 2 <sup>nd</sup> Law of Thermodynamics
<b>WEEK #12</b>	
Monday, Mar. 25 <sup>th</sup>	8.1: Reference Frames and Galilean Relativity
Tuesday, Mar. 26 <sup>th</sup>	8.2: Einstein's Principle of Special Relativity
Wednesday, Mar. 27 <sup>th</sup>	<b>LAB 9: The Balmer Series</b>
Thursday, Mar. 28 <sup>th</sup>	8.3: Time Dilation, 8.4 Length Contraction
Friday, Mar. 29 <sup>th</sup>	<b>College Closed</b>
<b>WEEK #13</b>	
Monday, April 1 <sup>st</sup>	<b>College Closed</b>
Tuesday, April 2 <sup>nd</sup>	8.5 The Lorentz Transforms
Wednesday, April 3 <sup>rd</sup>	<b>Test 3- Modules 6 and 7</b>
Thursday, April 4 <sup>th</sup>	8.6 Relativistic Momentum and Energy
Friday, April 5 <sup>th</sup>	9.1: The Photoelectric Effect
<b>WEEK #14</b>	
Monday, April 8 <sup>th</sup>	9.2: Compton Scattering and Pair Production
Tuesday, April 9 <sup>th</sup>	9.3: Wave-Particle Duality and the Uncertainty Principle
Wednesday, April 10 <sup>th</sup>	9.4: Modern Theories of the Atom, 9.5: Radioactivity
Thursday, April 11 <sup>th</sup>	Review
Friday, April 12 <sup>th</sup>	Review

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 notice is required. Deadlines can be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

## EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Homework	15%
Labs	25%
Term Tests	30%
Final Exam	30%
	<b>TOTAL</b>
	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](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information. <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

Note that the tests will take place in the lecture and lab period on the following dates:

Test 1- Wednesday, January 31<sup>st</sup> 9:30 – 11:20 am

Test 2- Wednesday March 6<sup>th</sup> 9:30 – 11:20 am

Test 3- Wednesday April 3<sup>rd</sup> 9:30 – 11:20 am

The date and location of the final exam will be announced later in the term.

## COURSE GUIDELINES & EXPECTATIONS

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- Course content, announcements, and important class information will be posted on d2L. Students must check d2L regularly.
- Homework problems will be posted on d2L. Homework can be submitted in person at the end of class or uploaded to the d2L “Assignments” folder. For overdue assignments, a late penalty of 10% per day will be assessed following the due date.
- Three midterm tests will occur at the dates and times listed above.
- Labs will take place in the lab period on Wednesday of each week. The due date for each lab report will be posted on the d2L calendar. Students must be present in the lab to take their own data. Each student is allowed one dropped or missed lab.
- Any outstanding labs or homework must be submitted prior to the last day of classes.

## SCHOOL OR DEPARTMENTAL INFORMATION

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### 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 illness and emergency circumstances. Holidays or scheduled flights are not considered to be emergencies.
- Missed exams normally receive a zero grade. Instructors are not required to provide make-up tests.

### PHYSICS DEPARTMENT GUIDELINES REGARDING LABS:

Laboratory activities involve practical applications of your knowledge and manual skills development. Development of these skills is a requirement to meet the Course Learning Outcomes.

- Students must obtain an overall grade of 50% or higher in the laboratory component of the course order to obtain credit for the course.
- Unless otherwise stated by your instructor, late penalties are as follows: For overdue labs, a late penalty of 10% per day will be assessed following the due date.-
- At the discretion of the instructor, a student who is repeating this Physics course with a laboratory grade of 70% or higher may apply for lab exemption.

### 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.
- If you miss up to three (3) laboratory sessions, you are still eligible to meet the Learning Outcomes for the course, though missed labs may receive a zero grade.
- If you miss a **total of four (4) or more labs for any reason** including, but not limited to: life circumstances, illness, family or pet obligations, planned vacations, milestone family events, work commitments, competitive athletic events., you will be unable to meet the learning outcomes for the class and will receive a **failing grade (F) in the entire course**, regardless of marks received on graded lab and lecture components. Exceptions will only be considered through an academic concession granted by the instructor or Dean/Associate Dean.
- 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.

#### 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

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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 <http://camosun.ca/students/>.

Academic Advising	<a href="http://camosun.ca/advising">http://camosun.ca/advising</a>
Accessible Learning	<a href="http://camosun.ca/accessible-learning">http://camosun.ca/accessible-learning</a>
Counselling	<a href="http://camosun.ca/counselling">http://camosun.ca/counselling</a>
Career Services	<a href="http://camosun.ca/coop">http://camosun.ca/coop</a>
Financial Aid and Awards	<a href="http://camosun.ca/financialaid">http://camosun.ca/financialaid</a>
Help Centres (Math/English/Science)	<a href="http://camosun.ca/help-centres">http://camosun.ca/help-centres</a>
Indigenous Student Support	<a href="http://camosun.ca/indigenous">http://camosun.ca/indigenous</a>
International Student Support	<a href="http://camosun.ca/international/">http://camosun.ca/international/</a>
Learning Skills	<a href="http://camosun.ca/learningskills">http://camosun.ca/learningskills</a>
Library	<a href="http://camosun.ca/services/library/">http://camosun.ca/services/library/</a>
Office of Student Support	<a href="http://camosun.ca/oss">http://camosun.ca/oss</a>
Ombudsperson	<a href="http://camosun.ca/ombuds">http://camosun.ca/ombuds</a>
Registration	<a href="http://camosun.ca/registration">http://camosun.ca/registration</a>
Technology Support	<a href="http://camosun.ca/its">http://camosun.ca/its</a>
Writing Centre	<a href="http://camosun.ca/writing-centre">http://camosun.ca/writing-centre</a>

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

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### 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:

<http://camosun.ca/services/accessible-learning/>

### Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

### Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/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 <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

### Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

### Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

### Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the "Attendance" section under "Registration Policies and Procedures"

(<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

### 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 <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/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: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and [camosun.ca/sexual-violence](http://camosun.ca/sexual-violence). To contact the Office of Student Support: [oss@camosun.ca](mailto:oss@camosun.ca) or by phone: 250-370-3046 or 250-3703841

### 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 <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

**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.