

# COURSE SYLLABUS



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

CLASS SECTION: 001

TERM: 2022W

COURSE CREDITS: 4

DELIVERY METHOD(S): Lecture

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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For COVID-19 information please visit <https://legacy.camosun.ca/covid19/index.html>.

*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 explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.*

## INSTRUCTOR DETAILS

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NAME: Lectures- Stephanie Ingraham Lab- Chris Avis

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

OFFICE: F346C, F346D

HOURS: Stephanie- Monday- Thursday 12:30- 1:20pm

Chris- M, W, F: 10:30 AM -11:20 AM; Tu: 11:30 AM -12:20 PM, Th: 12:30 PM -1:20 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.*

## CALENDAR DESCRIPTION

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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

## COURSE LEARNING OUTCOMES / OBJECTIVES

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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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(a) Texts

Physics for Scientists and Engineers, 4th Edition, Knight, R.D. (Optional)

(b) Other

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.

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

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

Lectures:	Monday 2:30- 3:20pm	F322
	Tuesday 11:30- 12:20pm	F316
	Wednesday 2:30- 3:20pm	F322
	Thursday 10:30- 11:20am	F322
Lab:	Thursday 11:30am – 12:20pm	F316
	Friday 11:30am- 12:20pm	F316

## 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. 10 <sup>th</sup>	1.1: Mathematical Description of SHM
Tuesday, Jan. 11 <sup>th</sup>	1.1: Mathematical Description of SHM
Wednesday, Jan. 12 <sup>th</sup>	1.2: Energy in SHM 1.3: Other Examples of SHM
Thursday, Jan. 13 <sup>th</sup>	1.3: Other Examples of SHM / 1.4 Damping, Forced HM, Resonance
LAB	LAB 1: Uncertainties with Repeated Measurements
<b>WEEK #2</b>	
Monday, Jan. 17 <sup>th</sup>	2.1: Types of Wave Motion
Tuesday, Jan. 18 <sup>th</sup>	2.2: Mathematical Description of a Wave
Wednesday, Jan. 19 <sup>th</sup>	2.3: Speed of Waves
Thursday, Jan. 20 <sup>th</sup>	2.4: Reflection, Transmission & Interference
LAB	LAB 2: Simple Harmonic Motion
<b>WEEK #3</b>	
Monday, Jan. 24 <sup>th</sup>	2.5: Standing Waves on a String.
Tuesday, Jan. 25 <sup>th</sup>	2.5: Standing Waves on a String.
Wednesday, Jan. 26 <sup>th</sup>	3.1: Sound Waves
Thursday, Jan. 27 <sup>th</sup>	3.2: Standing Sound Waves
LAB	LAB 3: Standing Waves on a String
<b>WEEK #4</b>	
Monday, Jan. 31 <sup>st</sup>	3.2: Standing Sound Waves
Tuesday, Feb. 1 <sup>st</sup>	3.3: Beats and the Doppler Effect
Wednesday, Feb. 2 <sup>nd</sup>	4.1: Nature of Light / 4.2: Reflection & Refraction
Thursday, Feb. 3 <sup>rd</sup>	4.2: Reflection and Refraction of Light
LAB	<b>Test 1- Modules 1 and 2</b>
<b>WEEK #5</b>	
Monday, Feb. 7 <sup>th</sup>	4.3: Total Internal Reflection
Tuesday, Feb. 8 <sup>th</sup>	5.1: Plane Mirrors
Wednesday, Feb. 9 <sup>th</sup>	5.2: Images formed by Spherical Mirrors
Thursday, Feb. 10 <sup>th</sup>	5.2: Images formed by Spherical Mirrors
LAB	LAB 4: Standing Waves in an Air Column
<b>WEEK #6</b>	
Monday, Feb. 14 <sup>th</sup>	5.3: Images formed by Thin Lenses
Tuesday, Feb. 15 <sup>th</sup>	5.4: Selected Lens Combinations
Wednesday, Feb. 16 <sup>th</sup>	6.1: Interference & Young's Double Slit Experiment
Thursday, Feb. 17 <sup>th</sup>	6.1: Interference & Young's Double Slit Experiment
LAB	LAB 5: Properties of Refraction
<b>WEEK #7</b>	
Monday, Feb. 21 <sup>st</sup>	Reading Break
Tuesday, Feb. 22 <sup>nd</sup>	Reading Break
Wednesday, Feb. 23 <sup>rd</sup>	Reading Break
Thursday, Feb. 24 <sup>th</sup>	Reading Break
Friday, Feb. 25 <sup>th</sup>	Reading Break
<b>WEEK #8</b>	

Monday, Feb. 28 <sup>th</sup>	6.2: Diffraction Gratings
Tuesday, Mar. 1 <sup>st</sup>	6.3: Single-Slit Diffraction
Wednesday, Mar. 2 <sup>nd</sup>	6.3: Single-Slit Diffraction
Thursday, Mar. 3 <sup>rd</sup>	6.4: Thin Film Interference
LAB	<b>Test 2- Modules 3, 4, and 5</b>
<b>WEEK #9</b>	
Monday, Mar. 7 <sup>th</sup>	6.4: Thin Film Interference
Tuesday, Mar. 8 <sup>th</sup>	6.5: The Michelson Interferometer
Wednesday, Mar. 9 <sup>th</sup>	7.1: Temperature, Internal Energy and Heat
Thursday, Mar. 10 <sup>th</sup>	7.2: Specific Heat and Calorimetry
LAB	LAB 6: Image Formation in a Single Lens or Mirror
<b>WEEK #10</b>	
Monday, Mar. 14 <sup>th</sup>	7.3: Latent Heat; 7.4: Thermal Expansion
Tuesday, Mar. 15 <sup>th</sup>	7.4: The Ideal Gas Law
Wednesday, Mar. 16 <sup>th</sup>	7.5: Ideal Gas Processes
Thursday, Mar. 17 <sup>th</sup>	7.6: The First Law of Thermodynamics
LAB	LAB 7: Electrical Energy and the Specific Heat of Water
<b>WEEK #11</b>	
Monday, Mar. 21 <sup>st</sup>	7.7: Work and Heat in Ideal Gas Processes
Tuesday, Mar. 22 <sup>nd</sup>	7.8: Heat Engines
Wednesday, Mar. 23 <sup>rd</sup>	7.8: Heat Engines / 7.9: Refrigerators
Thursday, Mar. 24 <sup>th</sup>	7.10: Entropy and the 2 <sup>nd</sup> Law of Thermodynamics
LAB	LAB 8: Interference of Sound Waves
<b>WEEK #12</b>	
Monday, Mar. 28 <sup>th</sup>	8.1: Reference Frames and Galilean Relativity
Tuesday, Mar. 29 <sup>th</sup>	8.2: Einstein's Principle of Special Relativity
Wednesday, Mar. 30 <sup>th</sup>	8.3: Time Dilation
Thursday, Mar. 31 <sup>st</sup>	8.4 Length Contraction
LAB	<b>Test 3- Modules 6 and 7</b>
<b>WEEK #13</b>	
Monday, April 4 <sup>th</sup>	8.5 The Lorentz Transforms
Tuesday, April 5 <sup>th</sup>	8.6 Relativistic Momentum and Energy
Wednesday, April 6 <sup>th</sup>	9.1: The Photoelectric Effect
Thursday, April 7 <sup>th</sup>	9.2: Compton Scattering and Pair Production
LAB	LAB 9: The Balmer Series
<b>WEEK #14</b>	
Monday, April 11th	9.3: Wave-Particle Duality and the Uncertainty Principle
Tuesday, April 12th	9.4: Modern Theories of the Atom
Wednesday, April 13th	9.5: Radioactivity
Thursday, April 14th	Review
LAB	Review (No class Friday)

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

Test 1- Thursday February 3<sup>rd</sup> 10:30- 12:20pm  
 Test 2- Thursday March 3<sup>rd</sup> 10:30- 12:20pm  
 Test 3- Thursday March 31<sup>st</sup> 10:30- 12:20pm

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

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DESCRIPTION	WEIGHTING
Homework	10%
Labs	15%
Term Tests (3 @ 15% each)	45%
Final Exam	30%
<b>TOTAL</b>	<b>100%</b>

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>

## 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 assigned at the beginning of a particular week and will be due by the end of the day (11:59 PM) on the Friday of the following week. Any submissions after this time will be considered late. See below for late policies. Homework will be marked based on completion.
- 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.
- Three midterm tests will occur at the dates and times listed above. The final exam will occur in the exam period. The date and time will be announced later in the term.
- Labs will take place in the lab periods on Thursday and Friday of each week. Students must attend both lab periods. Lab reports will be due by the end of the day (11:59 PM) on the Friday of the week following the lab, with the exception of weeks where there is a test. Students must be present in the lab to take their own data. Each student is allowed one dropped or missed lab.
- If a lab or test is missed due to illness or extenuating circumstances, students must contact their lecture or lab instructor within 24 hours of the missed lab or test. Otherwise, the lab or test will be assigned a zero grade.

## 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 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 illness.
- Any outstanding homework or labs must be submitted prior to the final exam date and will be graded according to the late policy outlined by the instructor.
- Refer to your instructor’s information page for any additional policies regarding testing and grade calculation.

### PHYSICS DEPARTMENT GUIDELINES REGARDING LABS:

- 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 1 mark per day (10%) will be assessed for the first five days following the due date. After this date a complete report is still required and earns a maximum mark of 50%.
- 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.

## STUDENT RESPONSIBILITY

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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](http://camosun.ca/services/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.