

COURSE SYLLABUS



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

CLASS SECTION: 002

TERM: Winter 2022

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](#).

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

NAME: John Coffey

EMAIL: coffeyj@camosun.ca

OFFICE: F346C, or online

HOURS: Monday and Wednesday 12:30pm – 2:00pm 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

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

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

(a) Texts

Physics for Scientist 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

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

| | | | |
|-----------|-----------|----------------|------|
| Lectures: | Monday | 8:30 - 9:20am | F316 |
| | Tuesday | 8:30 - 9:20am | F316 |
| | Thursday | 8:30 - 9:20am | F316 |
| | Friday | 8:30 - 9:20am | F316 |
| Lab: | Wednesday | 8:30 - 10:20am | F316 |

Tentative Class Schedule:

Note that the lecture topics may vary by one day or two. Any significant changes to the schedule will be posted on d2L along with an email.

| WEEK or DATE RANGE | ACTIVITY or TOPIC | OTHER NOTES |
|--------------------|--|-------------|
| Week 1 | | |
| Monday, Jan 9 | 1.1: Mathematical Description of SHM | |
| Tuesday, Jan 10 | 1.1: Mathematical Description of SHM (Cont.) | |
| Wednesday, Jan 11 | LAB 1: Uncertainties with Repeated Measurements | |
| Thursday, Jan 12 | 1.2: Energy in SHM, 1.3: Other Examples of SHM | |
| Friday, Jan 13 | 1.3: Other Examples of SHM (Cont.) 1.4: Damping, Forced HM, Resonance | |
| Week 2 | | |
| Monday, Jan 16 | 2.1: Types of Wave Motion | |
| Tuesday, Jan 17 | 2.2: Mathematical Description of a Wave | |
| Wednesday, Jan 18 | LAB 2: Simple Harmonic Motion | LAB 1 Due |
| Thursday, Jan 19 | 2.3: Speed of Waves | |
| Friday, Jan 20 | 2.4: Reflection, Transmission, and Interference | HW 1 Due |
| Week 3 | | |
| Monday, Jan 23 | 2.5: Standing Waves on a String | |
| Tuesday, Jan 24 | 2.5: Standing Waves on a String (Cont.) | |
| Wednesday, Jan 25 | LAB 3: Standing Waves on a String | LAB 2 Due |
| Thursday, Jan 26 | 3.1: Sound Waves | |
| Friday, Jan 27 | 3.2: Standing Sound Waves | HW 2 Due |
| Week 4 | | |
| Monday, Jan 30 | 3.2: Standing Sound Waves (Cont.) | |
| Tuesday, Jan 31 | 3.3: Beats and the Doppler Effect | |
| Wednesday, Feb 1 | TEST 1: Modules 1 and 2 | |
| Thursday, Feb 2 | 4.1: Nature of Light 4.2: Reflection and Refraction | |
| Friday, Feb 3 | 4.2: Reflection and Refraction (Cont.) | HW 3 Due |
| Week 5 | | |
| Monday, Feb 6 | 4.3: Total Internal Reflection | |
| Tuesday, Feb 7 | 5.1: Plane Mirrors | |
| Wednesday, Feb 8 | LAB 4: Standing Waves in an Air Column | LAB 3 Due |
| Thursday, Feb 9 | 5.2: Images formed by Spherical Mirrors | |
| Friday, Feb 10 | 5.2: Images formed by Spherical Mirrors (Cont.) | HW 4 Due |
| Week 6 | | |
| Monday, Feb 13 | 5.3: Images formed by Thin Lenses | |
| Tuesday, Feb 14 | 5.4: Selected Lens Combinations | |
| Wednesday, Feb 15 | LAB 5: Properties of Refection | LAB 4 Due |
| Thursday, Feb 16 | 6.1: Interference and Young's Double Slit Exp | |
| Friday, Feb 17 | 6.1: Interference and Young's Double Slit Exp (Cont.) | HW 5 Due |
| Week 7 | | |
| Monday, Feb 20 | Family Day (Closed) | |
| Tuesday, Feb 21 | Reading Break | |
| Wednesday, Feb 22 | Reading Break | |

| WEEK or DATE RANGE | ACTIVITY or TOPIC | OTHER NOTES |
|--------------------|--|-------------|
| Thursday, Feb 23 | Reading Break | |
| Friday, Feb 24 | Reading Break | |
| Week 8 | | |
| Monday, Feb 27 | 6.2: Diffraction Gratings | |
| Tuesday, Feb 28 | 6.3: Single-Slit Diffraction | |
| Wednesday, Mar 1 | TEST 2: Modules 3, 4, and 5 | |
| Thursday, Mar 2 | 6.3: Single-Slit Diffraction (Cont.) | |
| Friday, Mar 3 | 6.4: Thin Film Interference | HW 6 Due |
| Week 9 | | |
| Monday, Mar 6 | 6.4: Thin Film Interference (Cont.) | |
| Tuesday, Mar 7 | 6.5: The Michelson Interferometer | |
| Wednesday, Mar 8 | LAB 6: Image Formation in a Single Lens or Mirror | LAB 5 Due |
| Thursday, Mar 9 | 7.1: Temperature, Internal Energy and Heat | |
| Friday, Mar 10 | 7.2: Specific Heat and Calorimetry | HW 7 Due |
| Week 10 | | |
| Monday, Mar 13 | 7.3: Latent Heat 7.4: Thermal Expansion | |
| Tuesday, Mar 14 | 7.4: The Ideal Gas Law | |
| Wednesday, Mar 15 | LAB 7: Electrical Energy and Specific Heat of Water | LAB 6 Due |
| Thursday, Mar 16 | 7.5: Ideal Gas Processes | |
| Friday, Mar 17 | 7.6: First Law of Thermodynamics | HW 8 Due |
| Week 11 | | |
| Monday, Mar 20 | 7.7: Work and Heat in Ideal Gas Processes | |
| Tuesday, Mar 21 | 7.8: Heat Engines | |
| Wednesday, Mar 22 | LAB 8: Interference of Sound Waves | LAB 7 Due |
| Thursday, Mar 23 | 7.8: Heat Engines 7.9: Refrigerators | |
| Friday, Mar 24 | 7.10: Entropy and Second Law of Thermodynamics | HW 9 Due |
| Week 12 | | |
| Monday, Mar 27 | 8.1: Reference Frames and Galilean Relativity | |
| Tuesday, Mar 28 | 8.2: Einstein's Principle of Special Relativity | |
| Wednesday, Mar 29 | TEST 3: Modules 6 and 7 | |
| Thursday, Mar 30 | 8.3: Time Dilation | |
| Friday, Mar 31 | 8.4: Length Contraction | HW 10 Due |
| Week 13 | | |
| Monday, Apr 3 | 8.5: The Lorentz Transformations | |
| Tuesday, Apr 4 | 8.6: Relativistic Momentum and Energy | |
| Wednesday, Apr 5 | LAB 9: The Balmer Series | LAB 8 Due |
| Thursday, Apr 6 | 9.1: The Photoelectric Effect | |
| Friday, Apr 7 | Good Friday (Closed) | |
| Week 14 | | |
| Monday, Apr 10 | Easter Monday (Closed) | |
| Tuesday, Apr 11 | 9.2: Compton Scattering and Pair Production | HW 11 Due |
| Wednesday, Apr 12 | 9.3: Wave-Particle Duality and the Uncertainty Principle | LAB 9 Due |
| Thursday, Apr 13 | 9.4: Modern Theories of the Atom | |
| Friday, Apr 14 | 9.5: Radioactivity | |

Note: There are three term tests which will take place during the Lab periods.

| | | |
|-----------------------------|-------------------|--------------|
| Test 1: Modules 1 and 2 | Wednesday, Feb 1 | 8:30-10:20am |
| Test 2: Modules 3, 4, and 5 | Wednesday, Mar 1 | 8:30-10:20am |
| Test 3: Modules 6 and 7 | Wednesday, Mar 29 | 8:30-10:20am |

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 | 10% |
| Labs | 15% |
| Term Tests (3 @ 15% each) | 45% |
| Final Exam | 30% |
| | 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](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

- 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 (11:59pm) on the Friday of the following week. Any submission 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 as a pdf. Please ensure you submit legible work. If it can't be read, it can't be marked.
- For overdue assignments, a late penalty of 10% per day will be assessed.
- Three term 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 on Wednesday of each week. Lab reports will be due by the end of the day (11:59pm) on the Wednesday of the following week, except for weeks where there is a test or reading break. **Students must be present in the labs 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 grade of zero.
- **Attend the lectures and practice the problems during class. The more ways that you experience the material, the more familiar it will become, and you will have a higher chance of succeeding in this class.**

SCHOOL OR DEPARTMENTAL INFORMATION

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, test, term 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 test. 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 day of class 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 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 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 your instructor, a student who is repeating this Physics course with a laboratory grade of 70% or higher may apply for lab exemption.

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

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

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.

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. To contact the Office of Student Support: 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.