CAMOSUN COLLEGE
School of Arts & Science
Department of Physics & Astronomy

PHYS-141-001
Physics for Science/ENGR 2
Winter 2020

COURSE OUTLINE

The course description is available on the web @ http://camosun.ca/learn/calendar/current/web/phys.html

Ω *Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.*

1. Instructor Information

(a) Instructor	Christopher Avis		
(b) Office hours	Mon. 10:30-11:20, Tues., Weds., Thurs.: 8:30-9:20; Fri.: 11:30-12:20		
(c) Location	F346D		
(d) Phone	250-370-3460	**Alternative:**	
(e) E-mail	avisc@camosun.bc.ca		
(f) Website	D2L (online.camosun.ca)		

2. Intended Learning Outcomes

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 principal 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.

c. State and explore the First and Second Laws of Thermodynamics through investigations into heat transfer, calorimetry and analyses of heat engines.
Solve technical problems involving linear and volume expansion of solids and liquids in response to temperature changes.
d. Apply concepts of specific and latent heat to solve technical calorimetry problems including systems undergoing phase changes.
e. Describe fundamental mechanisms of heat transfer.
f. Apply the Ideal Gas Law and the First Law of Thermodynamics to analyze simple heat engines.
g. Apply the concept of entropy and the Second Law of Thermodynamics to describe limits to the efficiency of heat engines.

4. 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.

5. 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.

3. Required Materials

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

(b) Other: Physics 140/141 Laboratory Manual, Scientific Calculator, Ruler

4. Course Content and Schedule

Mon.	Lecture: 11:30 AM – 12:20 PM	Fisher 316
Tue., Wed., Thu.:	Lecture: 9:30 AM – 10:20 AM	Fisher 316
Fri.:	Lab: 12:30 PM – 2:20 PM	Fisher 316

Tests are scheduled for the following dates:

Test #1: Friday, January 31st
Test #2: Friday, February 28th
Test #3: Friday, March 27th

5. Basis of Student Assessment (Weighting)

(a) Homework: 10 %
(b) Quizzes: 5 %
(c) Labs: 25 %
(d) Term Tests: 30%
(e) Final: 30%

COURSE SPECIFIC POLICIES

- Homework problems for a particular week will cover up to whatever section is finished on the last lecture of that week. They will be due at the **beginning of class** on the Friday of the following week. Students can work on homework assignments together and can hand in assignments in groups of up to three students.

- Short, five minute multiple choice quizzes will be delivered at the start of each Monday's lecture class. These will be based on the previous week's material and the corresponding multiple choice questions found online through D2L.

- Labs for a particular week will be due by the beginning of the lab one week following the lab. Each student is allowed one "dropped" or "missed" lab.

- Some labs will have a portion of their mark assigned based on a preparatory assignment due at the start of the lab. The details of these assessments will be mentioned in class the week before the lab.

PHYSICS DEPARTMENT GUIDELINES REGARDING TESTING AND GRADING:

- The final exam will cover the entire course and will be 3 hours long. 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 prior to the last day of classes, 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.

- Attendance is mandatory & you may be required to "sign in" at the beginning of each lab period. A lab may be waived or made up at a later time only in the case of documented illness or other extenuating circumstances. If you will be absent from a lab period due to illness it is your responsibility to notify your instructor.

- Unless otherwise stated by your instructor late penalties are as follows: For overdue labs (or assignments), 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.

- Students will complete a minimum of 9 laboratory experiments including 3 formal reports (with full uncertainty calculations) and at least at least one lab using technology to perform data analysis.

6. Grading System

[X] Standard Grading System (GPA)

[ ] Competency Based Grading System

7. Recommended Materials to Assist Students to Succeed Throughout the Course

8. College Supports, Services and Policies

Immediate, Urgent, or Emergency Support
If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ http://camosun.ca/about/mental-health/emergency.html or http://camosun.ca/services/sexual-violence/get-support.html#urgent

College Services
Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at http://camosun.ca/

College Policies
Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at http://camosun.ca/about/policies/. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS http://camosun.ca/about/policies/index.html

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at http://camosun.ca/about/policies/index.html for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	*In progress*: A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	*Compulsory Withdrawal*: A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

The following is a tentative lecture and lab schedule for the course.

Date	Lecture / Lab Topic
WEEK #1	
Monday, Jan. 6th	1.1: Mathematical Description of SHM
Tuesday, Jan. 7th	1.1: Mathematical Description of SHM
Wednesday, Jan. 8th	LECTURE: 1.2: Energy in SHM
Thursday, Jan. 9th	1.2: Energy in SHM 1.3: Other Examples of SHM
Friday, Jan. 10th	LAB EXERCISE: Uncertainties, Repeated Measurements
WEEK #2	
Monday, Jan. 13th	1.3: Other Examples of SHM / 1.4 Damping, Forced Oscillations and Resonance
Tuesday, Jan. 14th	2.1: Types of Wave Motion
Wednesday, Jan. 15th	2.2: Mathematical Description of a Wave
Thursday, Jan. 16th	2.3: Speed of Waves
Friday, Jan. 17th	LAB: SIMPLE HARMONIC MOTION
WEEK #3	
Monday, Jan. 20th	2.4: Reflection, Transmission & Interference
Tuesday, Jan. 21st	2.5: Standing Waves on a String.
Wednesday, Jan. 22nd	2.5: Standing Waves on a String
Thursday, Jan. 23rd	3.1: Sound Waves
Friday, Jan. 24th	LAB: STANDING WAVES ON A STRING
WEEK #4	
Monday, Jan. 27th	3.2: Standing Sound Waves
Tuesday, Jan. 28th	3.2: Standing Sound Waves
Wednesday, Jan. 29th	3.3: Beats and the Doppler Effect
Thursday, Jan. 30th	4.1: Nature of Light / 4.2: Reflection & Refraction
Friday, Jan. 31st	Test #1
WEEK #5	
Monday, Feb. 3rd	4.2: Reflection and Refraction of Light
Tuesday, Feb. 4th	4.3: Total Internal Reflection
Wednesday, Feb. 5th	5.1: Plane Mirrors
Thursday, Feb. 6th	5.2: Images formed by Spherical Mirrors
Friday, Feb. 7th	LAB: PROPERTIES OF REFRACTION
WEEK #6	
Monday, Feb. 10th	5.2: Images formed by Spherical Mirrors
Tuesday, Feb. 11th	5.3: Images formed by Thin Lenses
Wednesday, Feb. 12th	5.3: Images formed by Thin Lenses / 5.4: Selected Lens Combinations
Thursday, Feb. 13th	6.1: Interference & Young's Double Slit Experiment
Friday, Feb. 14th	LAB: IMAGE FORMATION w/ A SINGLE LENS / MIRROR
WEEK #7	
Monday, Feb. 17th	Reading Break
Tuesday, Feb. 18th	Reading Break
Wednesday, Feb. 19th	Reading Break
Thursday, Feb. 20th	Reading Break
Friday, Feb 21st	Reading Break
WEEK #8	

Monday, Feb. 24th	6.1: Interference & Young's Double Slit Experiment
Tuesday, Feb. 25th	6.2: Diffraction Gratings / 6.3: Single-Slit Diffraction
Wednesday, Feb. 26th	6.3: Single-Slit Diffraction
Thursday, Feb. 27th	6.4: Thin Film Interference
Friday, Feb. 28th	Test #2
WEEK #9	
Monday, Mar. 2nd	6.4: Thin Film Interference /6.5: The Michelson Interferometer
Tuesday, Mar. 3rd	7.1: Temperature, Internal Energy and Heat
Wednesday, Mar. 4th	7.2: Specific Heat and Calorimetry
Thursday, Mar. 5th	7.3: Latent Heat; 7.4: Thermal Expansion
Friday, Mar. 6th	LAB: INTERFERENCE OF SOUND WAVES
WEEK #10	
Monday, Mar. 9th	7.4: The Ideal Gas Law
Tuesday, Mar. 10th	7.5: Ideal Gas Processes
Wednesday, Mar. 11th	7.6: The First Law of Thermodynamics
Thursday, Mar. 12th	7.7: Work and Heat in Ideal Gas Processes
Friday, Mar. 13th	LAB: STANDING SOUND WAVES

WEEK #11	
Monday, Mar. 16th	7.8: Heat Engines
Tuesday, Mar. 17th	7.8: Heat Engines / 7.9: Refrigerators
Wednesday, Mar. 18th	7.10: Entropy and the 2nd Law of Thermodynamics
Thursday, Mar. 19th	8.1: Einstein's Theory of Special Relativity
Friday, Mar. 20th	LAB: ELECTRICAL ENERGY + SPECIFIC HEAT
WEEK #12	
Monday, Mar. 23rd	8.1: Einstein's Theory of Special Relativity
Tuesday, Mar. 24th	8.2: The Lorentz Transformations
Wednesday, Mar. 25th	8.2: The Lorentz Transformations
Thursday, Mar. 26th	8.3: Relativistic Momentum and Energy
Friday, Mar. 27th	*Test #3 (Physical Optics + Thermodynamics)*
WEEK #13	
Monday, Mar. 30th	9.1: The Photoelectric Effect
Tuesday, Mar. 31st	9.1: The Photoelectric Effect
Wednesday, Apr. 1st	9.2: Compton Scattering and Pair Production
Thursday, Apr. 2nd	9.3: Wave-Particle Duality and the Uncertainty Principle
Friday, Apr. 3rd	LAB: THE BALMER SERIES
WEEK #14	
Monday, Apr. 6th	10.4: Modern Theories of the Atom
Tuesday, Apr. 7th	10.4: Modern Theories of the Atom 10.5: Radioactivity
Wednesday, Apr. 8th	10.5: Radioactivity
Thursday, Apr. 9th	REVIEW
Friday, Apr. 10th	GOOD FRIDAY (NO CLASS)