



DEPARTMENT OF SCIENCE

COURSE OUTLINE – FALL 2019

PC1300 – WAVE MOTION, OPTICS AND SOUND – 3.8(3-1-3/2) UT 82.5 Hours 15 Weeks

INSTRUCTOR: Tanvir Sadiq, Ph.D., P.Eng. **PHONE:** 780.539.2865
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OFFICE HOURS: TBD or By Appointment

DELIVERY MODE(S): Lectures, Seminars, Labs

PREREQUISITE(S)/COREQUISITE: Math 30-1 or equivalent, Math 31 and Physics 30/MA 1000

REQUIRED TEXT/RESOURCE MATERIALS: Any calculus-based physics text including OER may cover the syllabus of this course.

I will assign online homework from *Fundamentals of Physics*, 11th Edition Extended with WileyPlus Access Code, Authors: Halliday, Resnick and Walker, Publisher: Wiley. A **WileyPlus** access code will be required to access the online homework system. Please note that, in the past a Wileyplus Access Code allowed students to use a WileyPlus E-book (stand-alone; the E-book version gives online access only and does not include a physical textbook) as well. Wiley may continue the same policy this year as well.

Lab Manual is required. Information about Lab Manual will be provided during the introductory lab.

CALENDAR DESCRIPTION: This course includes geometric optics, optical instruments, oscillations, waves, sound, interference, and diffraction.

LEARNING OUTCOMES: Upon successful completion, a student is expected to have:

- Reasonable understanding of the concepts of oscillatory motion, superposition of waves, sound and electromagnetic waves, geometrical and physical optics
- Experience with common mathematical and experimental tools, including problem solving for this course.
- Skills collecting and analyzing experimental data.

COURSE OBJECTIVES: This course is designed to be an introduction to university level physics, specifically for students in Engineering. It is assumed that students have mastered or at least been exposed to certain basics in physics (classical physics- forces, Newton's laws, momentum, geometrical optics, waves, etc.). In this course students will gain knowledge about wave motion, acoustics, and optics. The

properties of waves will be discussed. The effect of medium on the properties of waves will be covered. Students will gain knowledge in the reflection, interference, and diffraction of the waves. Students will understand the nature of lenses and their effect on the optical properties.

Laboratory Component

Lab No.	Lab Title	
1	Graphing and Analysis Using Spreadsheets	
2	Focal Length of a Thin Lens	
3	Oscillations of a Spring	
4	Standing Waves on a String	
5	Speed of Sound in Air	
6	Interference of Light	

EVALUATIONS:

Assignments	7.5%	(Online using WileyPlus, + Paper; Late submittal NOT allowed)
Labs	15.0%	(Must pass Lab component to pass the course. Attendance Required)
Seminars & Quizzes	7.5%	(Attendance Required)
Midterms*	30.0%	
Test 1		16 Oct 2019 (10% - 20%)
Test 2		18 Nov 2019 (10% - 20%)
Final Exam	40.0%	(Cumulative, Time & Location TBA by Registrar's office)

*The lowest of the two midterm will be assigned 10% weight and the one with higher score will be assigned 20% grade. The total weight of midterms will not exceed 30%. *None of the midterms will be dropped.*

GRADING CRITERIA (General Guideline only):

Alpha Grade	4-point Equivalent	Percentage Guidelines		Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100		C+	2.3	67-69
A	4.0	85-89		C	2.0	63-66
A-	3.7	80-84		C-	1.7	60-62
B+	3.3	77-79		D+	1.3	55-59
B	3.0	73-76		D	1.0	50-54
B-	2.7	70-72		F	0.0	00-49

**** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability.**

Please refer to the Alberta Transfer guide for current transfer agreements: www.transferalberta.ca

IMPORTANT NOTES:

1. YOU MUST PASS THE LABORATORY SECTION (minimum 50 % average) TO PASS THE COURSE.
All students are expected to come to the laboratory well prepared for the experiment that is to be performed and on time. Students are expected to attend all laboratory periods. Absences due to illness must be substantiated by presenting suitable evidence to the Instructor within five business days of missing the lab. An opportunity to make up a lab will be given only for **excused absences**.
The laboratory experiments are designed to allow a well-prepared student to finish all the work within the allotted time. **IT IS YOUR RESPONSIBILITY TO COMPLETE THE LAB ON TIME.** Formal lab reports should be type-written using the format provided to you by the instructor. Unless instructed otherwise, the lab reports are due the following Friday by 1430. **LATE LAB REPORTS WILL NOT BE ACCEPTED.**
2. CALCULATOR POLICY: Any calculator without communications features that is approved by UAlberta Engineering faculty (e.g. **TI-36XPro** / **TI-30XI**) may be used during PC1300 examinations. Smartphones, Blackberries, Tablets/Laptop computers *etc.* are prohibited. Cellular phones must be shut off during exams.
3. All assignments, and some quizzes must be submitted online using **WileyPlus**. Seminars, recitations *etc.* must be submitted on 8.5 x 11 inch *Engineering Paper* on the due date during class (if applicable). All work must be neat and legible, **done in pencil on one** side of the paper and stapled. Leave space between problems or separate them with straight line. Box your final answers. In case you do not receive your submitted work back with the rest of the class, please see me right away to resolve the problem. For further information see the example handout. Please be advised that ***late submittals will be awarded zero mark.***

All submissions should strictly follow the format provided by the instructor to avoid any penalty.

Your final course grades will be announced by the Student Services. Grades/Marks will NOT be disclosed by email or telephone.

Term Exams: Formula sheet (one sheet of paper 8.5 x 11 inch, both sides), calculator and HB pencils. Calculator: any calculator with no communication features. **TERM TESTS MISSED FOR ANY REASON WILL NOT BE RESCHEDULED.** Students not writing the Term exams, with a valid excuse (as defined by College policy) will have the midterm weight added to the final exam. This is not automatic, and if you miss the mid-term, you should follow all College guidelines and contact your instructor as soon as possible.

Final Exam: Formula sheet (one sheet of paper 8.5 x 11 inch, both sides), calculator and HB pencil required. Note that since the Final Exam is cumulative you can be tested on any of the material listed under course schedule, regardless of whether or not we cover it in-class.

STUDENT RESPONSIBILITIES:

Refer to the College Policy on Student Rights and Responsibilities at

www.gprc.ab.ca/d/STUDENTRIGHTSRESPONSIBILITIES

STATEMENT ON PLAGIARISM AND CHEATING:

Refer to the College Student Misconduct: Academic and Non-Academic Policy at ****Note:** all Academic and Administrative policies are available at

www.gprc.ab.ca/about/administration/policies/

UNIVERSITY TRANSFER (if applicable): UA, UC, UL, AU, Augustana UA, CUC, GMU, KUC

COURSE SCHEDULE:

Chapter 1. Measurement

- 1-1 Measuring Things Including Length
- 1-2 Time
- 1-3 Mass

Chapter 15. Oscillations

- 15-1 Simple Harmonic Motion
- 15-2 Energy in Simple Harmonic Motion
- 15-4 Pendulums, Circular Motion
- 15-5 Damped Simple Harmonic Motion
- 15-6 Forced Oscillations and Resonance

Chapter 16. Waves - I

- 16-1 Transverse and Longitudinal Waves
- 16-2 Wave Speed on a Stretched String
- 16-3 Energy and Power of a Wave Traveling Along a String
- 16-4 The Wave Equation
- 16-5 Interference of Waves
- 16-6 Standing Waves and Resonance

Chapter 17. Waves - II

- 17-1 Speed of Sound
- 17-2 Traveling Sound Waves
- 17-3 Interference
- 17-4 Intensity and Sound Level
- 17-5 Sources of Musical Sound
- 17-6 Beats
- 17-7 The Doppler Effect
- 17-8 Supersonic Speeds, Shock Waves

Chapter 33. Electromagnetic Waves

- 33-1 Electromagnetic Waves
- 33-4 Polarization
- 33-5 Reflection and Refraction
- 33-6 Total Internal Reflection
- 33-7 Polarization by Reflection

Chapter 34. Images

- 34-1 Images and Plane Mirrors
- 34-2 Spherical Mirrors
- 34-3 Spherical Refracting Surfaces
- 34-4 Thin Lenses
- 34-6 Three Proofs

Chapter 35. Interference

- 35-1 Light as a Wave
- 35-2 Young's Interference Experiment
- 35-3 Interference and Double-Slit Intensity
- 35-4 Interference from Thin Films
- 35-5 Michelson's Interferometer

Chapter 36. Diffraction

- 36-1 Single-Slit Diffraction
- 36-2 Intensity in Single-Slit Diffraction
- 36-3 Diffraction by a Circular Aperture
- 36-4 Diffraction by a Double Slit
- 36-5 Diffraction Grating
- 36-6 Intensity in Double-Slit Interference

Note: This list is general. Not all topics listed above will be covered with the same degree of detail. Additional/alternate topics may be covered depending on time constraints and student interest.

Students are expected to attend all classes. Stay awake in class. If you miss a class, make arrangements to copy the notes from your class fellows. If you are using older edition of the textbook, **you** are responsible for matching page numbers, topics, figures, and problems with the editions being used in the class. You are encouraged to ask questions, but do not monopolize the class time. Give others a chance to ask questions as well.