NORTHWESTERN POLYTECHNIC

DEPARTMENT OF SCIENCE

COURSE OUTLINE – Fall 2022

PC1300 (A2): WAVE MOTION, OPTICS AND SOUND – 3.8 (3-1-1.5) 82.5 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR:	**Braden Kelly**	**PHONE:**	(780) 539-2963
OFFICE:	**J218**	**E-MAIL:**	bkelly@nwpolytech.ca
OFFICE HOURS:	unrestricted		

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

PREREQUISITE(S)/COREQUISITE:
Math 30-1 or equivalent, Math 31, and Physics 30/MA1000

REQUIRED TEXT/RESOURCE MATERIALS:
An open source resource from the University of Alberta will be made available to students in pdf form.

Any calculus- based physics text including OER may cover the syllabus of this course.

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

RECOMMENDED TEXT/RESOURCE MATERIALS:

Halliday & Resnick, *Fundamentals of Physics*, 12 Edition. Wiley.

DELIVERY MODE(S):
Lecture, seminars, and Labs.

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.

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.

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.ca.

** 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**

EVALUATIONS:

Component	Weight	Comment
Assignments	12%	Weekly, submitted online.
Quizzes	3%	Weekly, based on weekend videos and readings.
Laboratory	20%	Minimum 50% to pass the course
Midterm Exam	20%	October 14th, 2022 (Friday) in class. Self made formula sheet allowed
Final Exam	45%	TBA
Total	100%	

Course organization: Blended learning format.

Each week you will be asked to prepare for class by working through the assigned material on your own as well as taking a short online quiz.

- **Weekly preparation:** Online videos and reading will be assigned on D2L almost every weekend. After watching the videos you will complete a short, fairly simple online quiz before the start of lectures that week. There will be 11 weekly quizzes, and the quiz with the lowest mark will be dropped. Note: deadlines will never be extended.
- **Lectures:** Monday and Friday lectures will build on and add new material to that in the weekend videos and readings. Since the weekend preparation will cover the basics more time will be spent on challenging concepts and working through example problems.

- **Seminars:** The Friday seminars will be used to work additional example problems if necessary and will also allow students to work on their weekly homework. The instructor will be available to help with questions in a guiding sort of manner.
- **Online homework assignments:** are hosted on D2L. They will typically appear on Monday and be due on Saturday at midnight. There will be about 10 assignments of which the best 9 will count.

GRADING CRITERIA: (The following criteria may be changed to suite the particular course/instructor)

Please note that most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

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

COURSE SCHEDULE/TENTATIVE TIMELINE:

Week		Day	Date	Topic	Details	Due Dates	Item
	L01	Fri	02-Sep				
	Weekly Videos			**Simple Harmonic Motion I**	• Period, (angular) frequency, amplitude, phase • Equation of motion for horizontal mass-spring system		
				Reading	1.1, 1.5, 5.1 to 5.2.3, 5.4 (optional: 5.3)		
1		Mon	05-Sep	Labour Day			
	S01	Fri	09-Sep		Seminar		
2	L02	Fri	09-Sep		• Amplitude and phase from initial conditions • Example problems	Fri. Sep 9	Quiz 1
	Weekly Videos			**Simple Harmonic Motion II**	• Velocity and acceleration for mass-on-spring • Energy of Simple Harmonic Oscillator (SHM)		
				Reading	5.2.4, 5.5, 5.6 (exclude 5.6.2), 5.7, 5.8		
3	L03	Mon	12-Sep		• The Pendulum • Amplitude and phase from initial conditions	Mon Sep 12	HW 1 Quiz 2
	S02	Fri	16-Sep		Seminar		
	L04	Fri	16-Sep		•Example Problems		
4	Weekly Videos			**Damped and Driven Oscillators**	• Damped Oscillators • Types of Damping • Driven oscillators		

				Reading	6.1 to 6.3 (optional derivations in 6.3.1 & 6.3.2), 6.3.3		
	L05	Mon	19-Sep		• Damping examples: pendulum decay • resonance	Mon Sep 19	HW 2 Quiz 3
	Lab1	Tues	20-Sep		Oscillators		
	S03	Fri	23-Sep		Seminar		
	L06	Fri	23-Sep		• Transient vs. Steady state solutions		
5	Weekly Videos			**The Wave Equation**	• Period, wavelength, wavenumber, phase velocity • Partial derivatives • Deriving the wave equation		
				Reading	7.1 to 7.5 (optional: appendices A.11 and A.2)		
	L07	Mon	26-Sep		• Solutions to the wave equation • Phase and medium velocities • Low amplitude transverse waves on a string	Mon Sep 26	HW 3 Quiz 4
		Fri	30-Sep	National Day for Truth and Reconciliation			
6	Weekly Videos			**Acoustic Waves and Superposition**	• Bulk modulus, pressure and density • Acoustic wave equation • Principles of superposition		
				Reading	2.3.3, 3.1-3.2,7.6, 8.1-8.3+7.7-7.9, 8.4		
	L08	Mon	03-Oct		• Wave intensity • Decibal scale	Mon Oct 3	HW 4 Quiz 5
	Lab2	Tues	04-Oct				
	S04	Fri	07-Oct		Seminar		
	L09	Fri	07-Oct		• Interference pattern from two point sources • Beats • Possibly cover Doppler effect and Shockwaves, sonic boom		
7	Weekly Videos			**None**			
				Reading	8.6 (exclude 8.6.2), 8.7 (material will not be on the midterm)		
		Mon	11-Oct	**Thanksgiving Day**			
	S02	Fri	14-Oct		Seminar	Fri Oct 14	
		Fri	14-Oct	**Midterm Exam**		Fri Oct 14	
8	Weekly Videos			**Physics of Music**	• Reflection at a boundary • Standing waves on strings • Standing waves on pipes		
				Reading	8.2, 8.5		
	L10	Mon	17-Oct		• Harmonics of standing waves	Mon Oct 17	HW 5 Quiz 6
	Lab3	Tues	18-Oct				
	S05	Fri	21-Oct		Seminar		
	L11	Fri	21-Oct		• Harmonics and physics of music		

9	Weekly Videos			**Geometric Optics**	• Reflection of light waves and images • Refraction and Snell's law		
				Reading	all of chapter 9		
	L12	Mon	24-Oct		Curved mirrors and image formation	Mon Oct 24	HW 6 Quiz 7
	S06	Fri	28-Oct		Seminar		
	L12	Fri	28-Oct		• Thin Lenses		
10	Weekly Videos			**Optical Instruments**	• Lensmaker equation • Spherical and chromatic aberrations		
				Reading	all of chapter 10		
	L13	Mon	31-Oct		• Magnifying glass • Microscope	Mon Oct 31	HW 7 Quiz 8
	Lab4	Tues	01-Nov				
	S07	Fri	04-Nov		Seminar		
	L14	Fri	04-Nov		• Refracting and reflecting telescopes		
11	Weekly Videos			**Huygens' Principle, Polarization, Dispersion**	• Polarization • Brewster's Angle • Dispersion		
				Reading	11.1 to 11.3		
		Mon	07-Nov	**Reading Week**			
		Fri	11-Nov				
		Fri	11-Nov				
	L15	Mon	14-Nov		• Examples of polarization • Huygen's principle and refraction	Mon Nov 14	HW 8 Quiz 9
	S08	Fri	04-Nov		Seminar		
	L16	Fri	04-Nov		• Dispersion examples • Rainbows		
12	Weekly Videos			**Interference of light**	• Interference in thin films • Newton's rings		
				Reading	11.4, 11.5		
	L17	Mon	21-Nov		• Thin wedge interference • Anti-reflective coating and optical filters	Mon Nov 21	HW 8 Quiz 9
	Lab5	Tues	22-Nov				
	S09	Fri	25-Nov		Seminar		
	L18	Fri	25-Nov		• Interferometers • Detecting gravitational waves		
13	Weekly Videos			**Diffraction**	• Diffraction - intro with water waves • Single slit diffraction • Double slit diffraction		
				Reading	11.6, 11.7		

	L19	Mon	28-Nov		• Diffraction - double wide slits	Mon Nov 28	HW 9 Quiz 10
	S10	Fri	02-Dec		Seminar		
	L20	Fri	02-Dec		• Circular aperture • Resolving power of telescopes		
				Diffraction Cont'd			
	L21	Mon	05-Dec		• Diffraction gratings •Resolving power for diffraction grating	Mon Nov 21	HW 10 Quiz 11
	Lab6	Tues	06-Dec				
	S11	Fri	07-Dec		Seminar		
	L22	Fri	07-Dec		Finish course material, review for final exam		

STUDENT RESPONSIBILITIES:

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. Formal lab reports should be type-written using the format provided to you by the instructor.

CALCULATOR POLICY: Any calculator without communications features that is approved by UAlberta Engineering faculty (*e.g.* **TI-36XPro** / **TI-30XII**) may be used during PC1300 examinations. Smartphones, Blackberries, Tablets/Laptop computers *etc.* are prohibited. Cellular phones must be shut off during exams. All calculators with removable covers must have the covers removed and stored elsewhere during the exam.

Braden's Odds and Ends…

When writing exams, ensure that you bring your student I.D. with you, and that you write your student I.D. on each page of the examination. Do not write your name on each page, only your student I.D.

Exam attire: Headware worn in a way that obstructs the invigilator from seeing the eyes of a student are not allowed. An example is brim-forward baseball caps. Baseball caps can be worn with brims facing backwards, like the cool kids wear them. Hoodies must have the hoods down. This is in part to ensure no Sith Lords take the exams. Dark or tinted eyewear are also not permitted during an exam without a doctor's note. This is not due to Corey Hart.

STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Calendar at https://www.nwpolytech.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at https://www.nwpolytech.ca/about/administration/policies/index.html

**Note: all Academic and Administrative policies are available on the same page.