



DEPARTMENT Of Science

COURSE OUTLINE – Fall 2023

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:	Dr. Braden Kelly	PHONE:	(780) 539-2963
OFFICE:	J218	E-MAIL:	bkelly@nwpolytech.ca
OFFICE HOURS:	Unrestricted drop-in.		

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:

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

DELIVERY MODE(S):

Lectures: Tuesday & Thursday, 10:00 – 11:20am, room J201

Seminar S1: Friday 8:30-9:20am, room J226

Seminar S2: Friday 11:30am – 12:20pm. room J226

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.alberta.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	4%	Weekly, submitted online.
Seminars	8%	Weekly, submitted in seminar
Quizzes	3%	Weekly, based on weekend videos and readings.
Laboratory	20%	Minimum 50% to pass the course
Midterm Exam 1	10-15%	TBD Likely 2 nd week of October
Midterm Exam 2	10-15%	TBD Likely 3 rd week of November
Final Exam	40%	TBA
Total	100%	

Best midterm mark will be weighted as 15%, worst will be weighted as 10%

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:** Tuesday and Thursday 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 require completion of a set of seminar questions. The questions are due at the end of seminar and are graded.

Students may work together but must submit their own work. Students may bring their notes and textbook, but may not use outside resources.

- **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:

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

Grading Chart for courses with Alpha Grading:

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	95-100	C+	2.3	67-69
A	4.0	85-94	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
1	Weekly Videos		Simple Harmonic Motion I	<ul style="list-style-type: none"> • Period, (angular) frequency, amplitude, phase • Equation of motion for horizontal mass-spring system 		
	L01	Tues	05-Sep	Introduction.		
	L02	Thurs	07-Sep	<ul style="list-style-type: none"> • Characteristics of Simple Harmonic Motion • Vertical Mass spring system 	Thurs Sep 07	Quiz 1
	S01	Fri	08-Sep	<ul style="list-style-type: none"> • Seminar 		
2	Weekly Videos		Simple Harmonic Motion II	<ul style="list-style-type: none"> • Velocity and acceleration for mass-on-spring • Energy of Simple Harmonic Oscillator (SHM) 		
	Lab1	Mon	11-Sep	Section L1	Mon Sep 12	Quiz 2
	L03	Tues	12-Sep	<ul style="list-style-type: none"> • Amplitude & Phase from simple initial conditions • Example Problems 	Mon Sep 12	HW 1



	L04	Thurs	14-Sep		<ul style="list-style-type: none"> • The Pendulum • Amplitude and phase from initial conditions 			
	S02	Fri	15-Sep		<ul style="list-style-type: none"> • Seminar 			
3	Weekly Videos			Damped and Driven Oscillators	<ul style="list-style-type: none"> • Damped Oscillators • Types of Damping • Driven oscillators 			
	Lab1	Mon	18-Sep		Section L2	Mon Sep 19	Quiz 3	
	L05	Tues	19-Sep		<ul style="list-style-type: none"> • Damping examples: pendulum decay • resonance 	Mon Sep 19	HW 2	
	L06	Thurs	21-Sep		<ul style="list-style-type: none"> • Transient vs. Steady state solutions 			
	S03	Fri	22-Sep		<ul style="list-style-type: none"> • Seminar 			
4	Weekly Videos			The Wave Equation	<ul style="list-style-type: none"> • Period, wavelength, wavenumber, phase velocity • Partial derivatives • Deriving the wave equation 			
	Lab2	Mon	25-Sep		Section L1	Mon Sep 25	Quiz 4	
	L07	Tues	26-Sep		<ul style="list-style-type: none"> • Solutions to the wave equation • Phase and medium velocities 	Mon Sep 25	HW 3	
	L08	Thurs	28-Sep		<ul style="list-style-type: none"> • Low amplitude transverse waves on a string 			
	S04	Fri	29-Sep		<ul style="list-style-type: none"> • Seminar 			
5	Weekly Videos			Acoustic Waves and Superposition	<ul style="list-style-type: none"> • Bulk modulus, pressure and density • Acoustic wave equation • Principles of superposition 			
	Lab2	Mon	02-Oct		Section L2	Mon Oct 3	Quiz 5	
	L09	Tues	03-Oct		<ul style="list-style-type: none"> • Wave intensity • Decibal scale 	Mon Oct 3	HW 4	
	L10	Thurs	05-Oct		<ul style="list-style-type: none"> • Interference pattern from two point sources • Beats 			
	S05	Fri	06-Oct		<ul style="list-style-type: none"> • Seminar 			
6	Weekly Videos			None				
		Mon	09-Oct	Thanksgiving Day			Mon Oct 9	HW 5
	L11	Tues	10-Oct		<ul style="list-style-type: none"> • Doppler effect • Shockwaves, sonic boom • Review for Exam 			
	L12	Thurs	12-Oct	MIDTERM EXAM				
	S06	Fri	13-Oct		<ul style="list-style-type: none"> • Seminar 			
7	Weekly Videos			Physics of Music	<ul style="list-style-type: none"> • Reflection at a boundary • Standing waves on strings • Standing waves on pipes 			
	Lab3	Mon	16-Oct		Section L2	Mon Oct 16	Quiz 6	
	L13	Tues	17-Oct		<ul style="list-style-type: none"> • Harmonics of standing waves 	Mon Oct 16	HW 6	
	L14	Thurs	19-Oct		<ul style="list-style-type: none"> • Harmonics and physics of music 			



	S07	Fri	20-Oct		• Seminar		
8	Weekly Videos			Geometric Optics	• Reflection of light waves and images • Refraction and Snell's law		
	Lab3	Mon	23-Oct		Section L1	Mon Oct 23	Quiz 7
	L15	Tues	24-Oct		• Curved mirrors and image formation	Mon Oct 23	HW 7
	L16	Thurs	26-Oct		• Thin Lenses		
	S08	Fri	27-Oct		• Seminar		
9	Weekly Videos			Optical Instruments	• Lensmaker equation • Spherical and chromatic aberrations		
	Lab3	Mon	30-Oct		Section L2	Mon Oct 30	Quiz 8
	L17	Tues	31-Oct		• Magnifying glass • Microscope	Mon Oct 30	HW 8
	L18	Thurs	02-Nov		• Refracting and reflecting telescopes		
	S09	Fri	03-Nov		• Seminar		
10	Weekly Videos			Huygens' Principle, Polarization, Dispersion	• Polarization • Brewster's Angle • Dispersion		
	Lab4	Mon	06-Nov		Section L1	Mon Nov 14	Quiz 9
	L19	Tues	07-Nov		• Examples of polarization • Huygen's principle and refraction	Mon Nov 14	HW 9
	L20	Thurs	09-Nov		• Dispersion examples • Rainbows		
	S10	Fri	10-Nov		• Seminar		
11	Weekly Videos			None	None		
		Tues	14-Nov	Reading Week			
		Thurs	16-Nov				
		Fri	17-Nov				
12	Weekly Videos			Interference of light	• Interference in thin films • Newton's rings		
	Lab4	Mon	20-Nov		Section L2	Mon Nov 21	Quiz 10
	L21	Tues	21-Nov		• Thin wedge interference • Anti-reflective coating and optical filters	Mon Nov 21	HW 10
	L22	Thurs	23-Nov		• Interferometers • Detecting gravitational waves		
	S11	Fri	24-Nov		• Seminar		
13	Weekly Videos			Diffraction	• Diffraction - intro with water waves • Single slit diffraction • Double slit diffraction		
	Lab5	Mon	27-Nov		Section L1	Mon Nov 28	Quiz 11
	L23	Tues	28-Nov		• Diffraction - double wide slits		



	L24	Thurs	30-Nov		<ul style="list-style-type: none"> • Circular aperture • Resolving power of telescopes 		
	S12	Fri	01-Dec		<ul style="list-style-type: none"> • Seminar 		
14				Diffraction Cont'd			
	Lab5	Mon	04-Dec		Section L2	Mon Dec 4	HW 11
	L25	Tues	05-Dec		<ul style="list-style-type: none"> • Diffraction gratings • Resolving power for diffraction grating 		
	L26	Thurs	07-Dec		<ul style="list-style-type: none"> • Finish course material 		
	S13	Fri	08-Dec		<ul style="list-style-type: none"> • Seminar 		
15				Review			
	L27	Tues	12-Dec		<ul style="list-style-type: none"> • Review for final exam 		

The schedule will be subject to change and is meant as a rough guide only. Refer to the up-to-date version on MyClass and in-class announcements for changes. This is meant to show the order of the course content, not necessarily the timeline.

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.

Final Exam Period:

The final exam period for Engineering will follow a modified schedule this year. Students in Engineering will have an exam period that is one (1) day longer than the official final exam period for NWP students.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at <https://www.nwpolytech.ca/about/administration/policies/index.html>.

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

Additional Information:

Submitting Late work is not allowed. Late work will be given a grade of zero and will not be marked.