NORTHWESTERN POLYTECHNIC

DEPARTMENT Of Science

COURSE OUTLINE – Fall 2024

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:

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, 12th Edition. Wiley.

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DELIVERY MODE(S):

Lectures: Monday & Wednesday, 8:30 – 9:50am, room J201
Seminar S1: Friday 10:00-10:50am, room J203
Seminar S2: Friday 11:30am – 12:20pm. room J204

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 2nd week of October
Midterm Exam 2	10-15%	TBD Likely 3rd week of November
Final Exam	40%	TBA
Total	100%	

Highest midterm mark will be weighted as 15%, lowest 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.
- **Homework assignments:** There will be 12 assignments of which the best 10 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

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COURSE SCHEDULE/TENTATIVE TIMELINE:

Week		Day	Date	Topic	Details	Due Dates	Item
1	L01	Wed	04-Sep		Introduction.		
	S01	Fri	06-Sep		Partial Derivatives/Excel/Word		
2	Weekly Videos			**Simple Harmonic Motion I**	• Period, (angular) frequency, amplitude, phase • Equation of motion for horizontal mass-spring system		
	L02	Mon	09-Sep		• Characteristics of Simple Harmonic Motion • Vertical Mass spring system	05-Sep, M	Quiz 1
	Lab1	Tues	10-Sep		Spring Constant Experiment		
	L03	Wed	11-Sep		• Amplitude & Phase from simple initial conditions		
	S02	Fri	13-Sep		• Seminar		
3	Weekly Videos			**Simple Harmonic Motion II**	• Velocity and acceleration for mass-on-spring • Energy of Simple Harmonic Oscillator (SHM)		
	L04	Mon	16-Sep		• The Pendulum • Amplitude and phase from initial conditions	Sep 16, M	Quiz 2 HW 1
	L05	Wed	18-Sep		• Damping examples: pendulum decay • resonance		
	S03	Fri	20-Sep		• Seminar		
4	Weekly Videos			**Damped and Driven Oscillators**	• Damped Oscillators • Types of Damping • Driven oscillators		
	L06	Mon	23-Sep		Section L2	Mon Sep 23	Quiz 3
	Lab2	Tues	24-Sep		• Transient vs. Steady state solutions	Mon Sep 23	HW 2
	L07	Wed	25-Sep		• Solutions to the wave equation • Phase and medium velocities		
	S04	Fri	27-Sep		• Seminar		
5	Weekly Videos			**The Wave Equation**	• Period, wavelength, wavenumber, phase velocity • Partial derivatives • Deriving the wave equation		
	L08	Mon	30-Sep		Reconciliation Day	Tue Oct 1	Quiz 4
	Lab2	Tues	01-Oct		Spring Constant	Oct 2, W	HW 3
	L09	Wed	02-Oct		• Low amplitude transverse waves on a string		
	S05	Fri	04-Oct		• Seminar		

6	Weekly Videos			**Acoustic Waves and Superposition**	• Bulk modulus, pressure and density • Acoustic wave equation • Principles of superposition		
	Lab3	Mon	07-Oct		Section L2	Mon Oct 7	Quiz 5
	L10	Tues	08-Oct		• Wave intensity • Decibal scale	Mon Oct 7	HW 4
	L11	Wed	09-Oct		• Interference pattern from two point sources • Beats		
	S06	Fri	11-Oct		• Seminar		
7	Weekly Videos			**None**			
		Mon	14-Oct	**Thanksgiving Day**		Mon Oct 9	HW 5
	Lab3	Tues	15-Oct		Spring Constant		
		Wed	16-Oct	**MIDTERM #1 EXAM**			
	S07	Fri	18-Oct		• Doppler effect • Shockwaves, sonic boom • Review for Exam		
8	Weekly Videos			**Physics of Music**	• Reflection at a boundary • Standing waves on strings • Standing waves on pipes		
	L12	Mon	21-Oct		**Section L2**	Mon Oct 21	Quiz 6
	Lab4	Tues	22-Oct		• Harmonics of standing waves	Mon Oct 21	HW 6
	L13	Wed	23-Oct		• Harmonics and physics of music		
	S08	Fri	25-Oct		• Seminar		
9	Weekly Videos			**Geometric Optics**	• Reflection of light waves and images • Refraction and Snell's law		
	L14	Mon	28-Oct		• Curved mirrors and image formation	Mon Oct 28	Quiz 7
	Lab4	Tues	29-Oct			Mon Oct 28	HW 7
	L15	Thurs	30-Oct		• Thin Lenses		
	S09	Fri	01-Nov		• Seminar		
10	Weekly Videos			**Optical Instruments**	• Lensmaker equation • Spherical and chromatic aberrations		
	L16	Mon	04-Nov		• Magnifying glass • Microscope	Mon Nov 4	Quiz 8
	--	Tues	05-Nov		No LAB	Mon Nov 4	HW 8
	L17	Wed	06-Nov		• Refracting and reflecting telescopes		
	S10	Fri	08-Nov		• Seminar		
11	Weekly Videos			**None**	None		
		Tues	12-Nov	**Reading Week**			
		Wed	13-Nov				
		Fri	15-Nov				

12	Weekly Videos			**Huygens' Principle, Polarization, Dispersion**	• Polarization • Brewster's Angle • Dispersion		
	--	Mon	18-Nov	**MIDTERM #2 EXAM**		Mon Nov 18	Quiz 9
	--	Tues	19-Nov		NO LAB	Mon Nov 18	HW 9
	L18	Wed	20-Nov		• Examples of polarization • Huygen's principle and refraction • Dispersion examples • Rainbows		
	S11	Fri	22-Nov		• Seminar		
13	Weekly Videos			**Interference of light**	• Interference in thin films • Newton's rings		
	L19	Mon	25-Nov		• Thin wedge interference • Anti-reflective coating and optical filters	Mon Nov 21	Quiz 10
	Lab5	Tues	26-Nov			Mon Nov 21	HW 10
	L20	Wed	27-Nov		• Interferometers • Detecting gravitational waves		
	S12	Fri	29-Nov		• Seminar		
14	Weekly Videos			**Diffraction**	• Diffraction - intro with water waves • Single slit diffraction • Double slit diffraction		
	L21	Mon	02-Dec		• Diffraction - double wide slits	Mon Nov 28	Quiz 11
	Lab5	Tues	03-Dec				
	L22	Wed	04-Dec		• Circular aperture • Resolving power of telescopes		
	S13	Fri	06-Dec		• Seminar		
15				**Diffraction Cont'd**			
	L23	Mon	09-Dec		• Diffraction gratings •Resolving power for diffraction grating	Mon Dec 4	HW 11
	--	Tues	10-Dec		NO LAB		

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.