Grande Prairie Regional College
Department of Science and Technology

PC 1300 A2 – Wave Motion, Optics and Sound
Fall 2003
3.8(3-0-1.5)UT

Administrative Details

Instructor	Jaime P. Santiago J209 539-2865 santiago@gprc.ab.ca
Lectures	TR 9:00 – 9:50 am J203 F 9:00 – 9:50 am J228
Laboratory Work	F 10:00 – 11:20 am J103 F 11:30 – 12:50 am J101
Marks Distribution	
Assignments	10 %
Laboratory	20 % (Note: Student must pass lab component to pass course!)
Tests (3)	12 % each for a total of 36%
Final Exam	34 %
Tests	
Dates	Tuesdays, Oct. 7, Nov. 4 and Dec. 2, 2003
Place	J203 (regular classroom)
Time	9:00 – 9:50 a.m.
Textbook and Laboratory Manual	*University Physics, 11ᵗʰ Edition* Hugh D. Young and Roger A. Freedman Pearson/Addison-Wesley *Phys 130/En Ph 131 Laboratory Manual* Department of Physics University of Alberta
Course Website	http://www.gprc.ab.ca/departments/physics and follow the links.

Course Description and Syllabus

Calendar Description

PC 1300 3.8(3-0-1.5)UT – Wave Motion, Optics and Sound

This course includes: geometrical optics, optical instruments, oscillations, waves, sound, interference, and iffraction.

Prerequisites: Pure Mathematics 30, Mathematics 31 and Physics 30.
Corequisites: MA 1000

Note: Restricted to Engineering students only.

Syllabus

Part 1: Geometric Optics

1. The Nature and Propagation of Light (Chapters 32, 33 and 34)
   1.1. The nature of light, wavefronts and ray approximation
   1.2. Reflection and refraction
   1.3. Dispersion and Polarization
   1.4. Huygen's Principle
   1.5. Reflection and Refraction at a Plane Surface
   1.6. Reflection and Refraction at a Spherical Surface
   1.7. Thin lenses
   1.8. Optical instruments (magnifying glass, human eye, camera, microscope, telescope)

Part 2: Oscillations and Waves (Chapters 13, 15 and 16)

2. Periodic Motion (Chapter 13)
   2.1. Oscillations
   2.2. Simple harmonic motion
   2.3. Harmonic motion and circular motion
   2.4. Energy in simple harmonic oscillations
   2.5. Applications of Simple Harmonic Motion
   2.6. The simple and physical pendulums
   2.7. Damped and forced oscillations; Resonance

3. Mechanical Waves (Chapter 15)

   3.1. Characteristics of waves; transverse and longitudinal waves; wavelength and frequency

   3.2. Mathematical description of a wave
   3.3. Speed of a transverse wave
   3.4. Energy in wave motion
   3.5. Wave interference, boundary conditions and superposition
   3.6. Standing waves on a string
   3.7. Normal modes of a string

4. Sound and Hearing (Chapter 16)

    4.1. Characteristics of sound waves
    4.2. Speed of sound
    4.3. Sound intensity
    4.4. Standing sound waves and normal modes
    4.5. Resonance
    4.6. Interference of waves; beats
    4.7. The Doppler Effect; Shock waves

Part 3: Physical Optics (Chapters 35 and 36)

5. Interference (Chapter 35)

    5.1. Interference and coherent sources
    5.2. Two-Source interference of light
    5.3. Intensity in interference patterns
    5.4. Thin films

6. Diffraction (Chapter 36)

    6.1. Fresnel and Frauhofer diffraction
    6.2. Diffraction from a single slit
    6.3. Intensity in the single-slit pattern
    6.4. Multiple slits
    6.5. The diffraction grating
    6.6. Circular apertures and resolving power

Laboratory Component

Lab No.	Lab Title	Date
1	Introduction to lab, Microsoft Excel, Microsoft Word	Sept. 5/12
2	Geometrical Optics	Sept. 19/26
3	Oscillations of a Spring	Oct. 3/10
4	Standing Waves on a String	Oct. 17/Oct. 24
5	Speed of Sound in Air	Oct. 31/Nov.7
6	Interference of Light	Nov. 14/21

Assignments

Assignments will be assigned every class meeting and due the following class. Assignments will also be posted on the course website. Solutions will be posted on the course website after their due dates. No late assignment will be accepted.

PC 1300 Lecture Topics: Fall, 2003 Textbook: University Physics, 11th Ed. (Young and Freedman) Course Website: http://www.gprc.ab.ca/departments/physics Textbook Website: http://www.aw.com/young11					
Lecture No.	**Topic**	**Chapter-Section**	**Date**	**Assignment**	**Due Date**
1	Course introduction, the nature of light, waves and particles, electromagnetic waves, spectrum, wavelength, amplitude	33.1, 32.2, 32.3, 32.6	4-Sep	Ex 32.2, 32.32	5-Sep
2	Reflection and Refraction	33.2	5-Sep	Prob 33.34, 33.40	9-Sep
3	Total internal reflection, Dispersion	33.3, 33.4	9-Sep	Prob 33.46, 33.54	11-Sep
4	Polarization	34-9	11-Sep	Ex 33.29	12-Sep
5	Huygen's Principle	33.7	12-Sep	Prob 33.49, 33.51	16-Sep
6	Reflection and Refraction at a Plane Surface, Image Formation by a Plane Mirror	34.1	16-Sep	Ex. 34.2, Prob 34.78	18-Sep
7	Reflection at a Spherical Surface	34.2	18-Sep	Prob 34.69	19-Sep
8	Convex Mirrors, Graphical Methods for Mirrors	34.2	19-Sep	Ex 35.4, Prob 34.93	23-Sep
9	Refraction at a Spherical Surface	34.3	23-Sep	Ex. 34.22, Prob 34.82	25-Sep
10	Thin Lenses	34.4	25-Sep	Ex 34.48	26-Sep
11	Graphical Methods for Lenses	34.4	26-Sep	Ex 34.30, 34.32 Prob 34.99	30-Sep
12	Camera, The Eye, The Magnifier, Microscopes and Telescopes	34.5, 34.6, 34.7, 34.8	30-Sep	Prob 34.106, 34.109	2-Oct
13	Periodic Motion, Describing Oscillation, Simple Harmonic Motion	13.1	2-Oct	Ex 13.4, Prob 13.58	3-Oct
14	Equations of SHM, Displacement Velocity and Acceleration in SHM	13.2	3-Oct	Prob 13.63, 13.74 Ex 13.14	9-Oct
	Test 1		7-Oct		
15	Energy in Siimple Harmonic Motion	13.3	9-Oct	Ex 13.28 (Use energy), Prob 13.84	10-Oct
16	Applications of Siimple Harmonic Motion	13.4	10-Oct	Prob 13.80, 13.95	14-Oct

17	The Simple Pendulum, The Physical Pendulum	13.5, 13.6	14-Oct	Prob 13.86, 13.88	16-Oct
18	Dampled Oscillations, Forced Oscillations and Resonance	13.7,13.8	16-Oct	Ex 13.52, 13.55	17-Oct
19	Mechanical Waves, Types of Mechanical Waves, Periodic Waves, Mathematical Description of a Wave	15.1, 15.2, 15.3	17-Oct	Ex 15.7, 15.11	21-Oct
20	Particle Velocity and Acceleration in a Sinusoidal Wave, Speed of a Transverse Wave	15.3, 15.4	21-Oct	Prob 15.47, 15.80	23-Oct
21	Energy in Wave Motion	15.5	23-Oct	Ex 15.24, Prob 15.63(a)	24-Oct
22	Wave Interference, Boundary Conditions, and Superposition; Standing Waves on a String	15.6, 15.7	24-Oct	Ex 15.27, 15.33	28-Oct
23	Normal Modes of a String	15.8	28-Oct	Ex 15.43 Prob 15.72	30-Oct
24	Sound Waves	16.1	30-Oct	Ex 16.1, 16.2	4-Nov
25	Test 2		31-Oct		
	Speed of Sound Waves	16.2	4-Nov	Ex 16.10, 16.11	6-Nov
26	Sound Intensity	18-9	6-Nov	Ex 16.23(a) Prob 16.48, 16.50	7-Nov
27	Standing Sound Waves and Normal Modes, Resonance	16.4, 16.5	7-Nov	Prob 16.53, 16.57	13-Nov
28	Interference of Waves, Beats	16.6, 16.7	13-Nov	Prob 16.62	14-Nov
29	The Doppler Effect, Shock Waves	16.8, 16.9	14-Nov	Prob 16.66, 16.74	18-Nov
30	Interference and Coherent Sources	35.1	18-Nov	Prob 35.41, 35.45	20-Nov
31	Two-Source Interference of Light	35.2	20-Nov	Ex 35.10, 35.16	21-Nov
32	Intensity in Interference Patterns	35.3	21-Nov	Ex 25.23, Prob 35.48	25-Nov
33	Interference in Thin Films	35.4	25-Nov	Prob 35.52, 35.56	27-Nov
34	Fresnel and Fraunhofer Diffraction, Diffraction from a Single Slit	36.1, 36.2	27-Nov	Prob 36.53	2-Dec
35	Test 3		28-Nov		
	Intensity in a Single-Slit Pattern	36.3	2-Dec	Ex 36.14 Prob 36.55	4-Dec
36	Multiple Slits, The Diffraction Grating	36.4, 36.5	4-Dec	Ex 36.26	5-Dec
37	Circular Apertures and Resolving Power	36.7	5-Dec	Prob 36.58, Ex 36.34, 36.41	9-Dec

Grades

Letter Grade	4-Point Equivalent	Designation
A+	4.0	Excellent
A	4.0	
A-	3.7	First Class Standing
B+	3.3	
B	3.0	Good
B-	2.7	
C+	2.3	Satisfactory
C	2.0	
C-	1.7	
D+	1.3	Minimal Pass
D	1.0	
F	0.0	Fail