

West Chester University, Department of Physics

PHY100-01/02: Waves of Reality (Fall 2020)

Prof. Brandon Mitchell Room SSS-402A e-mail:
bmitchell@wcupa.edu <mailto:mitchebj@mountunion.edu>

Office Hours: My office hours for Fall 2020 are:

M: 1:30 – 2:30

W: 1:30 – 3:30

F: 1:30 – 2:30

Please sign up for office hours at: <https://calendly.com/prof-mitchell>

Recommended Reading: Physics in the Arts (1st or 2nd Ed.) by P.U.P.A Gilbert and W. Haeberli, Academic Press.

Course Web Page:

D2L

The entire course is housed on D2L. The main page contains our schedule and required assignments and lecture videos.

Lecture Notes: The lecture notes are a critical tool for your learning experience. They contain a summary of the relevant information and provide an outline for the content. They will also contain several examples. The notes will only be partially filled in, which means watching the lecture videos is necessary. The lecture notes will be provided via D2L, so be sure to download them.

Worksheets: At least once a week there will be a worksheet, which goes along with the current subject matter. You should work on these problems before you watch the video explanation.

Content: This is a special section of PHY100 called **Waves of Reality**. This class will be geared towards how physics shows up in art and music. We will initially study what will seem like basic physics: force and motion, electric and magnetic fields, periodic oscillations, and wave properties. We will then begin to focus on light, optics and color and the human eye. Next we will focus on sound, sound production, sound perception and the organization of sound into musical scales such that “music” can be constructed.

West Chester University General Education Goals: PHY 100 is an approved course in the WCU General Education program. As such, it is designed to help students meet the following general education goals:

General Education Goal #2: Employ quantitative concepts and mathematical methods
(secondary course objective)

General Education Goal #3: Think critically and analytically (primary course objective)

More specifically, after successfully completing this course a student will be able to:

- Mathematically describe mechanical systems.
- Recognize concepts of physics in action in mechanical systems, including force and wave phenomena. This includes the propagation of light and sound and how it can be manipulated.
- Analyze mechanical systems through visualization, modeling, algebra, as well as diagrammatic and graphical techniques.
- Combine the above elements in order to solve multi-part problems as well as formulate quantitative predictions for physical experiments and the design of physical musical instruments.

These General Education Goals will be accomplished through in-class exercises, suggested homework problems, review exercises, written assessments, a project, and several exams. These items will involve qualitative and quantitative aspects.

Course Goals: This course introduces basic concepts in physics and then uses them to examine light, color, perception, sound, music and acoustics. This includes what light is and how we perceive it, how sound is produced and how it is perceived, as well as, the creation and interpretation of music. We will end by discussing the influence of room design on its acoustics, and how musical instruments work. Throughout the semester, you will be examining these concepts from a scientific and aesthetic perspective integrating your own personal experiences with ideas from several disciplines including, physics, music, anatomy & physiology and psychology. The lecture videos will include lectures with demonstrations, worked out examples and embedded concept questions to check your understanding.

Expectations: I expect you to engage in the course material and activities, and reach out to me as necessary. I do not expect you to love math in all of its intricacies, but do expect you to have a very basic understanding of algebra, trigonometry and geometry. When problems with math arise, I expect you to seek. I am happy to assist/review with you. You may find this course challenging and fast paced, but as long as you work diligently, you will succeed.

Guidelines for Office Hours: You set the agenda for office hours. Come with questions about the lecture, reading, homework, exams, grading, or anything else of concern or interest. Note: You must demonstrate some effort/thought process towards an answer on homework problems before coming to see me. "I have no idea where to begin" is not an acceptable opening statement.

Attendance: Students must watch at least 90% of the videos and answer the embedded questions. Your score on the questions will not be used, these are only meant to gauge your current understanding of the material, and it is expected that you will get some of these wrong. You will get points for simply attempting the question and this will count as your attendance grade. All efforts will be made on my behalf to ensure that class time is productive and beneficial for your learning. We will go through several examples and conceptual questions meant to build and challenge your understanding of the material.

Late Work Policy: As with all summer courses, this is a very fast paced course. There will usually be two homework assignments due almost every week and there will also be a written assignment and a project. However, I understand that many of you have other obligations and things come up. Please email me **BEFORE** the due date and I will try to accommodate your situation.

Homework: Generally, you will have two homework assignments per week, which can be found on D2L. The homework assignments will contain 10 problems. I will drop your lowest homework grade, and extra credit may be assigned throughout the semester. Pay attention as some assignments will allow two attempts, while others will only allow one. Some of the homework assignments will allow two attempts per questions, while others will only allow one. Please pay attention to this, the information on number of attempts is on the front page of the homework, before you start it.

Exams: All Exams will be timed and completed online. You may open the exam whenever you want, but once the exam is opened, you will only have either **65 or 90** minutes to complete the exam. The first two online exams will be 65 minutes, and the comprehensive 3rd exam will be 90 minutes and will be taken on the last day of class. If you will be unable to take the exam, you must contact me before the exam, and we will discuss how to proceed. Your excuse for missing the exam must be a university sanctioned excuse. You will only have ONE attempt on all questions!

Final Project and Written Assignment: You will have one written assignment due at the end of the semester. This will be on the music portion of this class. It will involve using your knowledge of resonance to play a song using glasses filled with water. **Details on this will be provided later, and I reserve the right to modify this portion of the class as I deem necessary.**

Grading: Your course grade is based on your Attendance which corresponds to completing the online video questions (5%), Homework (30%), Final Project Written Assignment (10%), Exams (40%), and Final Project Performance (10%). **The final project and final paper are mandatory; your overall grade will depend on them.**

Your total homework grade will be the average grade (minus the grade) for all assignments. Your total exam grade will be 10% for Exam I, 15% for Exam II and 20% for the Cumulative Exam III.

A NOTE ON "CURVING" AND THINGS TO KEEP IN MIND: The Exams are designed to have an average between 85-88%. If, for some reason, the average falls below this range, I will curve the exam appropriately. If the average is above this range, good job! **The homework assignments and project TOGETHER are weighted more heavily than the three exams. You must do well on all components of this course to do well in the course as a whole.**

A letter grade will be assigned based on performance in the course according to the following scale:

Grade	Quality Points	Percentage Equivalents	Interpretation
A	4.00	93-100	Excellent
A-	3.67	90-92	
B+	3.33	87-89	Superior

B	3.00	83-86	
B-	2.67	80-82	
C+	2.33	77-79	Average
C	2.00	73-76	
C-	1.67	70-72	
D+	1.33	67-69	Below Average
D	1.00	63-66	
D-	0.67	60-62	
F	0	< 60%	Failure

Refer to the Undergraduate Catalog for description of NG (No Grade), W, Z, and other grades. Straight percentages will be given for all work, with the mid-semester and final grade based on overall class performance. Other considerations will influence your final grade including, class participation, class and laboratory attendance, and seeking timely guidance during office hours. Any student achieving at a level of 'C-' or below will be given an estimated grade on their mid-term deficiency grade report.

E-Mail and Communication: The best way to contact me is via e-mail. But, be aware that I will only read and respond to e-mails written in proper English, with correct grammar, spelling, and etiquette. Do not send me any e-mails addressed to "hey" or "yo," like you would text a buddy or close friend.

Boiler Plate Language Common to All WCU Syllabi

COVID-19 STATEMENT

Part of West Chester University's response to the COVID-19 pandemic was to switch the vast majority of instruction to remote. This decision was made out of an abundance of caution to protect the health of all members of the WCU community. Faculty have been asked to make every effort to adapt their courses to this novel situation while still meeting the critical learning outcomes of the course. Students are asked to discuss any problems with the new course format and schedule directly with their instructors. Patience and flexibility on everyone's behalf are critical to our community's navigation of this public health crisis.

ACADEMIC & PERSONAL INTEGRITY

It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu.

STUDENTS WITH DISABILITIES

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support

your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at <https://www.wcupa.edu/universityCollege/ossd/>. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. **Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy.** Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: <https://www.wcupa.edu/admin/diversityEquityInclusion/sexualMisconduct/default.aspx>

EMERGENCY PREPAREDNESS

All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

ELECTRONIC MAIL POLICY

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

FALL 2020 - W.O.R Schedule

WEEK #1

Monday August 24th:

Watch Introduction & Overview

Wednesday August 26th:

Download Lecture 1 Notes

Watch Math Review & Units

Start Homework #1

Friday August 28th:

Download Math Review Worksheet.

Watch Conversion Factors

Download the Math Review Worksheet KEY.

WEEK #2

Monday August 31st:

Download Motion Worksheet.

Watch Distance & Speed

Download the Motion Worksheet KEY.

Wednesday September 2nd:

Watch Velocity & Acceleration

Finish Homework #1

Start Homework #2

Friday September 4th:

Download Lecture 2 Notes

Watch Forces

Download Forces Worksheet.

Download the Force Worksheet KEY.

WEEK #3

Monday September 7th:

LABOR DAY! – NO CLASSES

Wednesday September 9th:

Watch Newton's Laws

Download Extra Forces Examples.

Finish Homework #2
Start Homework #3

Friday September 11th:
Watch Energy & Power

WEEK #4

Monday September 14th:
Download and Read Lecture on Temperature

Wednesday September 16th:
Download Lecture 3 Notes
Watch Periodic Motion
Finish Homework #3
Start Homework #4

Friday September 18th:
Watch Traveling Waves
Download the Waves Worksheet
Download the Waves Worksheet KEY.

WEEK #5

Monday September 21st:
Download the Lecture 4 Notes
Download the E/M Worksheet
Watch Electricity & Magnetism
Download the E/M Worksheet KEY.

Wednesday September 23rd:
Start the **Online Exam #1**

You will have **65 minutes** to complete the exam. It will contain 20 Multiple Questions. The exam will be posted at 9:00 AM and will close at 11:59 PM. You will get one attempt at each question. There is NO time limit per question other than the overall time limit.

Friday September 25th:
Watch E/M Fields & Induction

WEEK #6

Monday September 28th:

Download Lecture 5

Watch Light Rays & Transmission

Download the Light Waves Worksheet

Download the Light Waves Worksheet KEY.

Wednesday September 30th:

Download Lecture 6

Watch Plane Mirrors

Finish Homework #4

Start Homework #5

Friday October 2nd:

Watch Curved Mirrors

WEEK #7

Monday October 5th:

Download Lecture 7

Watch Refraction of Light

Wednesday October 7th:

Watch the online Mirages & Dispersion Lecture

Download the Reflect/Refract Worksheet

Download the Reflect/Refract Worksheet KEY.

Finish Homework #5

Start Homework #6

Friday October 9th:

Download Lecture 8

Download the Ray Tracing Worksheet.

Watch Converging Lenses Lecture

Watch the Ray Tracing Worksheet Video

WEEK #8

Monday October 12th:

Watch The Human Eye.

Wednesday October 14th:

Download Lecture 9

Watch Color Vision.
Finish Homework #6
Start Homework #7

Friday October 16th:

Watch Color Mixing.
Download the Selective Reflect Worksheet
Watch the Selective Reflect Worksheet Video.

WEEK #9

Monday October 19th:

Download Lecture 10
Watch Eye Anatomy.
Download the Color Worksheet
Watch the Color Worksheet Video.

Wednesday October 21st:

Watch Human Perception of Light.
Finish Homework #7
Start Homework #8

Friday October 23rd:

Download Lecture 11.
Watch Sound Waves.

WEEK #10

Monday October 26th:

Download the Sound Waves Worksheet
Watch Sound Waves Worksheet Video.

Wednesday October 28th:

Start the Online Exam #2

You will have **65 minutes** to complete the exam. It will contain 19 Multiple Questions. The exam will be posted at 9:00 AM and will close at 11:59 PM. You will get one attempt at each question. There is NO time limit per question other than the overall time limit.

Friday October 30th:

Download Lecture 12

Watch Interference of Waves.

WEEK #11

Monday November 2nd:

Watch Standing Waves

Download the Wave Interference Worksheet

Watch the Wave Interference Worksheet Video.

Wednesday November 4th:

Download Lecture 13

Watch Waves on a String.

Download the Guitar Worksheet

Watch the Guitar Worksheet Video.

Finish Homework #8

Start Homework #9

Friday November 6th:

Watch Waves in a Pipe.

Download the Pipes Worksheet

Watch the Pipes Worksheet Video.

WEEK #12

Monday November 9th:

Watch Basics of Instruments.

Wednesday November 11th:

Download the Sound & Music Worksheet

Watch Sound & Music Worksheet Video.

Friday November 13th:

Download Lecture 14

Watch Complex Waves.

Watch the Frequency Spectra Worksheet Video.

WEEK #13

Monday November 16th:

Download Lecture 15

Watch The Ear and Hearing.

Download the Human Ear Worksheet

Download the Human Ear Worksheet KEY

Wednesday November 18th:

Watch Beats and Bands.

Finish Homework #9

Start Homework #10

Friday November 20th:

Download the Two Notes Worksheet

Watch the Two Notes Worksheet Video.

Recommended Project Start Date!

All Final Project Information can be found HERE.

WEEK #14

FALL BREAK – NO CLASSES

WEEK #15

Monday November 30th:

Download Lecture 16

Watch Introduction to Musical Scales.

Wednesday December 2nd:

Watch More Musial Scales.

Finish Homework #10

Friday December 4th:

Complete the Interactive Review Worksheet (All Materials Can Be Found HERE)

The Interactive Review Worksheet KEY is HERE (Available at 4 PM)

Final Exam Study guide is HERE.

WEEK #16

Monday December 7th:

Complete TIMED Exam #3 Online

You will have **90 minutes** to complete the exam. It will contain 18 Multiple Questions. The exam will be posted at 9:00 AM and will close at 11:59 PM.

Friday December 11th:

Upload your Final Project Answers and Performance Clip by **NOON**.