PHY 100: Waves of Reality

West Chester University

Spring 2021

Instructor Office Hours

|  |  |
| --- | --- |
| Day | Time |
| Monday | 2 – 3 PM |
| Wednesday | 10:30 – 11:30 AM |
| Friday | 2 – 3 PM |

**Dr. Brandon Mitchell**

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Email: [Bmitchell@wcupa.edu](mailto:Bmitchell@wcupa.edu)

Please sign up for office hours at my [online scheduler](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](http://www.wcupa.edu)

# 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 objection)

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 80% 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:** I understand that many of you have other obligations and things come up. Please email be BEFORE the due date and I will try to accommodate your situation.

**Homework:** Generally, you will have one homework assignments per week on Wednesday, 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.

**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.

**Midsemester Project:** You will have a short midsemester project which involves a short 5-minute experiment and a one paragraph write-up.

**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%), Midsemester project (5%), Final Project Written Assignment (10%), Exams (40%), and Final Project Performance (5%). **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:** THERE IS NO CURVE ON THE EXAMS OR ANY OTHER ASSESSMENT ALONE. THE TOTAL GRADES IN THE END WILL BE “CURVED” AS DEEMED NECESSARY. **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.

“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.”

**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. The OSSD hours of Operation are Monday – Friday, 8:30 a.m. – 4:30 p.m. 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 www.wcupa.edu/ussss/ossd.

**EXCUSED ABSENCES POLICY FOR UNIVERSITY-SANCTIONED EVENTS:** Students are advised to carefully read and comply with the excused absences policy 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 meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. 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 the webpage for the Office of Social Equity at <http://www.wcupa.edu/_admin/social.equity/>.

**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.

**TENTATIVE SCHEDULE**

WEEK #1

**Monday January 25th:**

* Watch Introduction & Overview.

**Wednesday January 27th:**

* Download Lecture 1 Notes.
* Watch Math Review & Units.
* Start Homework #1.

**Friday January 29th:**

* Download Math Review Worksheet.
* Watch Conversion Factors.
* Download the Math Review Worksheet KEY.

WEEK #2

**Monday February 1st:**

* Download Motion Worksheet.
* Watch Distance & Speed.
* Download the Motion Worksheet KEY.

**Wednesday February 3rd:**

* Watch Velocity & Acceleration.
* Finish Homework #1.
* Start Homework #2.

**Friday February 5th:**

* Download Lecture 2 Notes.
* Watch Forces.
* Download Forces Worksheet.
* Download the Force Worksheet KEY.

WEEK #3

**Monday February8th:**

* Watch Newton’s Laws.
* Download Extra Forces Examples.

**Wednesday February 10th:**

* Watch Energy & Power.
* Finish Homework #2.
* Start Homework #3.

**Friday February 12th:**

* Read Lecture on Temperature.

WEEK #4

**Monday February 15th:**

* Download Lecture 3 Notes.
* Watch Periodic Motion.

**Wednesday February 17th:**

* Watch Traveling Waves.
* Download the Waves Worksheet.
* Download the Waves Worksheet KEY.
* Finish Homework #3.
* Start Homework #4.

**Friday February 19th:**

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.

WEEK #5

**Monday February 22nd:**

* Download the Lecture 4 Notes.
* Download the E/M Worksheet.
* Watch Electricity & Magnetism.
* Download the E/M Worksheet KEY.

**Wednesday February 24th:**

* Watch E/M Fields &Induction.

**Friday February 26th:**

* Download Lecture 5.
* Watch Light Rays & Transmission.
* Download the Light Waves Worksheet.
* Download the Light Waves Worksheet KEY.
* Start Midsemester Project, which can be found HERE.

WEEK #6

**Monday March 1st:**

* Download Lecture 6.
* Watch Plane Mirrors.

**Wednesday March 3rd:**

* Watch Curved Mirrors.
* Finish Homework #4.
* Start Homework #5.

**Friday March 5th:**

* Download Lecture 7.
* Watch Refraction of Light.

WEEK #7

**Monday March 8th:**

* Watch the online Mirages & Dispersion Lecture.
* Download the Reflect/Refract Worksheet.
* Download the Reflect/Refract Worksheet KEY.

**Wednesday March 10th:**

* Download Lecture 8.
* Download the Ray Tracing Worksheet.
* Watch Converging Lenses.
* Watch the Ray Tracing Worksheet Video
* Finish Homework #5.
* Start Homework #6.

**Friday March 12th:**

* Watch the Human Eye.
* Upload Midsemester Project Assignment HERE.

WEEK #8

SPRING BREAK – No Class

WEEK #9

**Monday March 22nd:**

* Download Lecture 9.
* Watch Color Vision.

**Wednesday March 24th:**

* Watch Color Mixing.
* Download the Selective Reflect Worksheet.
* Watch the Selective Reflect Worksheet Video.
* Finish Homework #6.
* Start Homework #7.

**Friday March 26th:**

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

WEEK #10

**Monday March 29th:**

* Watch Human Perception of Light.

**Wednesday March 31st:**

* Download Lecture 11.
* Watch Sound Waves.
* Finish Homework #7.
* Start Homework #8.

**Friday April 2nd:**

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.

WEEK #11

**Monday April 5th:**

* Download the Sound Waves Worksheet.
* Watch Sound Waves Worksheet Video.

**Wednesday April 7th:**

* Download Lecture 12.
* Watch Interference of Waves.

**Friday April 9th:**

* Watch Standing Waves.
* Download the Wave Interference Worksheet.
* Watch the Wave Interference Worksheet Video.

WEEK #12

**Monday April 12th:**

* Download Lecture 13.
* Watch Waves on a String.
* Download the Guitar Worksheet.
* Watch the Guitar Worksheet Video.

**Wednesday April 14th:**

* Watch Waves in a Pipe.
* Download the Pipes Worksheet.
* Watch the Pipes Worksheet Video.
* Finish Homework #8.
* Start Homework #9.

**Friday April 16th:**

* Watch Basics of Instruments.

WEEK #13

**Monday April 19th:**

* Download the Sound & Music Worksheet.
* Watch Sound & Music Worksheet Video.

**Wednesday April 21st:**

* Download Lecture 14.
* Watch Complex Waves.
* Watch the Frequency Spectra Worksheet Video.
* Finish Homework #9.
* Start Homework #10.

**Friday April 23rd:**

* Download Lecture 15.
* Watch The Ear and Hearing.
* Download the Human Ear Worksheet.
* Download the Human Ear Worksheet KEY.

WEEK #14

**Monday April 26th:**

* Watch Beats and Bands.

**Wednesday April 28th:**

* Download the Two Notes Worksheet.
* Watch the Two Notes Worksheet Video.
* Finish Homework #10 (LAST HOMEWORK!).
* Recommended Project Start Date!

**All Final Project Information can be found** HERE.

**Friday April 30th:**

* Download Lecture 16.
* Watch Introduction to Musical Scales.

WEEK #15

**Monday May 3rd:**

* Watch More Musial Scales.

**Wednesday May 5th:**

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.

**Friday May 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.

WEEK #16

**Thursday May 14th:**

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