

Physics 100: Elements of Physical Science (Spring 2018)

Prof. Brandon Mitchell

Room SSS-402A

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Lecture: MWF 2:00 - 2:50

Office Hours: My office hours for Spring 2018 are:

M 12:30 – 1:30 W 3:00 – 4:00 Th: 12:30 – 2:00

Occasionally I may be able to meet outside of regular office hours, please email me.

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

Course Web Page:

D2L

Course information can be found here throughout the semester. The syllabus, lecture notes, projects and homework will be found here. Check it regularly!!

Lecture Notes: The lecture notes are a critical tool for your learning experience and are required for class. 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 that attending class is necessary, but at least have classmate you can go to if you cannot attend class. The lecture notes will be provided via D2L, so be sure to download them. *You are required to bring the lecture notes to class.* The lecture notes will be uploaded no later than 5PM one day before you need them, or else a hard copy will be provided. You may not have your laptops out during class.

Worksheets: At least once a week there will be a worksheet, which goes along with the current subject matter. You will work on these problems with your neighbors and then I will go over the answers. **Please print the worksheets and bring them to class when asked to do so.**

Content: This is a special section of PHY100 called **Physics of the Arts: Sight, Sound and Music**. This class will 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. Class time will include interactive lectures, demonstrations and discussion. Assignments will include individual and group work, and are meant to not only assess your learning, but to foster your ability to design, research and present your work in a written manner.

Expectations: I expect you to engage the material, your peers and me both in and out of class and lab in physics related conversations. 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 assistance from your peers, the tutoring center or myself. 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, laboratory, reading, homework, exams, grading, or anything else of concern or interest. Attend in groups or as an individual. If you would like to discuss something in private, please make a separate appointment. When multiple people are present, people will alternate asking questions. 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 will be held responsible for all course materials missed due to class absences. 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: There will be a homework assignment due almost every week and there will also be two written assignments and a project to build. However, I understand that many of you have other obligations and things come up. Each student will have a total of 2 late-day points available to use when things get too busy to meet a deadline. An assignment that is two days late uses two late-day points. A weekend

counts for two late-days. After you have used your late-day points, late assignments will lose 5% (of total possible points) per day.

Laptop and Phone Policy: I will not be overly picky with cell phones as long as they are silent and do not become a distraction for your fellow classmates or myself. However, during practice questions and examples, no cell phones are allowed to be used. This is your time to practice the material in class....use it.

You are not to have your laptop out during class. Please bring the printed lecture notes to class or a notebook.

Homework: Generally, you will have one homework assignment per week, which can be found on D2L. The homework assignments will contain 10 - 12 problems. The quizzes can be found on D2L under the assessments tab, in the "Quizzes" category. The homework will be assigned on Thursday at 5:00pm and due the following Thursday by 11:45pm. I will drop your lowest two homework grades and extra credit may be assigned throughout the semester.

Exams: There will be one in-class exam and one online exam during the semester, as well as a comprehensive in-class final exam, which will be taken on the last day of class. All exams will be closed book, but you can use the provided equation sheet. In the event a student is unable to take an exam as scheduled, discussion of the exam with those that have taken the exam is forbidden. If you will be unable to make it to an exam, you must contact me before the exam, and we will discuss how to proceed. I will provide the class average to give a gauge as to where you fall relative to your peers. However, NO curved grade will be put into my gradebook. **IN GENERAL, THERE WILL NOT BE TEST CORRECTIONS.**

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 a wind instrument made of PVC pipe. The final project will be the construction of several PVC pipes, the tuning of the pipes and playing a song with them. **Details on these assessments 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 Homework (35%), Final Paper (15%), Exams (40%), and Final Project (10%).

Your total homework grade will be the average grade (minus the lowest two grades) for all assignments.

Your total exam grade will be 10% for the first two examinations, and 20% for the third cumulative examination.

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 in-class 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 | |

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|----|------|-------|---------------|
| 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.

Tutoring: Tutoring for PHY 100 is offered by the Learning Assistance Center (LARC), 223 Lawrence Center, x2535. More information is available at: <http://www.wcupa.edu/ussss/larc/>. LARC tutoring is free of charge, but you must sign up at the beginning of the semester.

Peer tutoring may also be offered by physics majors during the semester. Check the Physics Department webpage, under "Students / Current Students / Physics Tutoring", a few weeks into the semester (http://www.wcupa.edu/academics/sch_cas.phy/current.asp), or stop by the Physics Library, Merion 125, where the physics major hang out.

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.

| PHY100:TENTATIVE SCHEDULE | | | | |
|---------------------------|--|----------------------|------------------------|-------------|
| Date | Topic | Notes | Chapter | Assignments |
| Week 1 | Getting Started | Lecture 1 | Class Notes | |
| 1/22 | Introduction | 1 | | HW #1 |
| 1/24 | Math Review | 1 | | |
| 1/26 | Basics of Motion | 1 | | |
| Week 2 | Basic Physics | Lecture 2 | Class Notes | |
| 1/29 | Velocity and Acceleration | 2 | | HW #2 |
| 1/31 | What is a Force? & Newtons Laws | 2 | | |
| 2/2 | More Forces | 2 | | |
| Week 3 | Critical Background Physics | Lecture 2/3 | Physics in Arts | |
| 2/5 | Work, Energy and Power | 2 | | HW #3 |
| 2/7 | Periodic Motion and Waves | 3 | Chapter 10 | |
| 2/9 | Traveling Waves | 3 | | |
| Week 4 | Sound and E/M | Lecture 3/4 | Physics in Arts | |
| 2/12 | Sound Waves | 3 | Chapter 1/10/14 | HW #4 |
| 2/14 | Electricity and Magnetism | 4 | | |
| 2/16 | Test 1 | | | |
| Week 5 | What is Light? | Lecture 4/5/6 | Physics in Arts | |
| 2/19 | E/M Waves and What is Light? | 4 & 5 | Chapter 1 | HW #5 |
| 2/21 | More Light Properties/Polarization | 5 | Chapter 1 | |
| 2/23 | Polarization and Shadows | 5 & 6 | | |
| Week 6 | Manipulating Light | Lecture 6/7 | Physics in Arts | |
| 2/26 | Reflection and Mirrors | 6 | Chapter 2 | HW #6 |
| 2/28 | Refraction and Dispersion | 7 | Chapter 2 | |
| 3/2 | Diamonds and Rainbows | 7 | Chapter 2 | |
| Week 7 | Detecting Light | Lecture 8/9 | Physics in Arts | |
| 3/5 | Converging Lenses | 8 | Chapter 3 | HW #7 |
| 3/7 | More Converging Lenses & The Human Eye | 8 | Chapter 3/4 | |
| 3/9 | The Human Eye and Color | 8 & 9 | Chapter 4/6 | |
| Week 8 | | | | |
| 3/12 | Spring Break! | | | SB |
| 3/14 | | | | |
| 3/16 | | | | |
| Week 9 | Perceiving Light | Lecture 9/10 | Physics in Arts | |
| 3/19 | Color Vision | 9 | Chapter 6 | HW #8 |
| 3/21 | Color Mixing | 9 | Chapter 7 and 8 | |
| 3/23 | Anatomy of the Eye | 10 | | |

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|----------------|---|----------------------|------------------------|-------------------------------|
| Week 10 | Properties of Sound Waves | Lecture 10-12 | Physics in Arts | |
| 3/26 | Human Perception of Light | 10 | | HW #9 |
| 3/28 | Sound Waves | Lecture 11 | Chapter 14 | |
| 3/30 | Interference, Impedence and Reflection. | Lecture 12 | Chaper 12/13 | |
| Week 11 | Musical Aspects | Lecture 12/13 | Physics in Arts | |
| 4/2 | Standing Waves | Lecture 12 | Chapter 17 | HW #10 |
| 4/4 | Buffer Day | | | |
| 4/6 | Complex Waves and Timbre | Lecture 13 | Chapter 19 | |
| Week 12 | Detecting and Perceiving Sound | Lecture 14/15 | Physics in Arts | |
| 4/9 | The Ear and Hearing | Lecture 14 | Chapter 16 | Test #2 |
| 4/11 | Inner Hair Cells and Beats | Lecture 14 | Chapter 13 | |
| 4/13 | Critical Bands, Harmony and Dissonance | Lecture 14 | Online Test #2 | |
| Week 13 | Making Sound | | Physics in Arts | |
| 4/16 | Buffer Day | | | HW #11 |
| 4/18 | Waves on String | Lecture 15 | Chapter 17 | |
| 4/20 | Waves in a Pipe | Lecture 15 | Chapter 18 | |
| Week 14 | Organizing Sound | | Physics in Arts | |
| 4/23 | Waves in a Pipe | Lecture 15 | Chapter 18 | Outline of Final Paper |
| 4/25 | Musical Scales | Lecture 16 | Chapter 20 | |
| 4/27 | Musical Scales | Lecture 16 | Chapter 20 | |
| Week 15 | Finishing Up | | | |
| 4/30 | Full Project Day | | | FINISH PROJECT |
| 5/2 | Full Project Day | | | |
| 5/4 | In-Class Exam III | | | |
| Week 16 | | | | |
| 5/7 | FINAL TIME (1:00-3:00) | | | |
| 5/9 | | | | |