WEST CHESTER UNIVERSITY OF PENNSYLVANIA

ELEMENTS OF PHYSICAL SCIENCE—PHY 100-03—FALL, 2015

MWF 2:00-2:50 pm, Rm. Merion 109

Instructor: Dr. David E. Chyba

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Office Hours *(starting second week)*: Monday: 11:00 am–12:00 noon
Tuesday: 2:00 pm–3:00 pm
Wednesday: 9:30 am–11:30 am; 3:30 pm–4:30 pm
Thursday: 2:00 pm–3:00 pm

—Also by appointment. Occasional cancellations of office hours are likely—

My office, SS 402A, is accessible by elevator (or stairwell) at the far south side (Rosedale Street side) of Schmucker Science South (the building where the Chemistry Department is located). Outside office hours, contact me before coming up; my office is attached to an outer room (SS 402) which will often be closed outside office hours. Note that the north-side stairwell opens directly into Rm. SS 402 and therefore the north-side stairwell door is kept locked—use the elevator or south-side stairwell.

Texts and Other Supplies—*Two books are required:*

(1) *Newton to Einstein: The Trail of Light (An excursion to the wave-particle duality and the Special Theory of Relativity)*, by Ralph Baierlein (Cambridge and New York: Cambridge University Press, 2001). ISBN-13: 978-0-5214-2323-6; ISBN-10: 0-5214-2323-6 (paper).

(2) *Physics for Future Presidents: The Science Behind the Headlines* by Richard A. Muller (New York: W. W. Norton & Company, 2008; paperback: September, 2009). ISBN-13: 978-0-393-33711-2; ISBN-10: 0-393-33711-1 (paper).

Additional Item(s) Needed: A *stand-alone* "scientific" calculator with trigonometric functions. The essential feature of a scientific calculator is a provision for directly entering numbers in scientific notation (usually a key or its "2nd function" labeled "EE" or "EXP"). I recommend the Texas Instruments TI-30Xa as an inexpensive and easy-to-use calculator having the necessary basic features. (A graphing calculator is *not* necessary. However, a graphing or multi-line calculator does have the advantage of allowing you to enter, examine, and edit an entire mathematical expression prior to evaluation. Complicated expressions are easier to evaluate on such a calculator.) **Note that a calculator which is part of an iPhone, iPad, or other electronic device is *not* allowed to be used for test-taking; only a *stand-alone* calculator may be used for taking a test, quiz, or exam.** ***(cont'd)***

A straight-edge will be helpful for making drawings in homework and in lecture notes. Graph paper may be helpful for making drawings for certain homework problems.

You must have a student account on the WCU computer network so that you can access postings on the "D2L" course information system and so that you can access university e-mail on the campus intranet. E-mail from the course instructor will come to you via the university e-mail system. Registering for a course at the University entitles you to such an account. Instructions for initializing your account can be found via the WCU homepage: click the "Current Students" tab; choose "IT Help Desk"; among the list of items at the left, click on "New Student Account". Or go to the corresponding page by entering the following address:

http://www.wcupa.edu/infoservices/clientServices/itHelpDesk/studentAccount.aspx

Comments on the textbooks: Both books listed above are required. Both are paperbound. Text (1) is the primary textbook. Text (2) is very readable. It describes the significance of physics for important contemporary government policy issues: terrorism, energy in general, nuclear energy, space exploration, and climate change. It is written for the non-scientist, and could be called "physics for informed citizens". I will provide a format for reporting on this book near the start of the semester. The report is due about a month before the end of the semester.

Affordability of Textbooks: You are going to the work and expense of attending college. *Please* buy the books and other supplies you need! They may cost a lot, but compared to tuition and the other expenses of this investment in your future, it is not so much. If finances do make getting your books and supplies a problem, the Provost's Office has sent around the following note and web link that may be helpful:

> The cost of textbooks may deter some students from purchasing them, which can hinder their academic success. As such, the Division of Student Affairs Multicultural Student Success Committee has compiled a list of affordable textbook purchasing options to encourage students to buy their required readings in a timely manner: www.wcupa.edu/TextBookTipsforStudents.

Description of My Version of Physics 100: This is an introductory one-term course emphasizing three themes: understanding the nature of light; the relation of the study of light to other areas of physics; and the history of these ideas. The course develops these themes by following "the trail of light" through the conceptual history of physics. This trail begins with knowledge of the properties and behavior of light, leading to the establishment of the wave nature of light. The trail then leads through three or four major landmarks in our understanding of Nature—light as an *electromagnetic* phenomenon and the reality of the *electromagnetic field*; the *wave-particle duality* of quantum mechanics; and Einstein's *Special Theory of Relativity*. The relation of physics to "science literacy" and to government policy is a fourth theme that is addressed through the supplemental reading.

The mathematics required for the course consists of basic algebra and geometry. It will be essential for the student to be able to use these skills. Correct use of a scientific calculator, especially in regard to order of operations, will also be essential. A small amount of trigonometry (the sine function) will be introduced and explained for limited use.

West Chester University General Education Goals: PHY 100 is an approved course in the WCU General Education program. This course strives to have students meet the following general education goals: (Goal #2) ability to employ quantitative concepts and mathematical methods; (Goal #3) ability to think critically and

analytically. These goals are accomplished through discussion of quantitative and qualitative examples and practice problems in class, through homework assignments, and through exams. Goal #3 is also addressed through written answers to both open-ended and specific questions in a report on an assigned book on the social and technological impacts of physical sciences and engineering.

Course Calendar: A tentative course calendar is on the last sheet of this syllabus (pp. 7–8).

Exams: I expect to have 3 exams during the semester, in addition to the final exam (unless we are deluged with snow!) The final exam will be given 3:30–5:30 pm Wednesday, December 9, 2015. The final exam will *not* be comprehensive, and will count the same as the semester exams. If we cover the topics I hope to, the final will be over the material following that covered by the preceding exam. Otherwise, it may cover some of the same material as the preceding exam.

Altogether, the exams will account for 60% of the course grade; each of the four exams included in the score will thus account for 15% of the course grade.

Exams will be on Wednesdays of Weeks 4, 9, and probably 12. As mentioned above, the "Final" will be on Wednesday of Finals Week (Week 16). I will provide formula sheet(s) with each exam. "Practice exercises" with answers will be provided in advance.

Grading: I tentatively plan to grade on approximately the following basis: semester exams plus final exam, 60% of the total grade (probably 15% for each semester exam and 15% for the final; homework assignments, including possible in-class exercises, 20%; report on the supplemental reading (one book), 20%. I may eventually vary these percentages if I think the outcome would better reflect the class's efforts; but it is unlikely that they would change by more than 5%, and very unlikely that they would change by more than 10%. I may "curve" particular exams *if* I think that is appropriate. My initial plan is for all semester exams included in the overall average to count equally, but I may vary this if it seems appropriate. I will let you know if I consider any of the preceding class-wide changes. Final numerical scores will be converted to letter grades according to the official scheme, but I may adjust the scores based on how the class does and on how difficult I perceive the course to have been. I do consider whether to adjust the letter grades of students whose numerical scores are close to letter-grade boundaries.

Make-up Exams: I am willing to allow make-up of semester exams for sufficiently good reasons, such as illness or emergency. ***The following rules apply to semester make-up exams:***

IMPORTANT: To limit possible abuse of the make-up exam privilege, I will REQUIRE the following:

- ***I must be notified in person, by telephone, or by e-mail by the day after the semester exam, if you need to miss the exam for any reason.***
- ***The make-up exam must normally be taken not later than six days from the exam date. Exceptions will be made only for truly serious reasons, such as extended illness, and must be explicitly granted by me.***

If you miss an exam without making it up in time and without an exemption from me, your grade for that exam will be zero. Missing the *final exam* will result in a zero for the exam unless extreme circumstances apply.

University's Statement of Excused Absences Policy for University-Sanctioned Events: Undergraduate students participating in University-sanctioned events such as, but not limited to, the Marching Band, musical ensembles, theatre group, athletic events, forensics competition, etc., will be granted an excused absence(s) by the respective faculty members for class periods missed. Students will be granted the privilege of taking, at an alternative time to be determined by the professor, scheduled examinations or quizzes that will be missed. The professor will designate such times prior to the event. Professors can provide a fair alternative to taking the examination or quiz that will be missed. Students must submit original documentation on University letterhead signed by the activity director, coach, or adviser detailing the specifics of the event in advance. Specific requirements include the following:

1. Responsibility for meeting academic requirements rests with the student.
2. Students are expected to notify their professors as soon as they know they will be missing class due to a University-sanctioned event.
3. Students are expected to complete the work requirement for each class and turn in assignments due on days of the event prior to their due dates unless other arrangements are made with the professor.
4. If a scheduled event is postponed or canceled, the student is expected to go to class.
5. Students are not excused from classes for practice on nonevent days.

The following are specifics for the student athlete:

1. The student athlete is expected, where possible, to schedule classes on days and at hours that do not conflict with athletic schedules.
2. Athletes are not excused from classes for practice or training-room treatment on nongame days.

Disability and Special Needs: If you have a physical disability, learning disability, test anxiety, etc., please contact the Office of Services for Students with Disabilities at extension 3217 and bring the resulting documentation to me to discuss how the university and I can assist you. Note that sufficient notice is needed in order to make accommodations possible.

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. I myself will provide information about this if I learn about it.

ADDITIONAL NOTES:

You, Me, and the Course: You are responsible for spending the "time on task" to do the work you need to do for this course. A teacher can encourage "active learning," but in the last analysis, active learning must be done by the student. If thinking of the entire semester at once is burdensome, focus on the current material!

I do not expect to provide "extra credit" work late in the semester. If you are tempted to hope for or rely upon "extra credit work" to pull you through, think of the current course material as your extra credit work as we go through the semester. I do understand that there may be many demands on your time, and I will try to be understanding and flexible. For grades to be meaningful as indicators of student performance, however, they must be based primarily on mastery of the course material and assignments, secondarily on effort made to achieve mastery, and, perhaps, thirdly on other factors.

I am very willing to provide help and explanations inside and outside the classroom (see "Office Hours" in the header information on page one). Whether you are a recent high-school graduate or working on starting a second (or third!) career, I'm interested in you. Students have found me to be very helpful in one-on-one and small group situations, so walk in or make an appointment to see me if you need help.

Electronics in the Classroom: Please turn off all cell phones, iPods, iPads, iPhones, Kindles, laptops, etc., before class. If you are expecting to receive an emergency call, set your cell phone to vibrate mode and answer the call outside the classroom. You are not allowed to use cell phones for texting or gaming during class; these activities are distracting to your classmates and to the instructor. Repeated violations of these rules may be penalized.

Possible exceptions may include use of an electronic device as an accommodation for a disability or if a student has an e-copy of the textbook. These situations should be discussed with me on an individual basis.

Recording in Class: You must obtain permission from me before recording class. Video recording requires permission of your classmates as well. Any on-line posting of such recordings, or circulation of such recordings to people not enrolled in the course, is *forbidden*, unless *additional special permission* is granted.

Academic 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 automatic failure and removal from this course.

For questions regarding Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department's handbook, the Undergraduate Course Catalogue, the Rams Eye View, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

Intellectual Property Statement: The instructor for this course utilizes copyrighted materials under the "Freedom and Innovation Revitalizing United States Entrepreneurship Act of 2007" (Fair Use Act). Apart from such copyrighted materials, all other intellectual property associated with this course is owned and copyright protected by the instructor, including, but not limited to, lectures, course discussions, course notes and

supplementary materials posted or provided to students authored by the instructor, assessment instruments such as quizzes and exams, and Power Point presentations. No recording, copying, storage in a retrieval system, or dissemination in any form, whether electronic or other format, by any means, of the intellectual property of the instructor, either in whole or in part, is permitted without the prior written permission of the instructor. When such permission is granted, it must specify the utilization of the intellectual property and all such permissions and waivers shall terminate on the last day of finals in the semester in which this course is held.

Links and references to on-line resources provided by the instructor may lead to other sites. The instructor does not sponsor, endorse, or otherwise approve of any information appearing in those sites, nor is the instructor responsible for the availability of, or the content located on or through, external sites. Apart from materials used in accordance with the Fair Use Act, the instructor takes no responsibility for material that is otherwise offered at web sites and makes no warranty that such material does not infringe on any third party rights. However, should any of this type of material be present and this fact is brought to the attention of the instructor, they will remove references to it from course materials.

Public Safety: The Emergency Communications Committee recommends that the number of WCU's Department of public safety be available on every course syllabus.

WCU Department of Public Safety: (610) 436-3311.

University Statement Regarding Title IX of the Education Amendments of 1972: 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/.

Tentative Course Calendar:

Week No.	Starts on Monday,	Coursework, Exams, and Other Events
1	Aug. 24	Introduction, syllabus. Format for report on supplemental reading handed out this week. Start Chap. 1 of text—reflection, refraction, reversibility; start Snell's Law; introduce sine function. Begin assigning homework.
2	Aug. 31	Introduce inverse sine function; develop and generalize Snell's Law; "total reflection" ("total internal reflection").
3	Sep. 7	*Labor Day Holiday—Monday, September 7.* Finish total reflection if needed; velocity of light; colors; "sidedness" ("polarization"). Finish Chap. 1; gloss over Chap. 2; possibly begin Chap. 3 on waves. Practice Exam I given out.
4	Sep. 14	Start Chap. 3 on waves and/or review for Exam I. **Exam I on Chap. 1 on Wednesday, Sep. 16.**
5	Sep. 21	Continue Chap. 3 on waves.
6	Sep. 28	Finish Chap. 3 on waves; start Chap. 4 on "Interference".
7	Oct. 5	*Fall Break Holiday—Monday, Oct. 5 and Tuesday, Oct. 6.* Continue Chap. 4 on interference.
8	Oct. 12	Finish Chap. 4 on interference. Start Chapter 5 on electricity and magnetism. Practice Exam II given out.
9	Oct. 19	Continue Chap. 5—"Electromagnetic Waves". **Exam II on Chaps. 3, 4 on Wednesday, Oct. 21.** *Friday, Oct. 23 is the last day to drop a course.*
10	Oct. 26	Finish Chap. 5; start Chap. 6—Photoelectric & Compton Effects; photon concept.
11	Nov. 2	Finish Chap. 6; start Chapter 7—Wave-particle duality; possible related topic. Practice Exam III given out.

(cont'd)

Week No.	Starts on Monday,	Coursework, Exams, and Other Events
12	Nov. 9	**Book reports collected Mon., Nov. 9. Penalty if turned in after Monday, Nov. 16.** Finish Chap. 7 if necessary, or possible extra topic, or review. **Exam III on Chaps. 5–7 on Wed., Nov. 11.** Begin Chaps. 8, 9 on the special theory of relativity.
13	Nov. 16	**Penalty if Book Report turned in after Monday, Nov. 16.** Special theory of relativity—topics from Chaps. 8–10 (including time dilation and length contraction).
14	Nov. 23	Special theory of relativity continued (topics from Chaps. 10–13). *Thanksgiving Holiday, Wed., Nov.25–Fri., Nov. 27.*
15	Nov. 30	Special theory of relativity—topics from Chaps. 11–13. Part or all of practice final exam given out. Group work on relativity? *Monday, Nov. 30, is the last day for term withdrawal.*
16	Dec. 7	Monday, December 7 is last day of classes. We will review for the final exam or possibly engage in group work on relativity. **Final Exam will be 3:30–5:30 pm, Wednesday, Dec. 9, in our classroom, Mer 109.** **The Final Exam will be on whatever we actually cover after Exam III.** (The Final Exam Period will extend from Tue. Dec. 8 through Sat. Dec. 12.)