Physics 1202W.200 (5 credits) Spring 2016
Introductory Physics for Biology and Pre-Medicine II

1 General Information

Welcome to Physics 1202W (which has a prerequisite of Physics 1201W). This is the second semester of a two-semester introductory course in physics for students whose main interests are in the biological sciences. The principal topics to be covered in this course are electromagnetism, waves, optics, and nuclear physics. These subjects, for example, provide the foundation of our understanding of all chemical interactions, and therefore our understanding of all biological processes. The applications of the topics presented in this course range from the molecular scale to large medical diagnostic machines. The material you learn in this course will be important to you throughout your career in the biological sciences. It will also help you to understand the physical world around you, by explaining to you how every motion in your environment is related to the forces that govern that motion. You will also increase your ability to communicate technical information with clarity and precision.

Instructor: Aaron Wynveen
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Phone: 612-625-6967 (not preferred)
E-mail: wynveen@physics.umn.edu, but not a good idea with this many students. If you have a question, see me in person after class or during my office hours.
Office hours: Tuesdays, 11:15-12:05, in Blegen 110; Wednesdays, 1:25-2:15, in Blegen 125.
Tutorial room (140 Williamson): Starting from Jan. 25th, Teaching Assistants will be available at certain times during the week to answer your physics-related problems. A schedule will be posted outside room 140. Note, ALL TAs should be able to help.

2 Required Materials

The textbook for the class is General Physics, 2nd edition (1991), by Morton M. Sternheim and Joseph W. Kane (volume 2). The laboratory manual will be available free(!) via the course website. You should download this during the first week of class so that it is accessible even without an internet connection. For lab, however, you should purchase a lab journal (a gridded journal with pages that cannot be easily removed, e.g., U of MN 2077-S) from the bookstore. A cheap scientific calculator with exponentials, trig functions, etc. is also required.

Supplementary Texts: Calculus will be used extensively in this course. Indeed, the subjects of differential and integral calculus were developed by Newton as tools for the analysis of problems in physics. If it is a few years since you have taken a calculus course, it would be a good idea to re-read the introductory parts of your old textbook. Several books have been written that offer help in the calculus topics relevant to introductory physics, for example: How to Ace Calculus by Adams, Thompson, and Hass, published by Freeman and Company;
The Competent Problem Solver for Introductory Physics: Calculus Version, University of Minnesota, School of Physics and Astronomy; Mathematical Preparation for General Physics with Calculus by Davidson and Marion, published by W.B. Saunders Company; and So You Want to Take Physics by Cole, published by Saunders College Publishing.

3 Class Times, Locations, and Important Dates

Group Quizzes (tentatively): 2.11, 3.3, 4.7, and 4.28 (Thursdays in Discussion Sessions)
In-lecture Quizzes (tentatively): 2.12, 3.4, 4.8, and 4.29 (Fridays in TBD)
Final Exam: Thursday, May 12, 6:30-9:30 pm. Location to be determined.

Lectures: M,T,W,F 12:20-1:10 in Willey 125

<table>
<thead>
<tr>
<th>Disc./Lab Sect.</th>
<th>TA</th>
<th>Disc. Time, Location</th>
<th>Lab (Wlmsn 150C)</th>
</tr>
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<tbody>
<tr>
<td>201/202</td>
<td>Zack Robinson</td>
<td>Th 12:20, KoltH 135</td>
<td>M 8:00-9:55</td>
</tr>
<tr>
<td>203/204</td>
<td>Santosh Adhikari</td>
<td>Th 12:20, VincH 2</td>
<td>Tu 8:00-9:55</td>
</tr>
<tr>
<td>207/208</td>
<td>Gino Graziano</td>
<td>Th 12:20, FolwH 108</td>
<td>W 8:00-9:55</td>
</tr>
<tr>
<td>209/210</td>
<td>Pamela Sooriyan</td>
<td>Th 12:20, AmundH 124</td>
<td>Th 8:00-9:55</td>
</tr>
<tr>
<td>211/212</td>
<td>Sergey Monin</td>
<td>Th 12:20, AkerH 227</td>
<td>Th 10:10-12:05</td>
</tr>
<tr>
<td>230/231</td>
<td>Pamela Sooriyan</td>
<td>Th 1:25, AkerH 227</td>
<td>W 4:40-6:35</td>
</tr>
<tr>
<td>232/233</td>
<td>Santosh Adhikari</td>
<td>Th 1:25, VincH 20</td>
<td>Th 2:30-4:25</td>
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<tr>
<td>234/235</td>
<td>Gino Graziano</td>
<td>Th 1:25, PeikH 28</td>
<td>F 8:00-9:55</td>
</tr>
<tr>
<td>236/237</td>
<td>Zack Robinson</td>
<td>Th 1:25, MCBio 2-122</td>
<td>Th 4:40-6:35</td>
</tr>
<tr>
<td>238/239</td>
<td>Sergey Monin</td>
<td>Th 1:25, AmundH 156</td>
<td>W 2:30-4:25</td>
</tr>
</tbody>
</table>

4 Class Web Page

URL: www.physics.umn.edu/classes/ and select 1202W.200. You must log on using your University X.500 user name and password. The class web page will be the location for announcements regarding lectures, lab, homework, quizzes, and the final exam. Solutions to the homework and quizzes will be posted here. You can download, as a .pdf file, any material appearing on the class web page, including this Syllabus.

5 The Class

While brisk and challenging, the pace of this course should allow you to understand the material in depth, even if you have not previously studied this subject. The course is structured so that each topic builds on those covered previously. Therefore it is important that you understand each topic as it is presented. If something is unclear, do not ignore it in the hope that “it won’t be covered on the test”. The topic that you do not understand now may turn out to be essential for the understanding of tomorrow’s topic, which may in turn be essential for the understanding of next week’s topic, etc. There are many sources of help: come to me after lecture, or during my office hours; ask your TA during Discussion Sessions or during office hours; ask your fellow students. Don’t be passive. The difficulties will not clear up by themselves. It may require hard work to master some of the essential concepts of physics, but with enough practice, you will come to understand (and appreciate) even the
most difficult concepts.

The lectures will (roughly) follow the sequence of topics presented in the book. I will try to clarify issues that I think are possible sources of confusion, and to emphasize the essential physical concepts for each topic. Lecture demonstrations will show the applicability of the theory to real-life situations. Example problems will also be done during class to show you how to approach a problem. You will get far more out of each lecture if you have already read the relevant material in the textbook. A tentative schedule is presented below, showing the chapters to be covered each week in lecture.

**Homework:** Each week, approximately ten end-of-chapter problems will be assigned. They will be collected by your TA at the Discussion Session. One problem, selected randomly, will be graded before the problems are returned to you at the next Discussion Session. The solutions to the assigned problems will be posted on the web page immediately after the problems are collected by your TA. While you are working on the homework problems, you are encouraged to discuss them with your fellow students, and to seek help from all sources, such as utilizing the TA office hours in Wmns 140. However, assignments submitted for grading should be written by you alone, in your own words. Also, additional practice problems will be provided online – working through problems is probably the best way to learn physics!

**Discussion Sessions:** During the Discussion Session you will solve physics problems, working together in teams of 3-4 students. After the problem has been solved, students may be called to the board to discuss their answers. On the Thursdays of weeks when an In-lecture Quiz is scheduled, the Discussion Session will be devoted to the “Group” portion of the quiz. Active participation in the Discussion Sessions is required for taking the Group Quizzes. Missing a discussion session without a valid excuse will result in a 5-point deduction from the group portion of the quiz.

**Quizzes and Final Exam:** Your course grade will be based, in part, on your quiz scores (four Discussion Section/In-lecture Quizzes). Each quiz score has a “Group” component, worth 25% of your total quiz grade and which is administered in the Thursday Discussion Session preceding the In-lecture Quiz on Friday (except for one Wednesday exam), and an In-lecture component, which is worth the remaining 75% of your total score. The lowest quiz score will be dropped, so that only three of your quiz scores will be used in determining your course grade. If, for some reason, you are unable to take a quiz at the scheduled time, this missed quiz will act as your dropped quiz. If you must be away from campus at the time of the final exam, I will try to arrange for you to take the final at some other time.

6 Laboratory Sessions

Because this course satisfies University requirements as a laboratory science class and as a writing intensive course, you must pass the laboratory (with a score of 60% or greater) to receive a passing grade in the course. The laboratory grade will be based on well-thought-out predictions, collaborative skills as evidenced by effective group work, and well-organized and
clearly written technical reports.

You will write a total of four laboratory reports. The specific laboratory problem for which you will write a report will be assigned to you by your instructor during the quiz weeks so that you can work on the reports after taking a quiz. Reports should be about 4 typed pages, including all necessary predictions, graphs, data tables, and calculations. Reports must be given to your laboratory instructor for grading no more than one week after they are assigned. Late reports will not be accepted. Graded reports will be returned to you no later than your next laboratory meeting. You will be allowed to resubmit the first lab report to achieve a higher grade. It must be given to your laboratory instructor within one week of the time the original report was returned to you.

Lab data is taken cooperatively, but you are responsible for writing your own reports. Copying lab reports can result in a failing grade for the course. Details of the laboratory grading scheme are in your laboratory manual and will be explained by your TA.

Read the relevant portions of the lab manual before attending lab. Each lab has several components. Your TA will tell you which components to prepare each week. All the laboratory problems have sections called “Prediction” and “Warm-Up”. Give your TA the predictions and the answers to the “Warm-Up” questions two days before your scheduled lab session.

Failure to participate in one laboratory will result in -20% of the grade of the following lab report (-40% if you miss 2 labs, etc.). Since the laboratory involves teamwork, no laboratory makeup will be allowed except in situations officially recognized by the University. In that case, the laboratory work must be made up by arrangement with your TA before your next scheduled laboratory period.

7 Grading

Your course grade will be based on the following components:
Homework: 10%
Laboratory: 15%
Scores of the three best quizzes: 45% (= 3 × 15%)
Final Examination: 30%

Upon calculating your final numerical grade, you will receive a letter grade of:

- A: ≥ 90%
- A- : < 90% or ≥ 85%
- B+: < 85% or ≥ 80%
- B: < 80% or ≥ 75%
- B-: < 75% or ≥ 70%
- C+: < 70% or ≥ 65%
- C: < 65% or ≥ 60%
- C-: < 60% or ≥ 55%
- D+: < 55% or ≥ 50%
- D: < 50% or ≥ 45%
- F: < 45% or Lab grade < 60%

Resolving grading disputes: If you are dissatisfied with a grade you have received for any component of the course, express your complaint in a well-written paragraph and give it to me along with the relevant papers. I will consider the issue and give you the result as soon
as possible. DO NOT WRITE ON YOUR GRADED EXAM.

Individual quiz scores may be rescaled (“curved”) at the end of the semester if deemed appropriate. You will be notified if this is the case.

8 Legal Matters

Policy on Cheating, from the CSE student guide: “The College of Science and Engineering expects the highest standards of honesty and integrity in the academic performance of its students. Any act of scholastic dishonesty is regarded as a serious offense, which may result in expulsion. The College of Science and Engineering defines scholastic dishonesty as submission of false records of academic achievement; cheating on assignments or examinations; plagiarizing; altering, forging, or misusing an academic record; taking, acquiring, or using test materials without faculty permission; acting alone or in cooperation with another to obtain dishonestly grades, honors, awards, or professional endorsement. Aiding and abetting an act of scholastic dishonesty is also considered a serious offense.” In cases of scholastic dishonesty, it is up to the instructor to determine the penalty.

8.1 Departmental Policies

Physics Department policy on Incompletes: “In order to receive an incomplete, you must have completed all portions of the course satisfactorily, including the labs, up to the date of the incomplete. An incomplete requires extraordinary circumstances as an excuse for not completing the course on time. It requires a written and signed agreement between the professor and the student, which is placed on file with the Physics Department. You cannot retake a major portion of the course through an incomplete.”

ATHLETES must provide their official University of Minnesota athletic letter containing the approved competition schedule to their instructor and the staff in the front office. Away exams will be arranged with the athletic adviser traveling with the team. Accommodations will be made for official university sports only (i.e. no accommodations will be made for intramurals, club sports, etc.)

DISABILITY SERVICES: If you have accommodations for this course, please provide the staff in the front office with a copy of your accommodation letter for the current semester. Exams will be arranged according to accommodations and sent to the testing center for administration.

8.2 Mandatory Policy Information

- Student conduct code
  http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html
• Scholastic Dishonesty
  See student conduct code

• Disability Accommodations
  http://ds.umn.edu/student-services.html

• Use of Personal Electronic Devices in the Classroom
  http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html

• Makeup Work for Legitimate Absences
  http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html

• Appropriate Student Use of Class Notes and Course Materials
  http://policy.umn.edu/Policies/Education/Education/CLASSNOTESSTUDENTS.html

• Grading and Transcripts
  http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html

• Sexual Harassment
  http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html

• Equity, Diversity, Equal Opportunity, and Affirmative Action
  http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.html

• Mental Health and Stress Management
  http://www.mentalhealth.umn.edu

8.3 Liberal Education Core Requirement

The class exposes the student to physical principles and concepts, demonstrates how these principles can be applied to quantitatively describe natural phenomena, and provides the student with an opportunity to perform hands-on experiments and measurements that model how physical knowledge is obtained. The fundamental principles of electricity and magnetism are considered along with light and optics and the physics underlying atoms and molecules. Throughout the course, the role of these physics concepts in our understanding of the nature of living systems is emphasized. The development of conceptual understanding of physical principles and their quantitative application are further deepened in the discussion section, where students practice problem solving skills. In addition, familiarity with the methods and findings of the physical sciences not only forms a crucial component of a common education, but also prepares students to be scientifically literate citizens.

Because all knowledge in the physical sciences is empirically acquired, the laboratory component of the course is essential to properly expose students to the scientific method and the ways of knowing and thinking in the physical sciences. The lab component involves the formulation of scientifically sound predictions by the student, followed by empirical testing of the hypotheses through hands-on experimentation. Since the language of the physical
world is mathematical, quantitative analysis of experimental data is an essential aspect of the lab experience. Physics, like all sciences, is a social endeavor, and students are exposed to cooperative problem solving, working in small groups with other students, in both the laboratory and discussion sections of the course.

9 Announcements

It is occasionally necessary to modify the course schedule, including the dates of quizzes. Students are responsible for ALL announcements made during the lecture, Discussion Session or Laboratory Period. Every announcement will be posted on the “Class News” web page. Missing an announcement is not an acceptable excuse for missing a quiz or a course-related deadline. It is the responsibility of any student missing a lecture to determine what course material and/or announcements were missed.

10 Tentative Lecture/Laboratory Schedule

<table>
<thead>
<tr>
<th>Week (date)</th>
<th>Book sections</th>
<th>Lab Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 (1.19)</td>
<td>23.3, 24.1.9 (Light/mirrors)</td>
<td>BEMA</td>
</tr>
<tr>
<td>Week 2 (1.25)</td>
<td>23.1,4,5; 24.2-8,13 (Refraction/lenses)</td>
<td>Labs I.3,4,7</td>
</tr>
<tr>
<td>Week 3 (2.1)</td>
<td>5.6; 16.1-4,12,13 (E-field/force)</td>
<td>Labs IV.5,6</td>
</tr>
<tr>
<td>Week 4 (2.8)</td>
<td>16.5,6 (E-potential) [Quiz#1]</td>
<td>Labs IV.1-4 (FLR)</td>
</tr>
<tr>
<td>Week 5 (2.15)</td>
<td>16.7-11 (E-materials)</td>
<td>Lab Review</td>
</tr>
<tr>
<td>Week 6 (2.22)</td>
<td>17.1-6,12 (Current/Circuits)</td>
<td>Labs III.4,6,7</td>
</tr>
<tr>
<td>Week 7 (2.29)</td>
<td>17.7,11; 18.1-6 (Circuits/Nerves)</td>
<td>Labs II.3,4 (FLR)</td>
</tr>
<tr>
<td>Week 8 (3.7)</td>
<td>19.1-6,9-11 (Magnetic force/fields)</td>
<td>Labs II.6,7</td>
</tr>
<tr>
<td>March 14-18</td>
<td>Spring Break!</td>
<td>No Labs</td>
</tr>
<tr>
<td>Week 9 (3.21)</td>
<td>19.7,8,12; 20.1,2,3 (Magnetic fields/Induction)</td>
<td>Labs V.7,8</td>
</tr>
<tr>
<td>Week 10 (3.28)</td>
<td>20.4,6 (Transformers/Mag.materials)</td>
<td>Labs V.1,2,5 (FLR)</td>
</tr>
<tr>
<td>Week 11 (4.4)</td>
<td>20.7,8,10-14:29 (Inductors, AC, NMR) [Quiz #3]</td>
<td>Labs VI.3,5</td>
</tr>
<tr>
<td>Week 12 (4.11)</td>
<td>20.5:21.1-9 (EM radiation/Waves)</td>
<td>Waves lab?</td>
</tr>
<tr>
<td>Week 13 (4.18)</td>
<td>23.1,2,6-9,13 (Interference/Diffraction)</td>
<td>Labs VII.1,2 (FLR)</td>
</tr>
<tr>
<td>Week 14 (4.25)</td>
<td>23.10,11 (Polarization) [Quiz #4]</td>
<td>Labs VIII.3,4</td>
</tr>
<tr>
<td>Week 15 (5.2)</td>
<td>30.1-6,9,10,12 (Nuclei and Review)</td>
<td>No Lab</td>
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“FLR” = formal lab report assigned that week.