Physics 265 – Modern Physics **Syllabus** **Block 7 – 2017-18**

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and by appointment

Textbook: Six Ideas that Shaped Physics, Thomas A. Moore, McGraw-Hill (2017). Unit Q and Unit T. I will also provide some supplementary reading materials.
Other supplies you will need: a good scientific calculator.
Schedule: We will meet from 9 am-11 am and 1 pm-3 pm each day. We will cover approximately two chapters each day. I hope to be able to cover new material from 10-11 am and from 1-2 pm (or so), but the schedule may shift somewhat. I will be present in the classroom until 3 pm to answer questions on the newly assigned homework problems.

Course Philosophy: This class will cover quantum mechanics and statistical mechanics. Quantum mechanics explains the behavior of particles whose wave-like nature is important (usually small particles like electrons, protons, and neutrons, but under the right circumstances, also whole atoms or molecules). Statistical mechanics explains the collective behavior of quantum mechanical systems (like gases, liquids, and solids). In this class, you should focus on gaining a qualitative understanding of the phenomena as well as an ability to solve problems using equations. I will also ask you to be able to *derive* and *describe* equations which you use (for instance, on a test), not just *use* the equations.

As is the case in all physics classes, you will learn the most in this class by practicing active learning. You should not just listen to what I tell you – you should take notes, jot down questions, and work the in-chapter exercises while you read the text, express new concepts in your own words, and read over your class notes before working on homework problems. Much of your learning will come through doing homework problems. I will do some combination of lecturing and asking you questions during class and occasionally you will work on in-class exercises. It is important for you to read the chapter before coming to class so that you are ready to think about the material in class.

Course Objectives:
This course supports the Educational Priorities and Outcomes of Cornell College with emphases on

knowledge: you will develop your understanding of two foundational theories of physics and their applications: quantum mechanics and statistical mechanics;
reasoning: you will evaluate evidence; interpret data; and use logical, mathematical, and statistical problem-solving tools;
communication: you will practice informal communication through group work and formal communication through written reports and oral presentations.

Specifically, by doing the work in this class, I expect that you will:

Develop and demonstrate conceptual understanding of physical models of phenomena including:
- wave-like behavior or small particles such as electrons, nuclei, atoms
- particle-like behavior of light
- quantum behavior of spin
- principles of quantum mechanics
- behavior of collections of particles in an ideal gas and in a solid using concepts like entropy

Strengthen quantitative reasoning skills and computational abilities
Learn to derive from first principles, describe, and justify the logic of important equations
Deepen understanding of the connection between observation, measurement, and theory
Display understanding through informal presentations and writing

Math: This course will probably be more mathematically intensive than the previous physics courses you have taken. During the block, you will be asked to carry out extensive algebraic manipulations, often involving trigonometric functions, as well as partial derivatives involving the chain rule and a variety of integral techniques, including integration by parts. I will also introduce functions of complex numbers and methods of finding solutions to a few, specific types of differential equations. You will also use Mathematica, specifically to carry out integrals and to graph complicated functions.

Academic Honesty: Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty can be found here:
https://www.cornellcollege.edu/registrar/pdf/Academic%20Honesty.pdf .

Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. Any student in this course who is involved in academic dishonesty (portraying another person's work or ideas as their own, submitting the same or similar papers in more than one course without permission from the course instructors, facilitating plagiarism, etc.) will not earn credit for the relevant assignments and may be formally charged with academic dishonesty.

Students with disabilities: Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.

Assignments:

Reading:

The chapters that we will cover each day are listed on the schedule. I will post more details on the reading on Moodle, with the homework. I expect you to read the assigned chapters, preferably before class. I encourage you to work the in-chapter exercises as you read.

***Problem Sets*:** **[Practice logical and mathematical problem solving]**

Daily problem sets will be assigned. These problems are for you to develop your physics muscles, by practicing. You are encouraged to work on these assignments with your classmates, both during designated class time and outside of class, and to consult with me on any questions you may have. Problem assignments will be posted on Moodle before we cover the material in class. You will not turn in most of these problem solutions. Occasionally, I will assign homework that you will turn in.

Homework Quizzes and Presentations: **(Approx. 120 pts – 5 pts per problem)**

[Practice problem solving and communication]

Almost every morning, we will have a quiz over the homework. On the morning of the quiz, I will randomly select one problem from each chapter's homework as the quiz questions. You will be able to use your notes, *but not the textbook*, to write up the solution for me. You must have *all of the information* you need to solve the problem in your notebook. Your solutions to the quiz questions must be neat and clear, must respond to all parts of the question, and must use units properly in order to get full credit.

I expect that before you start the quiz you will have completed all of the homework problems, and that you will spend the quiz time re-writing your solution neatly onto a separate piece of paper to turn in. I will typically allow 10 minutes per problem for the quiz. If you are unable to complete the quizzes in the allotted time, please meet with me to discuss the situation.

At my discretion, I will ask students to present problems by writing the solution on the chalk board as an alternative to a quiz. I will randomly select students who will present each problem. You will be evaluated on your presentation of the solution.

I will allow you one undocumented absence from a quiz for sickness or an emergency without penalty. You must notify me of the reason for your absence by e-mail on the day of the absence. Any further absences from quizzes will require some documentation - a note from a health care provider, for instance. If you are present for all of the quizzes, I will drop your lowest quiz score.

Homework Problems to turn in: **(Approx. 30 points – occasional 2-5 points per problem)**
[Practice problem solving and communication]
Some homework problems are very useful or interesting, but are too involved for a quiz or require work on a computer and a print-out. I will ask you to turn these problems in for credit. Late submissions will lose 20% of possible points if turned in within 24 hours, and an additional 20% for each additional 24 hours they are late.

Mathematica Problems: **(30 pts) [Demonstrate quantitative reasoning, computation]**
You will have several Mathematica problems to turn in. Problem 1 is due on Thursday, March 22 at 9 am and is worth 10 pts. Problem 2 is due on Sunday, March 25 at 9 pm and is worth 20 pts. Late submissions will lose 20% of possible points if turned in within 24 hours, and an additional 20% for each additional 24 hours they are late.

Article Responses (**Approx. 30 pts)** **[Demonstrate communication]**
We will all read two recent research articles that cover topics related to this course. You will write a short response to the articles. (More information will be provided). The first response is due Wednesday, April 4 at 9 am. The second response is due Tuesday, April 10 at 5 pm. Late submissions will lose 20% of possible points if turned in within 24 hours, and an additional 20% for each additional 24 hours they are late.

Exams: **(300 pts total) [Demonstrate logical and mathematical reasoning and problem solving]**
There will be three exams (100 pts each). The exams will consist of short answer questions, definitions, derivations, and problems. The problems will be similar to the homework problems. I will provide a select set of equations for the exams. You will need to memorize the rest of the necessary equations.

Exam 1:	Tuesday, March 27, 8:30 am to 11 am
Exam 2:	Tuesday, April 3, 8:30 am to 11 am
Exam 3:	Wednesday, April 11, 9 am to 11:30 am

Grading Scale:
My grading scale is approximately the following, although I reserve the right to adjust it slightly if I think my exams are too easy or too hard.
A: 95 -100, **A-:** 90-94, **B+:** 85-89, **B:** 80-84, **B-:** 75-79, **C+:** 70-74, **C:** 65-69, **C-:** 60-64, **D:** 45-59, **F:** below 45