MILLERSVILLE UNIVERSITY

PHYS 233, Modern Theories of Waves and Particles
Spring Semester 2012

Instructor: Dr. Mehmet I. Goksu

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Lecture:

15:00 – 15:50	Dr. Mehmet I. Goksu	M, W, F	Roddy 256

Office Hours:

13:00 – 15:00	M, W	Caputo 241
09:00 – 10:00	F	Caputo 241
by appointment or walk-in,		Caputo 241

Please feel free to call me or send me an email if you'd like to schedule a time to meet me. I will respond your message ASAP, usually on the same day or following day.

Materials:

The textbook: "Modern Physics", 2nd Edition by Randy Harris, Addison –Wesley publisher
This book is designed to follow the standard two-semester introductory, calculus-based, classical physics course. An understanding of the concepts of calculus is prerequisite. The necessary differential equations and wave mechanics are explained as needed.
Calculator: A scientific calculator.

Overview:

The course description for Physics 233 reads: Selected topics from areas of waves and optics, special relativity, and introduction to the concepts and development of modern physics and single particle quantum mechanics.
Prereq: PHYS 232. Coreq: MATH 311.

Objectives:

In Physics 233, you will be introduced to two of the most exciting developments in physics in the 20th century: relativity and Quantum Mechanics. We will investigate the origins and consequences of Einstein's Theory of Special Relativity; wave-particle duality; the Bohr model of the atom; the Schrödinger Equation; and the occasionally strange consequences of quantum mechanics.

Class activities will always assume that you have read the daily assignment and you are prepared to participate. In-class activities may involve conceptual mini-quizzes, group problem solving, mini lectures, and presentations of group work before the class.

Outlines

I. Special Relativity
   A. Consequences of Einstein's Postulates
   B. The Lorentz Transformation Equations
   C. The Doppler Effect
   D. Velocity Transformation
   E. Momentum and Energy

II. Electromagnetic Radiation
   A. Blackbody Radiation
   B. The Photoelectric Effect
   C. The Production of X-Rays
   D. The Compton Effect
   E. Pair Production

III. Matter Behaving as Waves
   A. A Double-Slit Experiment
   B. The Free-Particle Schrodinger Equation
   C. The Uncertainty Principle
   D. The Bohr Model of the Atom

IV. Bound States
   A. The Bound State Schrodinger Equation
   B. Particle in a Box
      1. The Infinite Well
      2. The Finite Well
      3. The Simple Harmonic Oscillator
   C. Expectation Values, Uncertainties, and Operators
   D. Stationary and Nonstationary states

V. Steps, Tunneling and Particle-Wave Propagation
   A. The Potential Steps
   B. The Potential Barrier and Tunneling
   C. Alpha Decay and Other Applications
   D. Particle-Wave Propagation

VI. Quantum Mechanic in Three Dimensions and the Hydrogen Atom
   A. The Schrodinger Equation in Three Dimensions
   B. The 3D Infinite Well
   C. Energy Quantization and Spectral Lines in Hydrogen
   D. The Schrodinger Equation for a Central Force
   E. Angular Behavior in a Central Force
   D. The Hydrogen Atom
   E. Hydrogenlike Atoms
   F. Photon Emission

Access Students:

If you have special needs as addressed by the Americans with Disabilities Act (ADA) and need assistance, please notify the Learning Services (Extension:3178) or the course instructor immediately. Reasonable efforts will be made to accommodate your special needs.

Grading Policy:
The course grade will be based on quizzes, three-exams, final exam and homework assignments.

Grade Distribution:

Homework	35%
Quizzes	10%
Exams	40%
Final Exam	15%

Grading Scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
92	88	83	78	74	70	65	60	57	54	50	<50

I may shift the borderline between certain letter grades by a small amount so that the line lands in the middle of a naturally occurring gap. Thus, it is possible you may get 87 % and end up with an **A-**, or you may get 88 % and end up a **B+**.

Attendance Requirements:
Attending the lectures is essential for the proper understanding of the material. You are expected to be present at every class and lab. I will follow the University's official "Class Attendance Policy". Please be sure to comply with these guidelines. If you have a valid conflict that does not allow you to take an exam or quiz, or to be at the lab at the scheduled time contact me as soon as possible. Missing an exam, lab or quiz requires a valid excuse; otherwise a grade of zero will be assigned. I reserve the right to determine what is, and is not, a valid excuse. As a rule only extreme situations, such as serious medical problems, will be considered valid excuses. Alarm clock malfunctions and similar events are NOT considered valid excuses. The university attendance policy is available online at http://mustang.millersville.edu/~registrar/attendance_policy.php

Lectures:
If you wish to maximize your learning experience during the lecture, you should read the chapter prior to class. This will allow you to ask questions during class concerning misconceptions or difficulties that may have arisen during the reading.
During the lectures, I will explain the concepts and do sample calculations to show how to apply these concepts. You should be prepared not only to ask questions but also to answer questions about the material. You are responsible for all the material discussed in class. Concepts not covered in class will not appear on the tests.

Homework:
Assigned readings:
We have a large amount of material to cover in this course, and it will be impossible to cover it all unless each of you do your part in reading the textbook before you come to class.
Reading a science textbook is not like reading a work of literature – you must read slowly and pause often to check your understanding. Keep notes on your readings in your class notebook,

and come to class prepared to ask about specific things that you do not understand. If you follow this regimen on a regular – preferably daily-basis, you will be amazed at how much your understanding of the material improves as weeks go by!

Written assignment:
All homework assignments that you turn in should be neat and legible, and represent the final results of your labors. In other words, you should not have any scratch work on the assignments you turn in. The solution sets that should be stapled must be **handed in at the beginning of class**. Part of the reason for doing homework problems is to give you practice in communicating your results to an audience, which is necessary skills for success in science. You should prepare your homework solutions with the idea that the audiences for your work are the other students in the class - not *the instructor!* Thus all of your problem solutions should be clearly and coherently written, with each step logically following from the previous one, and with some English explanation along with the calculation.
To be completely correct – and to receive full credit – any physics problems solution must not only arrive at the correct result but also adhere to certain standards of your presentation. If your problem solution contain any of the following deficiencies in presentation, you will receive an automatic deduction(s) from your problem score (deductions may be cumulative!):

- Units not associated with numbers where necessary
- Vector notation not used or incorrectly applied
- Lack of English – Language explanation where one is clearly called for.
- Illegible handwriting.
- Steps missing or out of order.

Finally, each problem should begin at the top of a new page and there must not be more than one problem per page.
I strongly urge you to work all the problems. If you do not understand the problems please ask me. Text problems that review concepts and calculations will be assigned from each chapter. Solutions to the assignments will be available after they are due.

Quizzes:
Quizzes will be administered once each week on Monday to test your comprehension of recently assigned lecture material and assigned problems. You might be asked to answer a conceptual question and/or calculation-type problem(s). The quizzes will be 10 to 20 minutes long, closed – book and closed notes. Solutions to the quizzes will be available right after the quiz. Be sure to bring a calculator to quizzes.

Exams:
There are three - one hour exams worth 100 points each and a final exam. The exams will cover concepts and definitions, assigned problems with minor numerical changes, and problems similar to those assigned.
The tests and the final exam will be closed –book/notes. For the exams, you will be provided with the fundamental equations and numerical constants that you need. Be sure to bring a calculator the exams!

The final exam is scheduled between 10:15 – 12:15 on Monday, May 7.

Makeup exam and quiz will be given only if you have a legitimate excuse. This makeup test/quiz will be given at a time specified by the instructor.

Academic Integrity

I am using Millersville University *Student Conduct Code* http://mustang.millersville.edu/~handbook/codeofconduct.php to create an environment for Academic Integrity. Academic dishonesty such as cheating and plagiarism are serious offenses in which immoral people engage. Incidents of academic misconduct will be met with a failing grade on the item in which the misconduct occurs, possible failure in the course, and the Dean of Student Affairs and the Vice President for Academic Affairs will be notified.
You are expected to do your own work. Although I often encourage students to work on homework assignments together, I suggest that you write up your own work alone.
Copying any part of another student's homework solution and submitting it for a grade is academic misconduct. Providing your work for another student to copy is academic misconduct.
Communication with anybody else during exams or quizzes is forbidden. This includes verbal, written, electronic, and other communications, either one-way or two-way. Communication with another, if determined to be cheating, may result in an immediate grade of "F" for that exam or quiz.
Any form of cheating on exams (or quizzes) is academic misconduct. Providing assistance to a fellow student during an exam is academic misconduct.

Tips for making the course easier:

1. Don't skip class. Although you may be tired or stressed out, come to class. Listening always help.
2. Don't delay looking at your class notes. If you take notes and then delay looking at them for several days, by then they likely will have been transformed into a foreign language. A better plan is to look over class notes later that day, even if for only a short time period. Scribble in extra notes about why things were said, what principles were stressed, etc.
3. Read the book. If you get confused, don't give up. You need to learn how to sort through complicated issues to organize the main ideas.
4. Do your homework. It will also help you to prepare for exams.
5. Study with a friend, form a study group so that you can ask each other questions.
6. Always ask for help/question if you do not understand solution or concepts.

All parts of this syllabus are tentative and subject to revision.