

# College of Southern Maryland

## PHY 2210 –General Engineering Physics III

### Syllabus – Fall 2009

**Instructor:** Richard H. Beers, Ph. D

**Class Times:** Section 76054            T/TH            PFA 207            8:30-9:50 am

**Office:** Room 210 or Classroom (207)

**Telephone:**  
College Lab/Classroom: (443) 550-6507  
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**Office Hours:**  
MW 10:00-11:30  
T 12:00-1:00  
T/TH 7:30-8:30  
TH 10:00-11:00  
or by appointment

**Text:** *Fundamentals of Physics*, Halliday, Resnick & Walker, *8<sup>th</sup> Edition (Required)*.  
The engineering sequence will require the three-volume version available in the bookstore. Study Guides and Solutions Manuals are available, but not required. Feel free to contact instructor prior to purchase of the latter.

**Prerequisites:** PHY 2200 and PHY 2200L.

**Credit Hours:** 3

**Calculator:** A calculator capable of performing scientific operations including exponential, logarithmic, trigonometric and matrix computations is required. TI-84 is recommended, TI-89s are acceptable, but not supported.

**Course Description:** This is the third of a three semester, calculus-based course sequence designed to introduce students to the general principles of engineering physics. Specifically, this course covers Induction and Inductance, AC Circuits, Maxwell's Equations, Electromagnetic Waves, Geometric Optics including Reflection, Refraction and Diffraction, Special Relativity, Matter and Waves, Atomic Physics, Quantum Mechanics, Solid State Physics, Nuclear Physics including Fission and Fusion, Particle Physics and Cosmology.

**Course Objectives:** This course is the third of a three-semester sequence designed for the Physicist/Engineer as a core course. It has a four-fold objective: (1) complete an instructional framework for the understanding of underlying physical principles ranging from AC Circuits, Electromagnetism, Geometric and Physics Optics, Modern Physics including Atomic and Quantum Theory to Nuclear and Particle Physics, (2) reveal a universe that is counter-intuitive, (3) teach skills in problem-solving and applications using sophisticated mathematical tools up to and including Advanced Calculus and (4) instill the principles of the “scientific method” of observing, questioning and explaining. Strong emphasis is placed upon understanding physical concepts, not merely finding formulas and plugging in numbers.

**Performance Evaluation:** Student performance will be measured as follows:

3 unit exams (non-comprehensive – see attached schedule): 20 % each, 60% total.

3 quizzes 5% each 15 % total

Comprehensive Final: 25%

Unit exams will be variable in format and will equally test intuition/concepts and quantitative analysis. Time permitting, feedback will be provided by the instructor to the student prior to turning in his/her exam. This may allow the student to improve his/her submitted exam. This feature is not available for make-up exams administered in the Testing Center. Quizzes and exams will draw, in part, on assigned homework. There is no make-up for quizzes.

Final grades will be assigned as follows:

90 – 100% A

80 – 89%+ B

70 – 79%+ C

60 – 69%+ D

Below 60% F

**Homework:** Homework will be assigned in class, and selected even-numbered problems will likely appear on exams or quizzes. Successful independent completion of the homework assignment serves as an invaluable aid in understanding the concepts presented in the course. Homework may be done either individually or collectively with fellow students. Work groups are encouraged. A solutions manual will be made available by the instructor for examination prior to or after class. Solutions may not be copied or transcribed.

**Attendance Policy:** Attendance will be taken at each class session. The course is fast-paced; and poor attendance usually results in a poor or failing grade. The student is responsible for any and all announcements, assignments, lectures, materials, handouts, scheduled exams or quizzes.

**Audit and Withdrawal Policy:** Students are reminded to consult the College Catalog for dates, procedures, responsibilities and impacts of changing registration status. **November 13** is the last day to withdraw from a course or change from AUDIT status to CREDIT status or from CREDIT to AUDIT. A contract between the student and instructor must be made before a student is permitted to change from credit to audit; and all conditions must be met. Successful audit contracts are rarely used in this class.

**Make-up Exam Policy:** Makeup exams will be allowed without penalty for legitimate reasons if the instructor is notified in advance or if an unavoidable emergency occurs. Arrangements for a make-up exam are the sole responsibility of the student and will be made directly with the instructor. All made-up exams must be completed within one week of the originally scheduled date. Quiz make-ups are generally not permitted.

**Student Integrity Policy:** Students are expected to perform independently on exams and quizzes unless otherwise authorized by the instructor. Any violations of the Student Code of Conduct as outlined in the Student Handbook result in a score of zero for the exam or quiz. The violation will be reported to the Director of Student Affairs and to the College Judicial Committee for review and possible disciplinary action.

**Disabilities and Special Needs:** Students with disabilities and special needs should have an Accommodation Plan on file so that necessary accommodations can be made. Students with disabilities who believe that they may need accommodations in this class are encouraged to contact Disabled Student Services in the Learning Assistance Department at 301.934.7614 as soon as possible to better ensure that such accommodations are implemented in a timely fashion.

**Unauthorized Persons:** Unauthorized persons (children, friends, family members, and any other persons not registered for the course) are not allowed in the classroom. Details of this college policy can be found in the Student Handbook.



Department of Mathematics, Physics, and Engineering

In order for you to be successful in your physics courses, the mathematics, physics, and engineering faculty has developed the following common expectations of all students in physics courses.

1. As a student, you need to take responsibility for your own learning. This includes, but is not limited to:
  - Arriving on time for each class
  - Staying for the entire class and not leaving class early
  - Actively participating in class and not sleeping or putting your head down
  - Not engaging in other activities that detract from the classroom learning experience. No phone calls, text messaging, etc.
  - Bringing the required materials to class. These might include textbooks, notebooks, binders, pencils, pens, and calculators.
  - Taking care of all business (phone calls, bathroom breaks, getting food, drinks, things from cars, etc.) before class starts.
2. You are expected to be an *active* learner in the classroom as well as out: to participate in group discussion, ask and answer questions, and work problems at the board.
3. You are expected to study your textbook, not merely work problems from it. The best way to do this is to read the section to be covered before the lecture is given, listen to the lecture and take notes, and then study the text again before tackling the practice problems. If this seems like a lot of work, remember that you need to allot 2 hours outside of class for each hour in class. This time commitment increases for online, web-hybrid, and computer-assisted classes.
4. There is no substitute for continued and ongoing studying and doing homework problems. The best way to learn physics is to do physics.
5. It is your responsibility to keep your homework up-to-date. If you are having difficulty with the course material, then you need to take action right away – do not wait until you have lost all hope! There are several options to get assistance:
  - Talk to your instructor during office hours.
  - Homework review is conducted prior to each class.
  - Visit the student success center on campus. Tutors and hours are available at [www.csm.edu/StudentSuccess/Tutoring/](http://www.csm.edu/StudentSuccess/Tutoring/)
  - Use online tutoring available at [www.smarthinking.com](http://www.smarthinking.com)
  - Remember, quizzes and tests draw heavily from assigned homework.
6. Realize that college level physics can be hard and is not always fun.

7. You are given the means to keep track of your grade and are expected to take responsibility for knowing your grade status throughout the semester.
8. Learning physics is different from learning some other subjects. In a physics course, you must be able to do four things:
  - a. *Understand* the material.
  - b. *Process* the material.
  - c. *Apply* what you have learned to solve a problem correctly, and
  - d. *Remember* what you have learned in order to learn new material.
9. Another reason that learning physics is different from learning other subjects is that it follows a sequential learning pattern, which simply means that the material learned on one day is used the next day and the next day, and so forth. This building block approach to learning physics is the reason it is difficult to catch up when you fall behind.
10. College physics courses cover twice the material in the same time frame as do high school physics courses. Faculty members have a certain amount of material to be covered each semester. They have to finish certain chapters because the next course is based on the information taught in this course. Improve your study skills so you can keep up!
11. Most physics problems involve the application of the laws of physics and the expression of these laws in mathematical terms. Students not only must understand how to apply the physical laws but also must use mathematical principles well enough to complete the problems with enough speed to finish the test.
12. During the first few days of class, do not take the attitude that “I already know this material” and start to slack off by not taking notes or not completing homework assignments. Good study habits start from the first day of class. Start practicing good study habits now while the material is familiar to you. In that way, those habits will already be a part of your routine when the material becomes more challenging.
13. Take pride in your work and never let yourself fall into the trap of believing that you cannot do physics. As a youth Einstein’s parents nicknamed him “die Dopperte”, the dopey one. Virtually everybody can, if he or she is willing to work hard enough. Be persistent and determined in your work.

COURSE OUTLINE – PHY 2210 – Fall, 2009

SESSION	DATE	SUBJECT	TEXT SECTION	HOME-WORK*
1 & 2	9/8 9/10	<p><b>Induction and Inductance</b>                      Course Preview, Review of Fundamentals and Electrostatics and Magnetism, Faraday's Law, Lenz's Law, Induced Electric Fields, Inductors &amp; Inductance, RL Circuits, Energy Storage</p>	30.1-30.11	
3 & 4	9/15 9/17	<p><b>Electromagnetic Oscillations                      Alternating Current</b>                      LC Oscillations, Alternating Current, Reactance and Impedance, LRC Circuits, Resonance, Power in Circuits and Transformers</p>	31.1-31.11	
5 & 6	9/22 9/24	<p><b>Quiz #1</b>  <b>Maxwell's Equations</b>  <b>Magnetism of Matter</b>                      Gauss' Law, Ampere's Law, Maxwell's Equations, Magnetism and Electrons, Magnetic Materials: Diamagnetism, Paramagnetism, Ferromagnetism, Magnetic Domains and Hysteresis</p>	32.1-32.11	
7 & 8	9/29 10/1	<p><b>Electromagnetic Waves</b>                      Travelling Electromagnetic Wave, Energy Transport and the Poynting Vector, Radiation Pressure, Polarization, Reflection, Refraction and Dispersion, Snell's Law, Brewster's Law, Total Internal Reflection</p>	33.1-33.9	
9 & 10	10/6 10/8	<p><b>Images</b>                      Real and Virtual Images, Plane Mirrors, Spherical Mirrors, Focal Points and Geometric Optics, Refracting Surfaces, Thin Lenses and Optics, Optical Instruments</p>	34.1-34.9	

11	10/13	<b>Test 1</b>	Chapters 30 - 34	
12	10/15	<b>Interference</b> Light as a Wave, Huygen's Principle, Wavelength and Index of Refraction, Diffraction, Young's Double Slit Experiment, Interference from Thin Films, Michelson Interferometer	35.1-35.8	
13 &14	10/20 10/22	<b>Diffraction</b> Diffraction and Wave Theory, Single Slit Experiment, Circular Apertures, Resolution and the Rayleigh Criterion, Diffraction by the Double Slit, Diffraction Grating, Dispersion and Resolving Power, Laue Spots and Bragg's Law	36.1-36.10	

15 & 16	10/27 10/29	<p style="text-align: center;"><b>Quiz 2</b> <b>Relativity</b></p> <p>Physical Dilemma, Inertial Frames, The Postulates, Speed of Light, Measurement and Simultaneity, Lorentz Factor, Time Dilation and Length Contraction, Proper Time and Length, Consequences, Doppler Effect, Relativistic Energy and Momentum, <math>E = mc^2</math></p>	37.1-37.12	
17 & 18	11/3 11/5	<p style="text-align: center;"><b>Photons and Matter Waves</b></p> <p>Quantum Physics, The Photon, Planck's Constant, Photo-electric Effect, Energy and Momentum of the Photon, Compton Scattering and Wavelength, Probability Waves, Electrons and Matter Waves, Schrodinger Equation, Uncertainty Principle</p>	38.1-38.9	
19 & 20	11/10 11/12	<p style="text-align: center;"><b>More about Matter &amp; Waves</b></p> <p>Confinement Principle, Quantum States and Quantum Numbers. Energy Changes, Correspondence Principle, Trapped Electrons, Quantum Corral, Atomic Models, Bohn Theory, Schrodinger Equation, Hydrogen Atom and Quantum Numbers</p>	39.39.9	
21	11/17	<p style="text-align: center;"><b>All About Atoms</b></p> <p>Properties of Atoms, Electron Spin, Angular Momenta and Dipole Moments, Stern-Gerlach, Magnetic Resonance, Pauli Exclusion Principle, Periodic Chart, X-Rays, Lasers</p>	40.1-40.12	
22	11/19	<b>Test 2</b>	Chapters 35-40	

23	11/24	<b>Conduction of Electricity in Solids</b> Electrical Properties of Solids, Crystals, Insulators and Metals, Conduction, Occupancy Probability. Fermi-Dirac Statistics, Semi- conductors, Doping (n & p), Carriers, Diodes, LEDs, Transistors	41.1-41.11	
	11/25-11/29	<b>Thanksgiving Holiday</b>		
24 & 25	12/1 12/3	<b>Nuclear Physics</b> The Nucleus and its Properties, Binding Energy, Nuclear Forces, Radioactivity, $\alpha$ , $\beta$ , $\gamma$ , The Neutrino, Carbon Dating, Radiation Dose, Nuclear Models	42.1-42.9	
26	12/8	<b>Quiz #3</b> <b>Energy from the Nucleus</b> Nuclear Fission, Fission Model, The Nuclear Reactor, Thermonuclear Fusion, Lawson Criterion, Magnetic and Inertial Confinement.	43.1-43.8	
27	12/10	<b>Quarks, Leptons &amp; The Big Bang</b> Particles, Fermions and Bosons, Leptons and Baryons, Quarks, The Universe, Big Bang	44.1-44.14	
28	12/15	<b>Test 3</b>	Chapters 41-44	
29	12/17	<b>Final Exam</b>	Chapters 30-44	

\*Homework to be assigned in class