Phys 2112 **Solving Physics Problems II** **Fall 2011**

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Office hours: Tentatively M,W,F 10; Tu,Th 12. You're welcome to try at other times that my door is open, or make an appointment.

Prerequisites Concurrent registration in Phys 2012, General Physics II; completion of Calculus II with a C- or better.

Text Halliday, Resnick, Walker *Fundamentals of Physics*, 9th ed.

Course content The schedule of topics follows that of Phys 2012. This course provides additional practice in applying basic physics principles and mathematical reasoning to problems in electricity, magnetism, and optics. The only way to become familiar with the physics and proficient at solving problems is to practice, practice, practice. Simply *watching* someone else work examples will not be enough for you to succeed in physics, so class meetings will emphasize working problems in groups using a consistent general problem-solving strategy. Electromagnetism involves ideas that are more abstract and often uses calculus in a more sophisticated fashion than encountered in General Physics I. This course provides additional opportunity to practice problem-solving in a structured environment with coaching from the instructor.

Class participation Attendance and active participation in class discussions and problem-solving will contribute to your course grade.

Assignments Each week at least one problem will be assigned to be handed in. Late assignments are not accepted.

Grading The course is graded S/N only. Course grades will be based on in-class performance and assigned problems. The preliminary grading scheme listed here is subject to revision. In-class scores: attendance = 1, active participation = 3, excused absence (for illness, emergency, university-mandated activity) = 0, unexcused absence = -1. Homework scale: excellent (in physics and presentation) =4, okay (minor deficiencies in presentiation or physics) = 3, significant attempt (but poorly presented or significant flaw in the physics) = 2, inadequate = 1. (An excellent solution is correct and conforms to the homework guidelines.) Your overall class score will be the sum of your in-class score and your problem score. A total of 75 points accumulated over the semester ensures an S for the course. You may discuss homework problems with others in the class – in fact, talking about a problem with someone elese is a good way to think out loud and practice the vocabulary; however, the work you submit must be your own in the sense that you can explain and defend it when asked. Turning in work simply copied from another or based on solution manuals or other comparable resources constitutes cheating and is subject to penalties (including a failing grade in the course) described in the UMD academic integrity policy at http://www.d.umn.edu/conduct/integrity/.

Individuals who have any disability, either permanent or temporary, which might affect their ability to perform in this class are encouraged to inform the instructor at the start of the semester. Adaptation of methods, materials, or testing may be made as possible to provide for equitable participation. Please contact the Office of Disability Resources to discuss and arrange reasonable accommodations. (KSC 258, 218-726-6130, or visit the DR website at www.d.umn.edu/access for more information.)

Links to other relevant campus policies:
http://www.d.umn.edu/vcaa/TeachingLearning.html
http://www.d.umn.edu/vcaa/FinalExams.html
http://www.d.umn.edu/vcaa/ExcusedAbsence.html
http://www.d.umn.edu/vcaa/ClassNotesAppropriateUseof.html
This syllabus may be amended from time-to-time at the discretion of the instructor.

Homework Requirements

> There is a peculiar synergy between mathematics and ordinary language... The two modes of discourse (words and symbols) stimulate and reinforce one another. Without adequate verbal support, the formulas and diagrams tend to lose their meaning; without formulas and diagrams, the words and phrases refuse to take on new meanings.
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> — David Layzer
> [Quoted in Am. J. Phys. **71**, 1223 (2003).]

Homework must be presented in a format so another person can understand the logic and the individual steps of the solution. The final answer itself will carry little credit. The bulk of the credit will be assigned for presenting a clear and correct process for solving a problem. The solution must be presented in a systematic, step-by-step fashion, with brief explanations of what is being done and the reasoning involved. Your solution should make clear what the problem is asking. It shouldn't be necessary to consult the problem statement to figure out what problem is being solved. Don't expect to solve problems adequately in the last hour before they are due. Start early so you can ask questions in time to get help. The presentation must be organized. You will find it necessary to work problems out initially on scratch paper, then re-copy them so the presentation follows a logical flow easily understood by others, with the wrong turns and preliminary mistakes removed. Do not turn in a hastily written first attempt.

- Gather information from the problem. Include diagrams that illustrate the system under consideration. Visualizing the problem whenever possible is an essential habit. Sort out what information the problem provides. Identify important variables or parameters in the problem in your diagram; give them symbolic names if not specified in the problem and list given or known values for these. Identify what th problem is asking for.

- Organize your attack: What concepts and principles are relevant to this problem? Identify the relevant equations representing these basic concepts and principles, definitions, and properties. Refer to the chapter summary for these basic results. Think about how these can be used to find the requested information.

- Apply the basic equations and concepts to solve for the desired quantities. Work problems symbolically as far as possible. Plug in numbers only *after* all the algebraic manipulations. Use standard and correct notation. Vector quantities need arrows: $\vec{E}$ or $\vec{B}$. Write complete equations: equations have expressions on both sides of an equals sign. Work down the page, presenting one step of a calculation at a time. Don't present several steps in a horizontal sequence, or try to combine several algebraic manipulations into a single line. Neither $\longrightarrow$ nor $\Rightarrow$ is a substitute for $=$. There's no shame in writing out a series of simple steps in detail to ensure you get the correct result. Hasty work is error-prone.

- Evaluate a final answer. Reflect on your answer: Are the units obtained what you expect? Is the numerical value reasonable? Include units with all numerical values throughout. Show explicitly that the units reduce to the final result as part of the step-by-step presentation. Display an appropriate number of significant figures. (At most 3 or 4 – mindlessly copying a number from a calculator display with many digits when only three are appropriate is silly and a waste of time. Learn how to make your calculator display scientific notation with 3 or 4 significant figures only.)

Good problem-solving habits can become routine and natural once you make the conscious effort to practice them in every problem.