Phys 2111 **Solving Physics Problems I** **Spring 2011**

Instructor: J. Maps *Office:* 384 MWAH *Phone:* 726-8125
Office hours: MWF 10-11 am or by appointment *E-mail:* jmaps@d.umn.edu

Prerequisites Concurrent registration in Phys 2011, General Physics I; completion of Calculus I with a C- or better. Concurrent registration in Calc II strongly recommended.

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

Course content The schedule of topics follows that of Phys 2011. This course provides additional practice in applying basic physics principles and mathematical reasoning to problems in mechanics and thermodynamics. The purpose of this course is to build problem-solving skills by providing additional coaching and practice that encourages a systematic approach to solving physics problems. 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.

Class participation Attendance and active participation in class problem-solving will contribute significantly to your course grade. You can't pass this course without coming to class regularly and working problems.

Assignments Each week at least one problem will be assigned to be handed in. See guidelines on written homework. 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=2, excused absence (for illness, emergency, university-mandated activity) = 0, unexcused absence = -1. Homework scale: excellent=5, fair=3, inadequate=1. (An excellent solution is correct and conforms to the Phys 2011 homework guidelines.) Your overall class score will be the sum of your in-class score and your problem score. A total of 65 points accumulated over the semester ensures an S for the course. You may discuss 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 thhe sense that you can explain and defend it when asked. Turning in work simply copied from another or based in any way 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.

Disabilities Individuals who have a 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. Appropriate adaptation of methods, materials, or testing may be made as possible to provide for equitable participation. To learn about services that UMD provides to students with disabilities and to identify appropriate accommodations contact the Office of Disability Resources, in 256 KSC (726-6130) or visit www.d.umn.edu/access.

Miscellaneous policies The information in this syllabus is intended as a guide. The instructor may adjust course requirements and policies as outlined here as deemed necessary. Such changes will be posted. The following University policies are also applicable: Student Conduct Code, Teaching and Learning Responsibilities, Academic Integrity, Excused Absences, Final Exams, Appropriate Use of Course Materials, or visit www.d.umn.edu/vcaa/SyllabusStatements.html for links to policies.

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. (Yes – that means using words and learning to write/speak physics!)

- Don't expect to solve problems adequately in the last hour before class. 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. Do not crowd several problems solutions onto one page. Do not erase large tracts of errant calculations and write over the used real estate. Big mistakes call for a new sheet of paper.
- Include diagrams that illustrate the system under consideration. Visualizing the problem whenever possible is an essential habit. 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.
- Start with equations representing basic principles, definitions, and properties. Work problems symbolically as far as possible. Plug in numbers *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.
- 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. Do not add units at the end of a problem as an afterthought.
- 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.

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