Physics 350, Undergraduate Classical Mechanics – Fall 2011
Course Syllabus*

Lecturer:	Prof. P. David Flammer
Lecture location:	Meyer Hall 220
Lecture times:	11:00am - 12:10pm Monday, Wednesday, Friday
Course website:	http://ticc.mines.edu/PHGN-350_Fall-2011
Office location:	Meyer Hall 447A
E-mail address:	pflammer (at) mines.edu
Office hours:	Tuesday 10:00 - 12:00; Thursday 2:00 - 4:00 (you can also catch me after class)
Phone:	(303) 384-2461
Course Text:	Stephen T. Thornton and Jerry B. Marion,
	Classical Mechanics of Particles and Systems, 5th edition
	(Thomas Learning Inc., 2004)
I-clicker:	Required (At this point, I think I'll be using this heavily in the class)

*Please note that this syllabus is open to changes as the course unfolds.

1 Course Goals

To understand and be competent in both concepts and calculational techniques associated with Newtonian, Lagrangian, and Hamiltonian Mechanics. To be able to use both analytical and numerical solution methods in classical mechanics.

These course objectives fulfill ABET (http://www.abet.org) Engineering Physics program outcomes 3(a,b,e) in the 2008-2009 Engineering Accreditation Criteria.

2 Course Outline

Classical mechanics occupied many great minds over three centuries, among them Newton and Leibniz, Lagrange, Hamilton, and Einstein. Certain areas, most notably *nonlinear* classical dynamics, continue to be an active area of research today. We will treat the following main subjects: single particle motion, systems of particles, linear and driven oscillators, motion under a central force, two-particle collisions and scattering, motion in non-inertial reference frames, planetary dynamics, dynamics of rigid bodies, coupled oscillations, and nonlinear dyanmics.

What are we leaving out? A lot, but a lot that can be neglected in a lot of cases. We neglect things like temperature, quantum effects, relativity, and we don't quite make it to continuous systems (fields and waves). You will get to these subjects in due time in other courses, but you should also feel free to ask about this or any other physics beyond the course material. I will try to point out the issues with the theory presented in this course as we go.

3 Course Evaluation

3.1 Homework

Analytical problem sets will be assigned on Friday and will be due the following Friday at the beginning of class, 11:00 a.m. There will also be approximately five numerical computer projects throughout the semester.

3.2 Exams

Two 90 minute mid-term examinations will be given during normal lecture times, plus an extra 20 minutes (11:00 - 12:30). The final will be two hours long. The date for the final will be announced as soon as the administration sets the final exam schedule.

3.3 Grading

Participation/attendance:	10%
Homework:	30%
Mid-terms:	30% (15% each)
Final:	30%

3.4 Physics Education Research

This course has been part of a study to improve physics education nationwide. All student information used will be retained anonymously. There may be one or two special exams given as an evaluation for comparative purposes with other universities. Any such exam will count as extra credit.

4 Some Important Class Notes

1. You should read the book before lecture. I'll tell you the reading for the next lecture in class. It's not possible to present every detail of every subject in class, and I want to cover material that might not be covered in the book. Midterms and the final will cover both the text and the lecture notes, as well as all homework. So there's a lot to study. Some additional supplemental texts are below if you feel that you have a hard time learning from the required text.

2. I want you to learn both concepts and calculation methods. Conceptual questions will count for a good portion of each exam, typically about a quarter of the available points.

3. A basic knowledge of Newtonian mechanics, waves, special relativity, calculus, linear algebra, and differential equations is expected for the course. This does not mean you are the world's expert. But you should have either taken these classes, passed them, and retain some basic understanding, or you should get textbooks and teach yourselves as needed.

4. The policy on student absences from class, labs, or exams is as follows. All students are advised to be familiar with CSM's policy regarding the make-up of work missed due to

excused absences. This policy may be found in the Bulletin at
http://inside.mines.edu/UserFiles/File/bulletins/2010-2011_undergraduate.pdf on page 27.
Please note that paperwork must be generated through the Associate Dean of Students; no
absences will be excused without authorization and associated documentation, as described.

In all cases of unexcused absences the faculty member has the right to deny the student the
opportunity to make up all or part of the missed work, as stated in the Bulletin. The make-up
policy for missed work in this class follows:

(i) Homework will normally be collected at the beginning of the Friday class session. The
course policy on unexcused late homework is as follows:

1 day late: maximum of 75%

2 days late: maximum of 50%

3 days late: maximum of 25%

4 days late: automatic grade of zero.

"1 day late" is defined as any time after the due date and time of Friday at 11:00 a.m. Please
plan ahead so you do not get yourself into a pinch.

(ii) Make-up exams for unexcused absences are not offered under any circumstances.

5. Other issues concerning exams:

(i) Exams are completely low-tech – no computational devices, calculators, cell phones,
or even slide rules. You should avoid use of computational aids to solve analytical homework
problems, as this will cause you to perform poorly on exams.

(ii) On the day of an exam you are permitted to only have out pencil and paper – no cell
phones, etc.

(iii) When taking exams, anyone found cheating will be given a failing grade for the
course, without exception.

6. Plagiarism of any kind will not be tolerated. If you use a source, you must quote it. Work-
ing together on homework does not count as plagiarism. A line by line copy of another
student's homework does. Use of internet material or any other media without citation is
plagiarism. For the purposes of this course, this includes non-copyrighted material. Any
suspected plagiarism cases will be referred to the Dean of Students for disciplinary action,
without exception. See the 2010-2011 Bulletin for a complete description of the honor code
and associated policies.

5   Suggestions

1. Work hard from the very beginning. This class can be easy at first, but it will get difficult
rapidly. We will go at a fast pace.

2. If you have difficulties, see me right away. *Do not* wait until you are completely lost and there
is no hope of catching up. Everything will only get more and more difficult. You cannot afford
not to understand any concept. In physics every new concept relies crucially on the previous
ones.

3. Interrupt me in class and ask lots of questions. Remember that if you do not understand something, chances are neither do most of your classmates, so it is likely not an obvious question. If you don't ask questions, I will assume that you all understand perfectly and continue at a fast pace.

4. You can work together on homework, but your success in the course will depend on how much time you put in carefully and completely doing all homework problems within the 10-15 hours allotted per week.

5. The best scientists and engineers are not necessarily the ones who got A's in college and/or graduate school. The best scientists and engineers are the ones found their week points in learning and figured out how to fix them.

6   Supplementary References

You may want to refer to the following references from time to time for clarification or for a different perspective. They are available in the library.

1. *Classical Mechanics*, John R. Taylor

2. *Introduction to Classical Mechanics, with Problems and Solutions*, David Morin

3. *Analytical Mechanics*, Fowles and Cassidy

4. *Classical Mechanics*, R. Douglas Gregory

5. *Mechanics, Third Edition*, Landau and Lifshitz volume I (advanced)

6. *Classical Mechanics, Third Edition*, Goldstein, Poole, and Safko (advanced)

7   Approximate Course Outline

1. Newton's Laws – 2 weeks

2. Harmonic Oscillators – 2 weeks

3. Gravitation – 2 weeks

4. Hamiltonian and Lagrangian Dynamics – 2 weeks

5. Central Forces – 1 week

6. Planetary Dynamics – 2 weeks

7. Systems and Particles and Scattering Theory – 1 week

8. Non-Inertial Reference Frames and Rigid Bodies – 2 weeks

9. Coupled Oscillations – 1 week

10. Nonlinear Dynamics, Fractals, and Chaos – 1 week