Course Information

Course: PHYS 331 Fall 2007
Advanced Classical Mechanics

Instructor: Katharina Vollmayr-Lee
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Classes: MWF 9 – 10 am Olin 264

Office Hours: MWF 10 – 11 am, and by appointment

Text: John R. Taylor, *Classical Mechanics*, University Science Books, Sausalito 2005.

Objectives: Mechanics describes the motion of systems ranging from elementary particles up to for example planets in the cosmos. Classical mechanics provides the basis for all areas in theoretical physics including quantum mechanics, statistical mechanics and fluid mechanics.

Starting with Galileo and Newton in the seventeenth century classical mechanics is one of the oldest branches of physics. In the eighteenth and nineteenth century Lagrange and Hamilton reformulated elegantly Newton's equations making the solution to more complicated problems feasible. A few decades ago classical mechanics was revitalized with the still evolving field of nonlinear dynamics. The recent rapid development of computers enable the solution of a vast variety of applications of classical mechanics resulting in active fields such as nonlinear dynamics, soft and condensed matter and astronomy.

In this course we start with a short review of classical mechanics as you have seen it in PHYS 211 and PHYS 221. We then go beyond Newton's mechanics developing so called variational approaches and their applications. As basis for the understanding of current research we cover topics such as nonlinear mechanics, special relativity and continuum mechanics.

Course Structure: Since this course will be interactive, it will be *essential that you come prepared to class*. For each class you will have reading assignments and corresponding questions. The purpose of these reading assignments is to spend class time most effectively. Therefore one of these questions will ask for your feedback about what part of the reading was most difficult, easy, and interesting. These reading assignments (email-answers) will be due 8 am on the day of the class. However, it would be extremely helpful if you could get them to me earlier, to give me time to incorporate your feedback

Usually I will start the class with a brief summary of the last class. Then the course material will be discussed in lecture form, in group work, and sometimes in the form of student presentations. There will be homework assignments weekly both for you to be continuously involved with the class material and for me to get feedback on your understanding of the class material. Homework assignments will be due Wednesday at the beginning of class. In the last fourth of the course each student will work on a project. These projects will be presented in seminar form during the last week of classes.
This course information and updated assignments will be available on the web: http://www.eg.bucknell.edu/~kvollmay/phys331_f2007/

Grading: Since the course structure relies on you coming to class prepared, it is important that you work steadily on the reading and homework assignments. For this reason, reading assignments are due 8 am before class and will *not* be accepted late. Scoring of the reading assignments will be on a 2-point scale: 0 if no answers are sent on time, 1 for answers, and 2 for answers that reflect that you have done the reading and have thought about it. Your participation is essential for the class discussions and therefore counts together with the reading assignments 5% towards your grade.
Homework will take a considerable amount of your time and counts therefore significantly towards your grade. Homework will not be accepted late, i.e. *0 points for late homework!* You are encouraged to work together on the homework, but you must write up your solution individually.
There will be three in class exams and a cumulative final.
Attendance is required.

Reading Assignments & Participation	5 %
Homework Assignments	45 %
Projects	5 %
Exam 1	10 %
Exam 2	10 %
Exam 3	10 %
Final	15 %

Course Syllabus

dates	topic	text
Aug. 22/24/27/29	Review: Newton's Laws	Ch 1 – 4
Aug. 31 Sept. 3	Oscillations	Ch 5
Sept. 5/7/10/12/14	Nonlinear Dynamics	Ch 12
Sept. 17	Exam 1	
Sept. 19/21	Variational Principle	Ch 6
Sept. 24/26/28 Oct. 1	Lagrange's Equations	Ch 7
Oct. 3/5/8/10	Hamiltonian Mechanics	Ch 13
Oct. 12	Exam 2	
Oct. 17/19/22	Central Force Motion	Ch 8
Oct. 24/26/29/31	Noninertial Frames	Ch 9
Nov. 2/5/7	Rigid Bodies	Ch 10
Nov. 9/12/14/16	Coupled Oscillators	Ch 11
Nov. 19	Exam 3	
Nov. 26/28/30	Projects	Ch 14 – 16
Dec. 3	Review & Outlook	
TBA	FINAL	