Physics 210   Graduate Classical Mechanics   Fall 2011

Instructor:	Stefano Profumo
Office:	ISB, Room 325
Phone Number:	831-459-3039
Office Hours:	Wednesday, 2:00 PM – 3:30 PM, or by appointment
E-mail:	profumo@scipp.ucsc.edu

Course Web Page

http://scipp.ucsc.edu/∼profumo/teaching/phys210_11/phys210_11.html

Class Hours

Mondays, 3:15PM and Wednesdays, 3:00PM, ISB 231

Course Description

This course is a graduate-level introduction to the theoretical techniques of classical mechanics. Emphasis will be given in particular to those principles and mathematical constructions relevant to modern physics (including quantum mechanics and general relativity), as well as to more classical physical applications. A list of topics that will be covered in this course includes:

- Variational Principles

- Lagrangian Formulation

- Applications: the Central Force Problem, the Motion of Rigid Bodies, Small Oscillations

- Hamiltonian Formulation

- Canonical Transformations

- Hamilton-Jacobi Theory and Action-Angle Variables

- Classical Chaos

Required Textbook (on reserve)

- *Classical Mechanics, 3rd edition* by H. Goldstein, C. Poole, and J. Safko

Other Textbooks

- *Mathematical Methods of Classical Mechanics* by V.I. Arnold (highly recommended)

- *Analytical Mechanics* by A. Fasano and S. Marmi (recommended)

- *The Elements of Mechanics* by G. Gallavotti

- *Theoretical Mechanics* by E. Neal Moore

- *Classical Mechanics* by V. Barger and M. Olsson

- *Mechanics* by L.D. Landau and E.M. Lifshitz

Note: the Relevant Library Sections are QA805 and QC125

Course Outline

		Topic	Reading
1	9/26	Preliminary remarks; Lagrangian formalism	1.1-1.4
2	9/28	Lagrangian methods: examples; Hamilton's principle	1.5-1.6; 2.1
3	10/3	Calculus of variations; Hamilton's principle with constraints	2.2-2.5
4	10/5	Symmetries and conservation laws	2.6-2.7
5	10/10	Central force problem; Closed orbits; Virial theorem	3.1-3.7
6	10/12	Scattering in a central force field	3.10-3.11
7	10/17	Lenz vector; Three-body problem; Numerical methods	3.9; 3.12
8	10/19	Coordinate transformations; Euler angles	4.1-4.5
9	10/24	Infinitesimal and finite rotations; Coriolis effect	4.6-4.10
10	10/31	Inertia tensor; Rigid-body motion	5.1-5.6
11	11/2	Small oscillations and related examples	6.1-6.4
12	11/7	Legendre transformation and Hamilton equations of motion	8.1-8.2; 8.4
13	11/9	Principle of least action; Canonical transformations	8.5-8.6; 9.1-9.2
14	11/14	Canonical transformations: examples; Poisson brackets	9.3-9.7
15	11/16	Symmetry groups; Liouville's theorem; Hamilton-Jacobi theory	9.8-9.9; 10.1-10.2
16	11/21	Hamilton Jacobi theory and applications	10.3-10.6
17	11/23	Classical chaos; Attractors	11.1-11.3
18	11/28	Poincare' maps	11.4-11.5
19	11/30	Bifurcations; Logistic equation; Fractals	11.6-11.9

Course Grading and Requirements

There will be four homework sets, handed out on the following dates:

- HW#1: handed out on 10/10, due on 10/17

- HW#2: handed out on 10/24, due on 10/31

- HW#3: handed out on 11/14, due on 11/21

- HW#4: handed out on 11/30, due on 12/8

Each one of the homework sets will count 10% towards the final evaluation. There will be one midterm exam, tentatively scheduled for Wednesday October 26, under "quals" conditions, which will count 20%. The remaining 40% will be based on your performance in the final exam, also to be held under "quals conditions", scheduled for Thursday, December 8, 12:00–3:00 P.M..