UNIVERSITY OF SOUTH CAROLINA
Department of Physics and Astronomy

Physics 503 August 19, 2011

Syllabus

Instructor: Brett Altschul (office PSC 703; 777-4985; `baltschu@physics.sc.edu`)
Office Hours: Monday 1:00–2:00 p.m., or by appointment
Lectures: Monday, Wednesday, and Friday 11:15 a.m.–12:05 p.m. (PSC 201)
Recitation: Wednesday 12:20–1:10 p.m. (PSC 006)
Attendance is mandatory on exam dates and optional (but highly encouraged) the rest of the time.

Topics: This course will cover classical mechanics: Newton's Laws; motion in one, two, and three dimensions; central force motion; rigid body motion; accelerated coordinate systems; Lagrangian and Hamiltonian dynamics.

Course Goals: By the end of this class, you should be able to calculate particle motion in one, two, and three dimensions; evaluate the internal motion of systems of multiple particles; carry out calculations in accelerated coordinate systems; and derive equations of motion from Lagrangians and Hamiltonians

Textbook: Symon, *Mechanics* (third edition)
This is a fairly comprehensive advanced undergraduate textbook on this subject. There are many other books that cover essentially the same material, with varying levels of mathematical sophistication. Symon's book covers more material than we will have time for in this course, but it also lacks some of the developments in the field over the last half century—including discussions of chaotic dynamics.

Grading: There will be (approximately) weekly problem sets, due in class, upon which 40% of your grade will be based. If you need extra time for a problem set, e-mail me; reasonable requests for extensions will be granted.
The other 60% of your will come from three equally weighted exams exams, given on **Wed., Sep. 28**, **Wed., Nov. 2**, and **Thur., Dec. 8**. (The last of these is during the final exam period and is scheduled for 9:00 a.m.)
Since this is a mixed graduate and undergraduate class, graduate students will receive less partial credit on assignments and exams.

Course Outline:

1. One-Dimensional Motion
   (a) Newton's laws
   (b) Forces in one dimension
   (c) Conservative forces; potential energy
   (d) Harmonic oscillators
      i. Simple harmonic oscillators
      ii. Damping
      iii. Forced harmonic oscillators

2. Two- and Three-Dimensional Motion
    (a) Vector forces
    (b) Tensor algebra
    (c) Energy and momentum
    (d) Central force motion
        i. Effective potential
        ii. Gravitation; the Kepler problem
        iii. Cross sections; Rutherford scattering
3. Systems of Particles
    (a) Conservation laws: linear momentum, angular momentum, and energy
    (b) Two-body problems; collisions
    (c) Coupled harmonic oscillators
    (d) Rigid body rotation
    (e) Tensors of inertia
    (f) Simple and compound pendulums
4. Accelerated Coordinate Systems
    (a) Moving coordinate systems
    (b) Rotating coordinate systems; fictitious forces
5. Energetics
    (a) Generalized coordinates
    (b) Lagrange's equations
    (c) Constraints
    (d) Hamilton's equations