311: Classical Mechanics   (Dieter Zeppenfeld, Fall 97)

Syllabus: the course will closely follow the textbook
    Barger & Olsson, Classical Mechanics, 2nd, McGraw Hill (1995)

1) One-dimensional motion
    Newton's laws
    Forces: gravity, Coulomb, friction
    Explicit solutions: skydiving
    Solutions for $F = F(x)$ or $F = F(v)$
    Harmonic oscillator, damped & forced oscillator

2) Kinetic and potential energy in 1 dimension
    Small oscillations
    Vector notation, vector algebra, tensors
    Potential energy in 3 dimensions
    2-dimensional motion: pendulum
    Coupled oscillators, normal modes

3) Lagrangian methods
    Lagrange function and action
    Constraints
    Variational principle
    Hamiltonians

4) Momentum conservation
    Rockets
    Elastic collisions, c.m & lab frames, inelastic collisions

5) Angular momentum
    Central forces
    Planetary motion, Kepler's laws, satellites
    Rutherford scattering

6) Rigid body motion
    2-body problem
    Rotation of rigid bodies
    Moments of inertia
    Billiard shots

7) Accelerated coordinate frames
    Coriolis force, Foucault's pendulum
    Principal axes, Euler's equations
    Spinning top

8) Gravitation
   Newton's theorem
   Tides
   General Relativity elements
   Perihelion advance

9) Cosmology
   Virial theorem
   Rotation curves, dark matter

10) Special relativity

11) Chaos