Physics 320
Mechanics II
Spring 2011

Instructor: Daniel Holland
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Moulton 313C; 438-3243
Office Hours: M,F 10-11; W 3-4; by appointment or try your luck

Time: TR 9:35 - 10:50 in MLT 309 (regular class time)

Text: Marion and Thorton: *Classical Dynamics of Particles and Systems* 5th edition (If you can find an earlier edition on line for less, that will work too.)

Other useful books:

Fowles and Cassiday,	*Analytical Mechanics*	Your old friend from physics 220
Symon,	*Mechanics*	Somewhat wordy but thorough.
Goldstein,	*Classical Mechanics*	Most beautiful mechanics book ever written, but problems are very difficult.
Landau and Lifshitz	*Mechanics*	Covers everything in Goldstein in one third of the space, very dense.

Copies of these books may be found in the physics conference room or the library. There are many other books on mechanics that you might like better. Try just browsing in the library, it amazing what you will learn.

You have now completed the F=ma approach to mechanics. Whereas this is all very nice, it assumes that you can actually write down the forces. This is usually not the case, especially when we are dealing with constrained motion. Once we have finished off a few loose ends on driven harmonic oscillators and a bit of nonlinear oscillators, we will develop the techniques that are really used for solving complex problems, i.e. Lagrangian and Hamiltonian mechanics. Both of these are based on energy principles and it is usually much easier to find your equations of motion from them. We will use these techniques to solve a number of more involved problems such as coupled harmonics oscillators. Towards the end of the semester we will vote on what we would like to concludes with. The topics I am currently considering are 1) rigid body dynamics, 2) continuous systems and waves, 3) Special Relativity. The syllabus is written assuming continuous systems.

Since realistic tests of your "problem solving capabilities" are difficult for one hour exams, the homework becomes a sizable portion of the grade. This semester the grading scale will be

Homework	50%
Mid Term Exam	25%
Final (non-comprehensive)	25%

Even though the final is not comprehensive, you may still have to use some of the stuff from the early part of the course in order to actually do the stuff at the end. Homework problems should be written out neatly and turned in on time. If you have not completed a homework set, turn in what you have completed since partial credit is better than none. Late problems will be given 1/2 credit since problem solutions will be posted on the due date. You will note that I have not separated out computer assignments as a category. Instead, I will treat numerical techniques as just another tool in your toolbox and will occasionally ask for numerical solutions to problems.

For exams you may have one sheet of paper with anything that you want on it plus the use of your mathematical handbook and/or your calculator. I would like to warn you to be careful about relying to heavily on the symbolic manipulator in your calculator, they don't always give you the best form for the integrals we will be doing.

VERY TENTATIVE SYLLABUS

Dates	Chapter(s)	Topics
Aug 22 – Aug 26	Chapter 3	Harmonic Oscillators, Principle of superposition, Fourier Series, Impulsive Driving Forces.
Aug 29 – Sep 02	Chapters 3 & 4	Nonlinear Oscillations, Phase Space, Plane Pendulum
Sep 05 – Sep 09 *(9/5 Labor Day)*	Chapters 4	Chaos, Lyapunov Exponent,
Sep 12 – Sep 16	Chapter 6	Calculus of Variations, Euler's Equations, Second form of Euler's Equations
Sep 19 – Sep 23	Chapter 6	Functions of several variables, constraints, Hamilton's Principle
Sep 26 – Sep 30	Chapter 7	Generalized coordinates, Lagrange's Equations, Undetermined multipliers
Oct 03 – Oct 07	Chapter 7	Equivalence of Lagrangian and Newtonian Mechanics, Conservation Theorems,
Oct 10 – Oct 14	Chapter 7	Canonical Equations, Hamiltonian Dynamics, Special Theorems (Liouwille and Virial)
Oct 17 – Oct 21	Chapter 9	Systems of particles, Conservation laws, Center of Mass/Lab frames
Oct 24 – Oct 28	Chapter 9	Two particle collisions, Elastic/Inelastic, Cross section, Rutherford Scattering.
Oct 31 – Nov 04	Chapter 12	Coupled Oscillations, Two coupled oscillators, Weak Coupling limit, General Problem
Nov 07 – Nov 11	Chapters 12	Normal coordinates , Molecular vibrations, Degeneracy, Loaded String
Nov 14 – Nov 18	Chapter 12 &13	Continuous Systems, Continuous String, Energy, Wave Equation
Nov 21 – Nov 25 *(Thanksgiving)*	Supplemental Text	Turkeys dynamics
Nov 28 – Dec 02	Chapter 13	Forced and Damped Motion, General Solutions to the Waves Equation
Dec 05 – Dec 09	Chapter 13	Separations of variables, Phase Velocity, Dispersion, Attenuation, Group Velocity, Wave Packets