Physics 401: Classical Mechanics II
Spring 2008 - 3 credits

Instructor: Prof. Matthew Enjalran
Off: Jennings Hall 115
Email: enjalranm1@southernct.edu
Phone: 392-5444
Web: http://home.southernct.edu/∼enjalranm1/

Off.Hrs: M 12:00 pm - 1:00 pm
M 3:00 pm - 4:00 pm
Tu 11:00 am - 12:00 pm
W 12:00 pm - 1:00 pm
Th 11:00 am - 12:00 pm
Th 3:00 pm - 4:00 pm

Lectures: M, W, F 11:10am - 12:00pm, Jennings 113

Text:

- (Required) *Classical Dynamics of Particles and Systems*, 5$^{\text{th}}$ Edition, by S.T. Thornton and J. B. Marion, Thomson-Brook/Cole (ISBN 0-534-40896-6).
- (Recommended) *Classical Dynamics of Particles and Systems/Students Solution Manual*, by J. B. Marion, Thomson-Brook/Cole (ISBN 0-534-40897-4).

Additional references: See class web page for a list of resources.

Assignments: There will be regular problem set assignments. One problem per assignment will be graded in detail on a scale of 10 points. The remaining problems in an assignment will be reviewed for completion and awarded 2 points each if a good faith effort has be made. Note, the selected problem will not be designated in advance, hence it is to your advantage to work all assigned problems. You may work together on the problem sets, in fact I encourage collaboration, but you are on an honor system to submit your own work.

Solutions will be placed in a binder in the physics department library in Jennings Hall 138. On occasion, we will also discuss home work problems in class.

Grading:		
	Problem Sets	40%
	Two in-class exams	40%
	Final exam	20%

Tentative exam dates:

- Exam 1, Friday, February 22.
- Exam 2, Friday, April 4.

Final exam: 10:15am - 12:15pm Wednesday, May 14, 2008.

Holidays: Presidents' Birthdays, Friday - Monday, February 15 - 18, 2008; Spring Break, Saturday - Sunday, March 15 - 23, 2008.

Disability Statement: If you are a student with a disability, before you may receive accommodations in this class, you will need to make an appointment with the Disability Resource Center, located in EN C 105A. To speak with me about accommodations, or other concerns, such as medical emergencies or arrangements in case the building must be evacuated, please make an appointment as soon as possible.

Course Goals: Most of the general ideas or concepts covered in the first part of this course were familiar to you, e.g., Newton's laws and conservation laws. But we did discuss some new ideas like the basic concepts of non-linear oscillatory systems and chaos. To a lesser degree this will be the case for the second half of mechanics. In the second semester, new concepts will be introduced along with, possibly, new techniques to solve the associated problems. In particular, we will introduce the technique calculus of variations and then use these ideas in the discussion of Lagrangian and Hamiltonian dynamics and conservation laws. The Lagrangian and Hamiltonian formalisms are different from Newton's approach of solving problems, but they are just as valid. In many ways these techniques are more powerful than Newton's method because they generalize more readily to other branches of physics - electricity and magnetism, quantum mechanics, quantum field theory, and statistical mechanics. In our treatment of rigid body dynamics and coupled oscillations, methods from linear algebra will be employed to solve matrix problems and systems of coupled differential equations.

The major goals for this course are similar to those of last semester: We want to develop a deeper understanding and appreciation of many fundamental concepts in classical physics. We will learn new mathematical techniques and develop a suitable level of proficiency in employing these new tools. The problem sets and exams will be structured to achieve these goals. I also encourage active participation in the lectures; please do not be shy about asking questions during class. To stimulate in-class discussions and, hopefully, the learning environment, you will be expected to work on, but not necessarily solve, example problems in class on a regular basis. These problems will not be collected and graded, but they could serve as the setup or initial steps to more complicated problems that make up part of an assigned problem set.

You should find some of the home work problems fairly straight forward while others will be very challenging. Working together on home work is encouraged. **Again, working together on homework is encouraged, but you are on the honor system to write-up and hand in your own solutions.** The exams will take the entire class period, but given that this time is limited (approximately 60 minutes for exams and 2 hours for the final) the degree of mathematical complexity of exam problems can not, in general, be as high as what you experience in the homework. However, this distinction does not hold with regards to the conceptual nature of problems.

Course Outline: A tentative list of topics/subjects that will be covered (or that we hope to cover) in this course is provided below. The corresponding chapters from the text, *Classical Dynamics*, are also provided. Our main emphasis will still be the physics of a single, classical, particle. However, we will cover the physics of simple many-particle systems and of rigid or extended bodies, in mainly the second half of the semester. This list of topics represents an ambitious plan for the semester, hence we may pick and choose topics from the latter chapters so that we can get to the most important concepts in each subject.

Topic	**Relevant chapters**
Calculus of Variations	Chapter 6
Lagrangian and Hamiltonian Dynamics	Chapter 7
Gravitation / Central Force Motion	Chapters 5 & 8
Many-Particle Systems	Chapter 9
Noninertial Reference Frames	Chapter 10
Rigid Body Dynamics	Chapter 11
Coupled Oscillations	Chapter 12 (& Review of Chapter 3)