Classical Mechanics

PHYS 321 - Spring 2015

Instructor: Kevin J. McCann
Physics Room 315
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Office Hours: MW 12-1 or by appointment

Text: Taylor, John R., *Classical Mechanics*, University Science Books, 2005, http://www.amazon.com/Classical-Mechanics-John-R-Taylor/dp/189138922X/ref=la_B001IODK2C _ 1_ 1?ie=UTF8&qid=1357762290&sr=1-1, $109.68 (1/26/15)

Class Time: MWF 2:00-2:50
Room: Sondheim 209

■ **Some Important Dates This Semester**

January 26	First Day of Class
March 15-22	Spring Break
April 17	Daffy Duck's Birthday
Monday, May 11	Last meeting of this class
Friday, May 15@1:00p-3:00p	Final Exam

If any classes are cancelled, I will attempt to make them up, probably at the free hour on Wednesday.

A Brief Course Outline

In this class we will study the principles of classical mechanics as first set forth in the works of Galileo and Newton. We will pay particular attention to the conservation of energy, momentum, and angular momentum, and the derivation of the equations of motion. After an initial review of basic classical mechanics, we will have a brief mathematical interlude during which we will develop the calculus of variations, and from it an entirely different approach to find both the equations of motion and conserved quantities, namely the Lagrangian approach.

The guide throughout this course will be the excellent text by Taylor, cited above. We will cover most of the first eleven chapters in the text, which means that our pace will

be one and one-half weeks per chapter on average. The pace will be fast and I expect to assign approximately 10 homework problems per week, roughly two assignments per chapter.

The tentative plan for this semester is in the following Table.

Date	Monday	Wednesday	Friday
January 26, 28, 30	1 – 5 Newton's laws	1 – 5 Newton's laws	Momentum & Ang Mom
February 2, 4, 6	4 Energy	4 Energy	6 Calculus of variations
February 9, 11, 13	6 Calculus of variations	7 Lagrangian Mechanics	7 Lagrangian Mechanics
February 16, 18, 20	7 Lagrangian Mechanics	7 Lagrangian Mechanics	7 Lagrangian Mechanics
February 23, 25, 27	7 Lagrangian Mechanics	Problems and Review	**Exam #1**
March 2, 4, 6	8 2 & N – body problems	8 2 & N – body problems	8 2 & N – body problems
March 9, 11, 13	Orbits and GR correction	9 Non – inertial frames	9 Non – inertial frames
March 16, 18, 20	←	**Spring Break – No Class!!**	→
March 23, 25, 27	9 Non – inertial frames	9 Non – inertial frames	11 Coupled Oscillators
March 30, April 1, 3	11 Coupled Oscillators	11 Coupled Oscillators	Review
April 6, 8, 10	**Exam #2**	13 Hamiltonian Mechanics	13 Hamiltonian Mechanics
April 13, 15, 17	13 Hamiltonian Mechanics	13 Hamiltonian Mechanics	16 Continuum Mechanics
April 20, 22, 24	16 Continuum Mechanics	16 Continuum Mechanics	16 Continuum Mechanics
April 27, 29, May 1	16 Continuum Mechanics	16 Continuum Mechanics	15 Relativity
May 4, 6, 8	15 Relativity	15 Relativity	15 Relativity
May 11	15 Relativity / Review		
May 15	**Final Exam 1 : 00 – 3 : 00 p**		

The numbers refer to Chapters in Taylor. This course plan is ambitious, and we may slip a bit from it, but not too much.

Preparation for the Course

As preparation for the course, you should be able to understand and use the simple vector concepts outlined in the first few sections of Chapter 1 in our text. You will also be expected to be able to solve the usual second order differential equations. You should review the meaning of and how to find the eigenvalues and eigenvectors of a matrix. In addition, you will be expected to be able to plot functions with a computer by using *Mathematica*, *Matlab*, *Maple*, or some other software. On occasion there will be homework problems that require the use of a computer to solve differential equations numerically and plot the results.

Email for this course

If you have questions or homework that you wish to email, be sure to put **PHYS 321 in the subject line**. If you are sending me a file as part of a homework assignment, please use the following file naming convention

last_name – Phys321 – short description.ext

where "ext" is the extension for whatever the format is, e.g. .nb, .mat, .doc, etc. For the short descriptions try to do something other than HW6 or assignment 12 or whatever; rather, do something like "harmonic oscillator" or "HO" or some other descriptor that lets me know which assignment it is. I will try to remember to suggest something with each assignment.

Grading

20% Exam #1 will be on Chapters 1-7

20% Exam #2 will be primarily on Chapters 8,9,11, but you should remember Chapters 1-7.

25% Homework

35% Final Exam will include all topics covered but with slightly more emphasis on Chapters 13-16

Homework Policy

You may work together on homework, but each student must turn in her/his own work. If you use results found on the internet or in texts, **you must cite them**. A cautionary note: the exam problems will often be similar to or even identical to homework questions; so, if you just copy someone else's work without understanding, you will not do well on the exams.

Late homework will not be accepted (no exceptions). Homework will be turned in at the beginning of class on the date it is due.

Your two lowest homework grades including ones not turned in will be dropped. This should allow for any problems due to illness, job interviews, weddings, vacations, or unexpected romances.