SYLLABUS **PHY 404G-001** **FALL 2013**

MECHANICS

MWF 09:00-09:50, CP 397

Lecturer: **Sung Seok Ambrose Seo**
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Office hours: **By appointment**

Textbook: **Analytical Mechanics**
Fowles & Cassiday, 7th Edition

Webpage: **Blackboard at http://elearning.uky.edu**

Please read this syllabus carefully, and refer to it often. If you have any questions about the structure or the administration of the course, you will probably find the answer here.

1. Description & Goals

This course focuses on the topics of classical mechanics, which are the **fundamentals** of all natural sciences. Especially, all other subjects in physics such as electricity and magnetism, statistical mechanics, and quantum mechanics are developed based on the foundation of classical mechanics. Classical mechanics allows us to predict what is happening from initial conditions using rigorous mathematics. This is clearly different from other "stamp collecting" sciences. We will discuss how a few general principles and concepts of mechanics suffice to understand very broad physical phenomena. You will learn how classical mechanics has revolutionized the way we study nature. Our goal is to sharpen your analytical thinking skills and problem solving skills by applying these principles and concepts to various examples.

Specific goals:

1. Build up a good foundation in Newtonian mechanics. Solve variety of problems analytically and systematically with confidence.
2. Learn analytical mechanics. Know how to set up Lagrangian equations and obtain the equations of motion in generalized coordinates.
3. Acquire the knowledge of some advanced topics such as central force field, gyroscopic motion, and normal modes.

Since we will use mathematics in describing physical concepts and solving problems quantitatively, a working knowledge of PHY 231, algebra, and calculus is a prerequisite for this course.

2. Course format

PHY 404G comprises three 50 min. lectures per week. The lectures are on Mondays, Wednesdays, and Fridays in CP 397 at 09:00-09:50 am. Lecture time will be devoted to discussing mechanics principles and examples. Please try to focus on both physical concepts and mathematical descriptions. **After each lecture, it is strongly recommended that you do homework and read the assigned sections in the textbook that is listed in the course schedule so that you can improve your understanding about what you learned in each class.**

3. Course grade

Your course grade will be determined according to the following table:

One-hour exams (4×100)	400
Final exam	200
Homework	300
Total	900

A total score of **800 or above** will guarantee an **A-grade**, **700 or above** will guarantee a **B-grade**, **600 or above** will guarantee a **C-grade**, and **500 or above** will guarantee a **D-grade**. We will not revise these standards regardless of the overall class average. This means that it is theoretically possible for all students in our class to get A-grade; a student sitting next to you is not your competitor; his/her high (low) score does not harm (help) your grade.

3.1 Exam grade (4×100 points + 200 points = 600 points)

The scheduled dates/times and relevant material for the hour exams and the final exam are given in the schedule at the end of this syllabus.

For full credit in the exams, you should show all work – including relevant concepts, description, diagram, equations, etc. – clearly. Good scientists and engineers must possess knowledge of their discipline and should be able to communicate that knowledge effectively. A solution is not complete when you write down equations or final numerical answers on the exams; you must demonstrate that the answer makes physical sense by using diagrams, graphs, and words as well as equations and numbers. Answers to essay-type questions must be given in concise and complete sentences. Doing these will enable me to give partial credit although your final answers are incorrect.

During the exams you are not allowed to consult textbooks, reference books, any printed/photocopied matters, class notes, etc. You will have to memorize the equations you need. You are not permitted to use cell phones, smart phones, laptops, PDAs, Kindles, etc., during the exams. You must bring your own calculator (graph calculators are OK) to the exams; you cannot borrow someone else's calculator in the middle of exam.

Cheating on exams is a very serious academic offense. Any student who cheats on an exam will receive an E-grade for the course, and will be subject to punishment in accordance to the University Senate Rules Section 6.3 and 6.4.

3.2 Homework grade (300 points)

At the end of each class, homework assignment (1 or 2 problems) will be given as homework. Homework should be submitted right before the next class starts (09:00 am). For example, the homework from the Sep 28(Wed) class must be turned in as a written form in paper before we start the Sep 30(Fri) class. At the beginning of each class, I will briefly review the pervious class materials and work on homework problems. Hence, the homework due (09:00 am) is strictly observed.

3.3 Course evaluation (bonus 10 points)

If you complete the online course evaluation, bonus points will be added to your total course scores before final letter grading. (e. g. Sam's total score is 790 so his final letter grade is

B. If he participates in the course evaluation, his total score becomes 790 + 10 = 800, and his final letter grade is A.)

Course evaluation is important for our Department's instructional program. The online course evaluation system has been developed to allow each student ample time to evaluate each component of the course and the instruction. The evaluation window will open on **Nov 20** and close on **Dec 11**. To access the system during this time, simply go to the Department of Physics Web page at http://www.pa.uky.edu and follow the link of **Physics and Astronomy Course Online Evaluation System** under the **COURSES** link. You will need to use your student ID number to log into the system, and this will also allow us to monitor who has filled out the evaluation. However, when you log in you will be assigned a random number that will keep all your comments and evaluation confidential.

4. Excused absences, code of conduct, etc.

If you miss an hour exam with a valid excuse, you will receive a score based on the average of your other tests and the final. If you miss two one-hour exams with valid excuse, you will receive an incomplete (I). Examples of excusable absences are (University Senate Rule 5.2.4.2): (i) Illness of the student or serious illness of a member of the student's immediate family, (ii) the death of a member of the student's immediate family, (iii) trips for student organizations, university classes, and intercollegiate athletics. Each case requires written verification. When feasible you should notify the instructor prior to the absence, and never more than one week after the absence. "Falling behind" and "sleeping in" are not valid excuses.

A good physics class cannot be made by the instructor's sole effort; your help is very important! Any behavior distracting other students from concentrating on the lectures is not allowed. **Eating in the classroom is strictly prohibited**; please schedule your meal time properly.

5. How to be successful in PHY 404G?

Even though you are all very smart, you should expect to spend at least three (3) hours studying for yourself to digest what you swallow in each lecture, i.e. at least 12 hours per week. If your schedule does not allow you adequate study time, your chances of successfully completing this course is very low. It would be better then for you to take PHY 404G in another semester when you can afford at least 12-16 hours of study per week. Please remember that you need to work hard to be successful in this class.

If you find difficulty in understanding the material although you spend a lot of time in studying, there are a few ways you can get help:

- **Your instructors:** Feel free to talk with your course instructor. You can meet with me by making an appointment.
- **Resource room:** The physics resource room is located in the M. I. King Science Library and is staffed by Physics & Astronomy graduate students to assist with physics homework problems, etc.
- **Exam solutions:** Solutions to the exams will be posted on the Blackboard website after the completion of each exam.

Tentative schedule

#		Date	Topic	Reading
1	W	Aug 28	Introduction, Overview, Vectors	1.1-1.6
2	F	Aug 30	Vectors	1.7-1.12
	M	Sep 2	*Labor day*	
3	W	Sep 4	Linear Motion	2.1-2.2
4	F	Sep 6	Linear Motion	2.3-2.4
5	M	Sep 9	Oscillations	3.1-3.4
6	W	Sep 11	Oscillations	3.5-3.6
7	F	Sep 13	Oscillations	3.7-3.9
8	M	Sep 16	Motion in 3D	4.1-4.2
9	W	Sep 18[(a)]	Motion in 3D	4.3-4.4
10	F	Sep 20	Motion in 3D	4.5-4.6
11	M	Sep 23	*1st Review*	
12	W	Sep 25	**Test 1**	**Chaps. 1, 2, 3, 4**
13	F	Sep 27	Non-Inertial Reference Frame	5.1-5.3
14	M	Sep 30	Non-Inertial Reference Frame	5.4-5.6
15	W	Oct 2	Gravitation	6.1-6.2
16	F	Oct 4	Kepler's Laws	6.3-6.6
17	M	Oct 7	Potential Energy	6.7-6.8
18	W	Oct 9	Orbits	6.9-6.11
19	F	Oct 11	Orbits	6.12-6.14
20	M	Oct 14	Systems of Particles, Momentum & Energy	7.1-7.2
21	W	Oct 16	Interacting Particles	7.3-7.4
22	F	Oct 18	Collisions & Variable Mass	7.5-7.7
23	M	Oct 21	*2nd Review*	
24	W	Oct 23	**Test 2**	**Chaps. 5, 6, 7**
25	F	Oct 25	Rigid Body, Center of Mass, Moment of Inertia	8.1-8.4
26	M	Oct 28	Rigid Body, Laminar Motion	8.5-8.6
27	W	Oct 30	Rigid Body, Impulse & Collision	8.7
28	F	Nov 1	Rigid Body in 3D	9.1-9.2
29	M	Nov 4	Rigid Body in 3D, Examples	9.3-9.5
30	W	Nov 6	Rigid Body in 3D, Eulerian Angles	9.6-9.7
31	F	Nov 8[(b)]	Rigid Body in 3D, Examples	9.8-9.10
32	M	Nov 11	*3rd Review*	
33	W	Nov 13	**Test 3**	**Chaps. 8, 9**
34	F	Nov 15	Lagrangian Mechanics, Hamilton's Principle	10.1
35	M	Nov 18	Generalized Coordinates	10.2-10.3
36	W	Nov 20	Lagrange's Equation	10.4
37	F	Nov 22	Lagrange's Equation, Examples	10.5
38	M	Nov 25	Generalized Momenta, Lagrange Multipliers	10.6-10.7
39	W	Nov 27	D'Alembert's Principle, Hamilton's Equations	10.8-10.9
	F	Nov 29	*Thanksgiving*	
40	M	Dec 2	*4th Review*	
41	W	Dec 4	**Test 4**	**Chap. 10**
42	F	Dec 6	Oscillating System, Stability	11.1-11.2
43	M	Dec 9	Coupled Oscillators	11.3
44	W	Dec 11	Vibrations, Wave Equation	11.4-11.6
45	F	Dec 13	*Course Review*	
	Tue	**Dec 17**	**Final Exam 8:00 AM – 10:20 AM, CP-397**	**All Chapters**

(a) Sep 18: Last day to drop a course without it appearing on your transcript.

(b) Nov 8: Last day to withdraw from the course and receive a grade of W. Students can withdraw or reduce course load after this date only for "urgent nonacademic reasons."