# Syllabus for

# Physics 311

# *Classical Mechanics*

## Fall 2014 Semester

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| Course title | Physics 311, Classical Mechanics |
| Lecture Time | MWF 9:05-9:55 AM |
| Lecture Location | Physics Nielsen 306 |
| Required textbook | "Analytical Mechanics", by Fowles and Cassiday, 7th edition |
| Professor | Soren P. Sorensen |
| Office | Science and Engineering Research Facility (SERF), room 607 |
| Office Hours | MWF 10:00 AM - 11:00 PM (Basically after class, but you are welcome to look me up or email me at any time or make an appointment) |
| Telephone (UT) | (865) 386 7051 |
| Email | sorensen@utk.edu |
| Teaching Assistant | TBD |
| Lecture Teaching Assistant | TBD |

## Text Assignments

| Chapter | Title |
|---|---|
| 1 | Fundamental Concepts: Vectors |
| 2 | Newtonian Mechanics: Rectilinear Motion of a Particle |
| 3 | Oscillations *(Sections 7, 8, and 9 required for homework, but not for tests)* |
| 4 | General Motion of a Particle in Three Dimensions |
| 6 | Gravitation and Central Forces |
| 7 | Dynamics of Systems of Particles |
| 8 | Mechanics of Rigid Bodies: Planar Motion |

## Course Description:

Physics 311-312 will discuss the fundamental aspects of Classical Mechanics: single particles motion, systems of particles, oscillations, motion in a central force field, two-body motion and planetary motion, two particle scattering, motion in non-inertial reference frames, dynamics of rigid bodies and oscillating systems, Lagrangian mechanics, and aspects of non-linear dynamics, chaos, and special theory of relativity.

## Learning objectives:

Students who successfully complete this course will be able to:

1. Understand and apply fundamental concepts of Classical Mechanics like, displacement, velocity, acceleration, force, work, kinetic energy, potential energy, mechanical energy, momentum, and angular momentum as well as the relationships between these concepts.

2. Understand and apply the conservation laws of mechanical energy, momentum, and angular momentum.
3. Analyze and solve problems in 1-, 2, and 3-dimensional systems by applying force and/or conservation concepts. In particular, the students will be able to identify the equation of motions by using Newton's Second Law, and solve these equations.

## Prerequisites:

Technically the course prerequisites are: Physics 136 or 138 or 231 and Computer Science 102. In general it will be assumed that you are familiar with calculus and calculus concepts (vector, differential and integral calculus), aspects of linear algebra like matrices and determinants, and aspects of differential equations. Since the use of numerical methods is an integral aspect of the course, you will need to be familiar with computer programming. If you have not taken CS 102, you will need to demonstrate a strong familiarity with a high-level computer language.

## MATLAB:

An important aspect of Physics 311-312 is to teach you to use both analytical *and numerical* methods in solving physics problems. In order to introduce numerical and computer programing methods we will be using the MATLAB packages throughout the course. You will be introduced to the fundamentals of MATLAB during the early lectures and you will then be assumed to gradually become proficient in the use of MATLAB as you get more and more advanced assignments. A good way to teach yourself about MATLAB is to use the book "*Getting Started with MATLAB*" by Rudra Pratap.

## Lectures:

The most important way for you to learn the physics contained in this course will be to carefully study the textbook and to try to solve as many homework problems as possible. *It is assumed that you have studied the material contained in each chapter before the lectures*, so during the lectures we can focus on a few particularly important issues.

## Homework:

The homework problems are due every Wednesday at the start of the lecture. The homework will count 30% of the final score. You will have a much, much better chance of doing well on the tests, if you try to do the homework on your own and only seek guidance from others, when you are completely stuck.

## Exams and Grading:

There will be given 4 tests, three during the semester and one final, comprehensive test at the end of the semester. Each semester test is counting 20% of the final score, *but only the two tests with the highest scores will be counted*. **The final test is mandatory and will count 30% of the final score. There is no make-up test,** so if you miss more than one of the tests you are in deep trouble. Only documentable medical issues will be reason for a comprehensive make-up test. If you know that you have potential scheduling conflicts, please tell as soon as you are aware of this potential conflict, so we together might be able to find a solution.

A "curve" might be used to transform your final score into the final grade. You are welcome to discuss and/or complain about the grading of a given assignment up to a week after it has been returned to you. After a week the score will not be changed.

During tests you are required to bring a pencil and a pocket calculator and you are allowed 2 pieces of paper (letter size) with notes and formulas written by yourself. *In particular, no laptops, cell phones, or other means of communication are permitted.* You will receive a handout containing information on Physical Constants, Units, selected tables of physical properties, and selected mathematical formulas.

| Exam Schedule | | |
|---|---|---|
| Test no. | Date & Time | Main content |
| *1* | *Friday, September 19, 9:05 – 9:55 AM* | *Chapters 1-2 + MATLAB* |
| *2* | *Friday, October 24, 9:05 – 9:55 AM* | *Chapters 3-4* |
| *3* | *Friday, November 21, 9:05 – 9:55 AM* | *Chapters 6-7* |
| *Final* | *Friday, December 5, 8:00 AM – 10:00 AM* | *Chapters 8 + Comprehensive* |

| Summary of weights for scores in the different components of the course | |
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| *Final exam* | *30%* |
| *Semester test 1* | *20%* |
| *Semester test 2* | *20%* |
| *Semester test 3* | *20%* |
| *Homework* | *30%* |

## Attendance:

You are technically not required to attend class, but I have not yet had a student that was able to pass this course with a reasonable grade without attending nearly all the lectures! Furthermore, if an announcement is made in class and you are not present, it will be your responsibility to be aware of the content of the announcement.

## Honor Code, Collaboration and Plagiarism:

As a student in this class you are highly encouraged to interact with other students concerning understanding of physics, in general, or homework problems. However, this interaction has to be at a level where it increases your general knowledge of physics and of different ways to approach a particular homework problem. It can never cross the level to actual plagiarism. If I judge you have copied other sources (online or other students) or you have aided others in plagiarizing your work, you will receive a 0 (zero) score on the particular assignment or test and your final grade will be reduced by a letter grade (A- will be B- etc.). A second offense will lead to a grade of F for the course and a report to the Dean of Students.

## Email:

You are required to have an official UT email address (name@utk.edu or name@tennessee.edu) and read your email on a daily basis, since some of the needed information for this class that cannot be transmitted to you during the lectures or on this web site will be given to you via email. In particular, issues like cancellation of classes or last minute changes in assignments. Please remember, that if you are using an existing non-UT email account (AOL, Yahoo, etc.) it is your own responsibility to re-route your UT email to your preferred account.

## Disabled Students:

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office of Disability Services at 865-974-6087 in 2227 Dunford Hall to coordinate reasonable accommodations for students with documented disabilities.