

SYLLABUS

The Physics of Living Systems I Phys 2110 Fall 2009

Instructor: D. Mark Riffe

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Office Hours: M W F, 9:30 – 10:30 am

Prerequisites: Math 1100 or 1210 (can be taken concurrently)

Texts: *Physics*, Cutnell and Johnson, 6th, 7th, or 8th edition
Class Notes, available at the class web site
Laboratory Manual, available at the campus bookstore

Credits: 4 semester credit hours

Lecture: M W F, WIDT 007, 12:30 – 1:20 pm

Course Web Site: <http://www.physics.usu.edu/riffe/2110/index.htm>. Here you will find **Lecture Notes**, **Class Notes**, **Homework Assignments**, and other material related to the course. Check the site frequently for updated information.

Physics Learning Center: The Physics Department maintains a help center in **GEOL 401** that is staffed during much of the business day.

About this course

I. What this course is:

This course is a BASIC PHYSICS COURSE. We will start with the fundamentals: FORCES, MOTION, and ENERGY. These concepts will then be applied to the HARMONIC OSCILLATOR, which is the prototypical example of a RESONANT SYSTEM. This will lead into our discussion of CHAOS, which is apparently ubiquitous in the natural world. We will then study FLUIDS. The end of the course will focus on THERMODYNAMICS, which governs the exchange of energy between the microscopic and macroscopic regimes.

II. What this course is not:

This is NOT an applied physics course. However, where possible we will relate the basic physics that you are learning to life sciences. Material with obvious application includes FLUID STATICS and DYNAMICS, CHAOS, and the LAWS of THERMODYNAMICS.

III. What to expect:

Do not expect that pure memorization will get you through this course. Although there is a certain amount of material that you will need to remember, physics is based on a relatively small number of principles that are then applied to a WIDE RANGE of situations. TO BE SUCCESSFUL YOU WILL LEARN TO APPLY THE PRINCIPLES TO THE SITUATION AT HAND. Therefore you will need to learn to THINK about the problems you are given on the homework assignments, lab situations, and exams. Doing the homework problems is critically important to succeeding in this course because they will give you the opportunity to THINK about the material!

Course Structure: There are three components to the course: lecture, recitation, and laboratory. You must be enrolled in all three components of the course.

I. Lecture

In lecture we will focus on the CONCEPTS related to the material, including some DISCUSSION OF UPCOMING LABORATORY EXERCISES. EXAMS and REVIEWS for upcoming exams will also happen during scheduled lecture periods. **YOU WILL GET MUCH MORE OUT OF THE LECTURE IF YOU HAVE READ THE MATERIAL AHEAD OF TIME.**

II. Recitation

During recitation you will REVIEW THE HOMEWORK PROBLEMS, be given QUIZZES, and GO OVER EXAMS that you have taken.

III. Laboratory

In the laboratory you will PERFORM EXPERIMENTS related to the material being covered in the lecture and recitation periods. A two-hour laboratory period is scheduled most weeks. The labs will focus on DATA COLLECTION and DATA ANALYSIS. There is a \$30.00 lab fee that supports the purchase and maintenance of the equipment you will use.

Learning Assessment: The assessment of your learning will be done through laboratory participation, quizzes (on homework assignments), and examinations.

I. Laboratory

Assessment of your laboratory participation and learning is done through questions on the exams. Approximately 1/3 of each exam will involve questions regarding the laboratories. Lab participation and completion will also be recorded and is part of your course grade.

All labs are expected to be completed on time. A missed lab can be made up only DURING THE WEEK that it is scheduled, during some other scheduled lab period *that has an open slot*. In order to make up the lab you must obtain a note from the Physics Department office (SER 250). This note will get you into another lab section that week only.

Penalties for missed labs:

1 lab: No points deducted, but you are still responsible for any exam questions pertaining to that lab.

2 labs: **50 points deducted** from your total point score in the course.

3 labs: **YOU WILL FAIL THE COURSE.**

II. Homework Assignments and Quizzes

There will be weekly homework assignments, **posted on the class web site:**
<http://www.physics.usu.edu/riffe/2110/index.htm>

Probably the most important thing that you can do to succeed in the course is to do the homework assignments and understand the concepts behind the homework questions and problems. Typically, each Tuesday you will review that week's assignment. On Thursday, there will be a quiz on that week's and/or the previous week's homework assignment.

There will be 10 quizzes, each worth a maximum of 24 points. A missed quiz gives you zero points for that quiz. Each quiz will contain one qualitative and one quantitative question, similar to the questions on the homework assignments.

III. Exams

General info:

The exams will test on material in the lectures, reading assignments, homework assignments, and laboratories. At the exam you may use the following: (1) a writing and erasing instrument, (2) a calculator, and (3) a 3" × 5" card with anything you want handwritten on it. **The card may NOT be larger than 3" × 5", and whatever is on the card must be handwritten.**

There will be four 50 minute exams, 3 during the course of the semester and one during final-exam week at the regularly scheduled final exam time.

Exam Scoring:

Exams will contribute to your overall grade in the following manner. At the time they are graded, each exam will be scored out of 220 points. However, at the end of the term the lowest exam score will be rescaled to a maximum of 110 points. For example, if you score 200, 180, 170, and 160 on the exams, your exam grade will be calculated as $200+180+170+(160/2) = 630$ (out of a maximum of 770 points).

IF YOU MISS ONE EXAM, YOUR ZERO ON THAT EXAM WILL BE YOUR LOWEST EXAM SCORE.

IF YOU MISS TWO EXAMS, YOU WILL FAIL THE COURSE.

THE FIRST THREE EXAMS WILL BE INDIVIDUALLY RESCHEDULED ONLY AT THE DISCRETION OF THE INSTRUCTOR. If you know that you will be unable to attend the scheduled time for one of the first three exams, then you must have an *exceptionally good reason* and *make previous arrangements with the instructor to take the exam at some other time.*

THE FINAL EXAM MUST BE TAKEN DURING THE SCHEDULED TIME.

The final exam is scheduled for Monday, December 7, 2009, 11:30 a.m. – 1:20 p.m.

Grading Breakdown and Grading Scale: 10 quizzes at 24 points/quiz, 3 best exams at 220 points/exam, lowest exam at 110 points, minus any penalties as described above. (Total maximum points = 1010) **The grading scale is not flexible: that is, grading will not be curved. Your course grade will solely depend on how you do related to this scale.**

A ≥ 930,
A- ≥ 900,
B+ ≥ 870,

B ≥ 830,
B- ≥ 800,
C+ ≥ 770,

C ≥ 730,
C- ≥ 700,
D+ ≥ 670,

D ≥ 600

Disability: If you have a disability that requires accommodation in order for you to take this class, please contact me. The disability must be documented by the Disability Resources Center.

Phys 2110 Fall 2009 Schedule

--Lectures, Reading Assignments, Lab, Homework, and Recitation--

Week of	Monday (lecture)	Tuesday (recitation)	Wednesday (lecture)	Thursday (recitation)	Friday (lecture)
Aug 24 Lab 1: Excel Intro	Class Overview ¹ (<i>syllabus</i>)	No meeting	Particle physics ² / Atomic sizes (<i>Class Notes 1</i>)	HW set 1	Center-of-mass and motion ³ (<i>Class Notes 2</i>)
Aug 31 Lab 2: Motion	Motion in 1D, part I ⁴ (2.1-2.3)	HW set 2	Motion in 1D, part II ⁵ <i>Lab 2 demo</i> (2.7)	Quiz on HW sets 1 & 2	Vectors ⁶ (1.5-1.8, 3.1)
Sept 7	Labor Day Holiday	HW set 3	Newton's 3 laws of motion ⁷ (4.1-4.5)	Quiz on HW set 3	Newton's 2 nd law with a constant force ⁸ (2.4-2.6, 3.2)
Sept 14	REVIEW	HW set 4	EXAM I (HW 1-4; Labs 1 - 2)	Exam I return and review	Physical forces I – gravity and drag forces ⁹ <i>Lab 3 demo</i> (4.7, <i>Class Notes 3</i>)
Sept 21 Lab 3: Terminal Velocity	Physical forces II – contact forces ¹⁰ (4.8-4.10)	HW set 5	Equilibrium application of N's 2 nd law ¹¹ (4.11)	Quiz on HW set 5	Nonequilibrium application of N's 2 nd law ¹² <i>Lab 4 demo</i> (4.12)
Sept 28 Lab 4: N's 2nd Law	Uniform circular motion ¹³ (5.1-5.3, 5.5)	HW set 6	Kinetic energy and work ¹⁴ (6.1-6.2)	Quiz on HW set 6	Potential energy and conservative forces ¹⁵ (6.3-6.5)
Oct 5 Lab 5: Work and Energy	Applications of the work-energy theorem / Power ¹⁶ <i>Lab 5 demo</i> (6.6-6.8)	HW set 7	Simple harmonic oscillator ¹⁷ (10.1-10.3)	Quiz on HW set 7	Motion and potential energy graphs ¹⁸ (<i>Class Notes 4</i>)
Oct 12	REVIEW	HW set 8	EXAM II (HW 5-8; Labs 3 - 5)	Damped harmonic oscillator / Attractors ¹⁹ <i>Lab 6 demo</i> (10.5, <i>Class Notes 5</i>)	Fall Break
Oct 19 Lab 6: Harmonic Oscillations	Driven damped harmonic oscillator / Resonance (10.6, <i>Class Notes 5</i>) ²⁰	Exam II return and review, HW set 9	Deterministic chaos ²¹ (<i>Class Notes 6</i>)	Quiz on HW set 9	Chaos in population dynamics ²² <i>Lab 7 demo</i> (<i>Class Notes 6</i>)

Oct 26 Lab 7: Chaos	Fractals / Unpredictability / Control / Dimensionality <i>Lab 7 demo</i> (Class Notes 6) ²³	HW set 10	Fluid statics, part I ²⁴ (11.1-11.3)	Quiz on HW set 10	Fluids statics, part II ²⁵ (11.4-11.6)
Nov 2	Fluid dynamics, part I ²⁶ (11.7-11.9)	HW set 11	Fluid dynamics, part II ²⁷ (11.10 – 11.11)	Quiz on HW set 11	Fluids dynamics, part III ²⁸ (Class Notes 7)
Nov 9	REVIEW	HW set 12	EXAM III (HW 9-12; Labs 6 - 7)	Exam III return and review	Diffusion ²⁹ <i>Lab 8 demo</i> (13.2, 14.4)
Nov 16 Lab 8: Diffusion	Temperature, internal energy, and heat ³⁰ (12.1 – 12.3, 12.6- 12.7)	HW set 13	Energy distributions and temperature ³¹ (14.1-14.3)	Quiz on HW set 13	The 1 st law of thermo- dynamics, part I ³² (15.1-15.4, 15.6)
Nov 23	The 1 st law of thermo- dynamics, part II ³³ (15.5)	No meeting	Thanksgiving Break	Thanksgiving Break	Thanksgiving Break
Nov 30 Lab 9: Thermal Equilibrium	Heat engines and the 2 nd law of thermodynamics ³⁴ (15.7-15.9 Class Notes 8)	HW set 14	Entropy, part I ³⁵ (15.11, Class Notes 9)	HW set 15 Quiz on HW set 14	Entropy, part II ³⁶ (Class Notes 9)

FINAL EXAM (HW 13 – 15 Labs 8 – 9) Monday, December 7, 2009, 11:30 a.m. – 1:20 p.m.
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Top Ten List: The following are the top ten items that will help you succeed in the course.

10. **Start with a positive attitude!**
9. **STUDY** the text and/or class notes **BEFORE** lecture
8. **ACTIVELY LISTEN** to the lectures
7. **Do the Homework BEFORE** recitation
6. **GO** to recitation
5. **Ask Questions / Get help** when you need it
4. **PARTICIPATE** in the laboratories
3. **UNDERSTAND** the **CONCEPTS** related to each homework problem
2. **Do the example exams** under **EXAM CONDITIONS**
1. **Finish up with a positive attitude!**

Possible Errors: The instructor reserves the right to correct any possible errors to this syllabus.
