

Tentative Syllabus for Physics 335: Fall 2014

Professor: Dr. Stuart Hutton

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To access the Physics Gateway: <http://hutton.lyon.edu>

Office Hours

I will schedule several office hour blocks. I will be very close to my office or research lab during these times. Otherwise, I will usually be close to my office or research lab. If you want to find me outside of office hours, make an appointment so that you will be sure to find me. My schedule is located on the physics home page which you may review to determine office hours.

Grading

As a general guide to grades, grades will be assigned as follows:

100-90] A	(90-80] B	(80-70] C	(70-60] D	<(60 F
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In this course, you will have several grading opportunities, tests, homework, in-class problems and laboratory projects. The various weight of each of these activities in your final point grade is shown below. **Late assignments will normally not be accepted. Additionally, since we will be doing in-class problems, poor attendance will negatively affect your grade: in particular, you will not receive credit for class participation for unexcused absences. There are no make-ups for in-class worksheets. About labs: A brief lab report will be normally due within 1 week of the lab completion. Labs will be done in accord with topics which we are covering as shown on the syllabus. We will be doing approximately 5 labs during this course.**

Tests (3 tests)=75%

Each test is worth 25% of your grade.

Homework / in-class problems / participation=15%

Laboratory projects =10%

All lab projects must be completed or your course grade will be reduced by 10%.

Your work on tests will be graded for correctness and clarity. **Failure to supply details leading to a result will result in very little credit for a problem.** If you want full credit for a problem, **you must** supply the logical steps that led to the result and the result **must include proper units.** Diagrams should be included where appropriate to define quantities used in your result. Homework and worksheets will be graded for completion. Students are generally expected to commit two hours of study outside of class for each hour of lecture.

Course Description

In this course you will be exposed to the fundamentals of modern physics with topics including relativity and quantum mechanics.

Course Objectives

As a consequence of this course, you should obtain an enhanced understanding of the fundamentals of modern physics. In addition, you should come away from this course with an ability to solve fundamental problems involving physical principles. The particular topics covered in this course are outlined in the schedule. Depending upon class interest, the actual topics may vary slightly from those stated. Refer to Student Learning Outcomes for a discussion of minimal course outcome expectations.

Course Prerequisites

You are **expected** to be proficient with algebra and trigonometry. In addition students should have course work in calculus and should have completed [Phy210/240:241] and [Phy220/250:251].

Text

Physics 335:

Modern Physics for Scientists and Engineers
Third Edition

By: Stephen T. Thornton and Andrew Rex

You may use earlier editions of this text (which can be obtained at much lower prices online {\$0.25 for example is a low price}) but you will need to be sure to read the correct portions of the text.

The schedule is designed around this particular text edition. You may use earlier or later editions but you will need to be sure to read the correct portions of the text. The text must be considered to be a very important resource so students are expected to be reading along in the text as the course progresses.

You have many resources on the campus: the library, your colleagues and your professor. Your prime learning resource, however, must be considered to be the classroom: **punctual and complete** class attendance is expected. **Unexcused absences will negatively impact your final grade: in particular, you will not receive credit for class participation for unexcused absences. Tardiness is considered to be an unexcused absence and will negatively impact your final grade. Absences will negatively impact your final grade. Tardiness is considered to be an unexcused absence and will negatively impact your final grade. Use of a networked device to communicate during class will be considered equivalent to an unexcused absence.**

Attendance

The Lyon College Catalogue for 2014-2015 states:

Students are expected to attend all class periods for the courses in which they are enrolled. They are responsible for conferring with individual professors regarding any missed assignments. Faculty members are to notify the Registrar when a student misses the equivalent of one, two, three, and four weeks of class periods in a single course. Under this

policy, there is no distinction between “excused” and “unexcused” absences, except that a student may make up work missed during an excused absence. A reminder of the college’s attendance policy will be issued to the student at one week, a second reminder at two weeks, a warning at three weeks, and notification of administrative withdrawal and the assigning of an “F” grade at four weeks. Students who are administratively withdrawn from more than one course will be placed on probation or suspended (see Academic Probation and Academic Suspension).

Academic Honesty

It is expected and encouraged that students in this class will work together on homework problems. If you use reference work, be sure to include proper references. On tests, students are required to keep notes and books closed except as instructed. **Your professor will supply all the paper needed for the tests.** Any questions during tests should be directed to the professor only. **CELL PHONES AND OTHER WIRELESS OR NETWORKED DEVICES (INCLUDING COMPUTERS) MAY NOT BE USED DURING TESTS except as authorized to permit access to reference materials,** If you do use such devices during a test to access unauthorized material, it will automatically be considered to be a violation of the Lyon College Honor Code.

All graded work in this class is to be pledged in accordance with the Lyon College Honor Code.

“Students seeking reasonable accommodations based on documented learning disabilities must contact the Dean of the Faculty at (870) 307-7332.”

Withdrawal Deadlines

Last day to drop with no record of the course is 01 September 2014.

Last day to drop with a W is 22 October 2014.

Tentative Schedule for Physics 335 (Modern Physics) Fall 2014
Class Times: Monday 3-3:50, Tuesday: 12-12:50, Thursday 12-12:50

Date	Assignment due	Topics and Events
Tuesday, August 19, 2014		Class Initialization
Monday, August 25, 2014		Chapter 2: Special Theory of Relativity
Monday, September 01, 2014	H01	Special Theory of Relativity
Monday, September 08, 2014	H02	Special Theory of Relativity
Monday, September 15, 2014	H03	Special Theory of Relativity
Monday, September 22, 2014	Test 01	Selected Topics from Chapter 3 e/m measurement determination of e Line spectra Photoelectric effect
Monday, September 29, 2014		Selected Topics from Chapter 3
Monday, October 06 2014	H05	Selected Topics from Chapter 4 Classical atomic model Bohr model of the Hydrogen atom (failures of the Bohr model) Atomic Excitation by Electrons
October 09 - October 12, 2014		Fall break
Monday, October 13, 2014	H06	Selected Themes from Chapter 4
		Chapter 5: Wave properties of matter
		Chapter 5: Wave properties of matter
		Chapter 5: Wave properties of matter
Monday, October 20, 2014	H07	Chapter 5: Wave properties of matter
		Chapter 6: The Quantum Theory
		Chapter 6
		Chapter 6
		Chapter 6
		Chapter 6
		Chapter 6
		Chapter 6
Monday, October 27, 2014	Test 02	
Monday, November 03, 2014	H08	Chapter 7: The Hydrogen Atom Selected topics
		Selected topics from Chapter 7
		Chapter 9: Statistical Physics
		Selected Topics from Chapter 9
		Selected Topics from Chapter 9
Monday, November 10, 2014	H09	Chapter 12: The Atomic Nucleus
		Chapter 12
Monday, November 17, 2014		Chapter 12
		Chapter 12
Monday, November 24, 2014	H10	Chapter 13: Nuclear Interactions Selected Topics
		Selected Topics from Chapter 13
		Selected Topics from Chapter 13
		Selected Topics from Chapter 13
November 26 - November 30		Thanksgiving Break
Monday, December 01, 2014	Test 03	
Monday, December 01, 2014		last week, tie up loose ends

CLASS SCHEDULE / OFFICE HOURS Fall 2014

Office Derby 248		General Lab Derby 148		Research Lab Derby 219
PROFESSOR Stuart Hutton				
Monday	Tuesday	Wednesday	Thursday	Friday
8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 011	8:00-9:15	8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 011	8:00-9:15	8:00-8:50 PHY240.01 Fundamentals of Physics I Derby 011
9:00-9:50 PHY210.01 Gen Physics I Derby 011	9:30-10:45	9:00-9:50 PHY210.01 Gen Physics I Derby 011	9:30-10:45	9:00-9:50 PHY210.01 Gen Physics I Derby 011
10:10-10:50 Office Hours Derby 248		10:10-10:50 Office Hours Derby 248		10:10-10:50 Office Hours Derby 248
11:00-11:50	11:00-11:50	11:00-11:50	11:00-11:50	11:00-11:50
12:00 - 12:50	12:00 - 12:50 Phy 335 Modern Physics Derby 011	12:00 - 12:50	12:00 - 12:50 Phy 335 Modern Physics Derby 011	12:00 - 12:50
1:00-1:50	1:00-2:15	1:00-1:50	1:00-3:50 PHY241.01 Fund Physics I Lab Derby 148	1:00-3:50 PHY241.02 Fund Physics I Lab Derby 148
2:00-2:50	2:30-3:45	2:00-2:50		
3:00-3:50 Phy 335 Modern Physics Derby 011				
4:00-4:50	4:00 - 4:50	4:00-4:50		

Physics Problem Solving Rubric

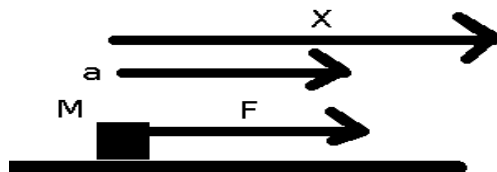
	1	0.75	0.5	0-.25
<p>1, Critical Thinking:</p> <p>Solution started correctly.</p> <p>Note: sketches may be considered here as required in problem statement.</p>	<p>correct approach</p> <p>If required, sketches were correct.</p>	<p>approach would lead to correct result</p> <p>Sketches miss one label or some other component absent or incorrect.</p>	<p>Something is right in the approach but insufficient to reach problem solution.</p> <p>Sketches miss multiple labels, directions incorrectly indicated</p>	<p>incorrect approach</p> <p>Sketch not present or not at all correctly labeled.</p>
<p>2. Quantative Literacy:</p> <p>Solution proceeded quantatively</p>	<p>Mathematical operations correct and units correct</p>	<p>Mathematical operations and units correct however an error usually related to incorrect units or the final numerical result present</p>	<p>Mathematical operations have some correct steps but misapplication or other errors prevented problem completion. Units reported in final result not present or incorrect .</p>	<p>Necessary mathematical operations incorrect and units absent</p>
<p>3, Informational Literacy</p> <p>Physical terminology</p>	<p>correct physical terminology needed to solve problem used</p>	<p>physical terminology needed to solve problem used but not complete or absent important concept.</p>	<p>physical terminology needed to solve problem incomplete and would not have lead to problem completion.</p>	<p>Did not use physical terms needed to solve problem.</p>
<p>4, Scientific Thought</p> <p>Note: this may be contained within an equation starting the problem solution.</p>	<p>correctly stated physical principle or law</p>	<p>physical principle or law used shown however omission or extraneous material present.</p>	<p>statement of physical principle or law present but would not apply to present problem so as to lead to solution.</p>	<p>no statement of or incorrect physical principle or law.</p>

Problem scoring: max per problem=4 points. In a test containing 4 problems, this equates to 25% of the total test score.

Example of a complete solution

Find the vector position at time t of an object of mass M when subjected to a constant force $\vec{F} = F \hat{x}$ for a period t if the object was initially at $x=0$ and at rest. Provide a numerical result with correct SI units for $F=1$ N, $M=1/2$ kg and $t=2$ s. Include a correctly labeled sketch showing F acting on M , a and x .

Solution:



$$\text{Newton's law: } \vec{F} = M\vec{a} \Rightarrow \vec{a} = \frac{\vec{F}}{M}; \vec{F} = F \hat{x} \Rightarrow \vec{a} = \frac{F}{M} \hat{x} : a_x = \frac{F}{M}$$

Constant force : kinematic equations of motion in x direction for position:

$$x = x_0 + v_{x,0}t + \frac{1}{2}a_x t^2$$

Object initially at rest: $v_{x,0} = 0$ m/s . Object initially at $x=0$: $x_0 = 0$ m .

Kinematic equation reduces to: $x = \frac{F}{2M} t^2$

$$\text{With numerical values: } x = \frac{1\text{N}}{2 \times \frac{1}{2}\text{kg}} (2\text{s})^2 = 4 \frac{\text{Ns}^2}{\text{kg}} = 4\text{m}$$

Final answer with vectors: $\vec{x} = 4\text{m} \hat{x}$

Score:

1: Started with Newton's law and used correct equation of motion, additionally a correctly labeled sketch was drawn showing correct vector directions as was required=1

2: Algebra (including vectors) correctly lead to final result, unit algebra correct=1

3: Correctly used physical information in the problem which were mass M , initial conditions (at $x=0$, at rest) , time t , constant force, vector directions=1

4: Correct numerical quantities (including correct vectors) provided in final result with correct SI units reported=1

Notes on the lab write-up for physics labs (Fall 2014)

Your first (cover) page should include the following information:
Your Name, Date, Partners, Title of Experiment and the abstract.

Each lab must be the unique written effort of the student team submitting the report. You may NOT reference or use lab reports (prepared by others, outside your team) in your report preparation.

Lab reports must be electronically submitted to the appropriate address as a single pdf document.

Title: Concise wording that describes the essence of the lab.

Abstract - a summary of your research including general methods and major conclusions. This is usually one paragraph long and should convince someone to read your paper. Include a statement of your hypothesis here and if data supported it.

Introduction: An overview of your experiment, statement of hypothesis, what you did and what the theory was behind the experiment.

Methods: - A brief discussion of experimental techniques. Diagrams are usually appropriate in this section.

Results -written usually in the past perfect tense or passive voice; describes your findings, data collected, and includes data tables, graphs, general trends, derived formulas, etc. All work and data tables must be shown here. In general, you need to have a copy of your original data with you but the data included in the lab report can be copied from your original data. Data should be absent of obvious errors (since you would have tracked down these items).

Discussion and analysis - tense can vary, describes your results in relation to other data, discusses problem associated with the lab, postulates trends in the data, predicts results given different circumstances, suggests sources of error, etc. Discuss how the data supports, or does not support your hypothesis and how well such support is in terms of error analysis such as percent differences. **Be sure to include sample calculations in this section.**

Literature Cited - a list of books, articles, etc., that you used to assist you in presenting your data and which were referred to in the write-up. **When citing a reference from the internet, you MUST include the URL that points directly to the document so that a single click of the mouse will bring up that exact document. Every lab report will have at least 1 citation or the report will not be accepted.**

Your presentation of the lab is important. Be sure it is grammatically correct and neatly typed. Be careful of tense changes within a paragraph. Data collected during a lab must be authentic. "Fudging" is unacceptable and unnecessary.

Lab write-ups should be as **concise** as possible within these guidelines. I am not looking for exhaustive tomes of work in a lab write-up.

Physics Lab Grading Rubric

Note: Each student has the opportunity to revise deficient portions of the lab report during the lab period except for teamwork, arrival and departure.

	1	0.5	0
Scientific Thought	Hypothesis in abstract and introduction. Supporting evidence (or non-supporting) discussed in conclusion.	Hypothesis in abstract and introduction but not relevant and supporting evidence (or non-supporting) not discussed in conclusion.	Hypothesis absent in abstract and introduction; Supporting evidence (or non-supporting) not discussed in conclusion
Critical thinking	Correct discussion of experiment, and how results relate to hypothesis.	Incomplete discussion of experiment and how results relate to hypothesis	poor or absent discussion of experiment, and how results relate to hypothesis.
Inquiry and Analysis	Complete discussion of experimental technique and data results	incomplete discussion of experimental technique and data results	poor or absent discussion of experimental technique and data results
Informational Literacy	Correct physical terminology contained in report. At least one reference present.	incomplete physical terminology contained in report. Reference present but not correct.	incorrect or absence of physical terminology contained in report. Reference not present.
Quantative Literacy	Correct usage of calculations including spreadsheets	correct usage of calculations including spreadsheets but something significant missing	Absent or incorrect usage of calculations including spreadsheets
Teamwork	Successful team completion of lab		Unsuccessful team completion of lab
Arrival	on time		tardy or absent
Departure	Work space returned as it was when arriving		Workspace left in disorder upon departure
Overall report	All required elements present		Required elements missing.
Quality	experimental results presented without obvious errors		experimental results presented with obvious errors

Student Learning Outcomes for the Physics Program at Lyon College

1. *Students who complete modern physics (Phy335) are able to quantitatively apply*

- 1a. special relativity and needed modifications of Newtonian Physics
- 1b. quantum mechanics as applies to simple situations.
- 1c. the basis of nuclear reactions and decay.

2. *Students will have lab exposure to milestone experiments in modern physics.*

2a. Phy335 students will also have lab exposure to several modern versions of important milestone experiments and fundamental experiments in modern physics.

The quantitative aspects (1a,1b,1c) can be measured of portions of currently-used standard exams and exam problems graded according to the problem solving rubric. For each exam, data will be recorded for 1 problem.

The Lab portions (2a) will be evidenced by very brief technical reports of several of the experiments performed in lab graded according to the standard lab grading rubric for two several selected experiments. Data will be recorded for two selected reports.