

# PHYSICS 110: PHYSICS FOR SCIENTISTS AND ENGINEERS I

## SYLLABUS

FALL 2009

<b>INSTRUCTOR:</b>	Dr. Q. Su	
<b>ADDRESSES:</b>	Office: 312A Moulton Hall	Office hours: after class, or walk in
	Phone: 438-5392	Email: <a href="mailto:qcsu@ilstu.edu">qcsu@ilstu.edu</a>
	Class Web page:	<a href="http://www.phy.ilstu.edu/su/phy110">http://www.phy.ilstu.edu/su/phy110</a>
	Quiz Web page:	<a href="https://mallard.phy.ilstu.edu/phy110su">https://mallard.phy.ilstu.edu/phy110su</a>
	Class Net Forum:	<a href="https://mallard.phy.ilstu.edu/phy110su">https://mallard.phy.ilstu.edu/phy110su</a>
<b>LECTURES:</b>	MLT 214 / TWRF / 10:00–10:50 am	
<b>LABS:</b>	Sect. 02: MLT 217 / T / 1:00–3:50 pm TA:	
	Sect. 03: MLT 217 / T / 6:00–8:50 pm TA:	
	Sect. 04: MLT 217 / W / 6:00–8:50 pm TA:	

**The material contained in this syllabus is tentative and subject to change at my discretion.**

## OBJECTIVES & FORMAT

We will learn basic principles and applications of physics in mechanics. Basic experimental skills will also be developed in these areas. Lectures will mix with demonstrations and tests. Only major topics will be discussed during lecture sections. **It is essential that you study the relevant sections before each lecture. Materials in the required sections (as well as labs) but not covered in the lectures may be tested.** Homework problems and questions raised from the class will be addressed during the review sessions. Homework will not be collected, but solutions will be posted.

## REQUIRED MATERIALS

Text: R. Serway, J. Jewett, Physics for Scientists and Engineers, 6<sup>th</sup> ed., Brooks, Belmont, 2004.

Lab manual: Laboratory Manual for Physics 110

Other: Scientific calculator.

## ON LIBRARY RESERVE

Q. Su, Physics 110 Class Notes, v1.4. available at PIP printing, also available online.

R. McGrew, J. Saul and C. Teague, Instructor's Manual to Accompany Physics for Scientists & Engineers (Vol-1), 6<sup>th</sup> ed., Brooks, Belmont, 2004.

## GRADING

Exams (3 x 160 pts)	480 pts
WebQuizzes (10 x 10 pts)	100 pts
Pop-up Quizzes (8 x 5 pts)	40 pts
Labs and Essay (8 x 25 pts)	200 pts
<u>Final Exam (180 pts)</u>	<u>180 pts</u>
total	1000 pts

**Scales** The high boundaries are **A**≥900, **B**≥800, **C**≥700, **D**≥500. The exact grade boundaries may be lower. They will be determined according to your overall performance. In borderline cases I may consider steady improvement, a good performance on the final exam and attendance.

**Web Quizzes** will be offered via the internet. The software tool we will be using is called *Mallard* and may be accessed via the address: <https://mallard.phy.ilstu.edu/phy110su>. We will take 12 web-based

quizzes and 10 best scores will be counted toward 100 points (or 10%) of the overall grade. Each quiz will consist of 5 problems of multiple-choice or fill-in-the-blank types. Each question in a quiz weighs equally. The passing grade for each quiz is 3 out of 5. To improve your grade you may retry the questions that you have answered incorrectly by loading a new set. Each new loading generates a similar but different set of questions. You may retry up to 10 times before the due date. After then no improvement may be made toward the quiz, but past quizzes are still accessible for practice without affecting scores attained.

**Pop-up Quizzes** will be offered in class throughout the semester. Problems appear in the pop-up quizzes should be similar to those of the WebQuizzes. The maximum points for each pop-up quiz is 5. Eight best quiz scores will be counted toward a total of 40 overall points.

**Mid-term Exams** will generally contain multiple-choice, fill-in-blank, true-false type, or show-your-work type problems. We will take 3 best out of 4 exams.

**Final Exam** generally contains multiple-choice, fill-in-blank or true-false type problems. There will be no show-your-work type of problems on the final. Final will be cumulative that covers the material taught throughout the semester, including possibly the labs.

**Physics Colloquia** The Physics Colloquium series invites guests, usually from outside the university, to present progress in physics and teaching developments. These seminars are aimed at undergraduate level. Attending these talks will give you a further appreciation and a broader understanding of today's physics. You are expected to attend at least one seminar throughout the semester (announcements will be made in class). After which please write a 4 page essay about the talk to earn a total of 25 possible points. The essay will be collected in week 14.

**Formula Sheet** All tests will be close-book. You will be allowed to bring to each test (*but not to the final*) a formula sheet (8.5 x 11 in) displaying only *formulas* and physical *constants* (no sketches, nor words). The formula sheet should be turned in together with each exam and will be returned.

#### **MAKE-UPS AND ABSENCES**

Make-up *Exams*, *WebQuizzes* and *Labs* will not be allowed because we allow you to drop an exam, two WebQuizzes and a lab/essay. No other projects or papers will be allowed as make-up or extra credit.

#### **WITHDRAWAL**

Friday, October 9 will be the last day to drop the course with a **WX** grade.

#### **SOLUTIONS**

Solutions to exams will be discussed in class.

## **HOMEWORK ASSIGNMENTS**

The following are suggested homework problems. Problem-solving is probably the best way to learn physics and is good preparation for the tests. Feel free to work together on these problems. If you encounter difficulty and your peers cannot help, see me outside of classes. Class related issues may also be discussed on a net-forum accessible through Mallard. You may drop by at other times if my office door is open, and I will generally be glad to help you. Leave a phone or an electronic mail message for further questions or make an appointment. Here is the list of homework assignments.

- Chap. 1: 6,7,13,15,17,22,29,34,44,49,52,50,68
- Chap. 2: 3,4,5,6,12,21,24,25,27,37,42,44,46,47,49,75
- Chap. 3: 1,2,7,15,19,23,28,31,41,47,49,50,59
- Chap. 4: 1,2,5,7,8,11,12,17,19,31,34,35,49,51,53
- Chap. 5: 5,7,9,11,14,21,22,26,33,41,43,45,46
- Chap. 6: 1,2,3,5,6,13,17,18,20
- Chap. 7: 1,7,10,26,28,30,31,35,39,40
- Chap. 8: 2,5,9,13,21,26,30,31,33,41,60,61
- Chap. 9: 1,4,9,10,17,20,24,33,37,38,39,41,47,48,58
- Chap. 10: 2,4,6,17,19,20,22,31,36,40,44,46,49,51,52,53,61,62
- Chap. 11: 3,6,13,17,25,28,29,35,37
- Chap. 12: 2,3,4,6,24,42
- Chap. 15: 1,5,7,9,17,20,27,31
- Chap. 13: 4,8,10,11,12,15,23

## PHYSICS LABORATORY

Students will ordinarily work in pairs in the laboratory. Students are expected to be on time. Prelab reading of the lab manual (or relevant text and class notes) is expected. Instructions are frequently given at the beginning of an experiment and might not be repeated for late-comers. Persons who are habitually late will not be allowed to use their partner's data.

### Laboratory Rules

1. The experimental work station is to be left in the condition that you found it.
2. Please report promptly any breakage or any inoperable equipment.
3. Data is to be entered in ink directly into the data sheet provided for each experiment. Data is never to be copied over or entered in pencil.
4. Data sheets are to be stamped or initialed by the lab instructor before leaving. Reports with unstamped data sheets will receive no credit.
5. Members of a team will take data collectively. Laboratory reports are to be written individually.
6. Graphs may be drawn in pencil. A graph should have a title and its axes should be properly labeled. Graphs should be drawn on finely ruled graph paper in full size.
7. For each of the labs, please read the lab manual and complete the prelab section as it will be collected by your TA at the beginning of the lab. Other questions should be answered as the relevant part of the lab is completed. Your TA will only answer general questions. You are responsible for figuring out the details by reading background material in the lab manual and by working with instruments or softwares provided. Your work will be collected at the end of the lab. No other report is required for that lab.

### Essay format

The essay shall address the following:

- (a) What is the speaker's field of study and why is it important to the society? (5 pt)
- (b) What was the method used by the researcher? (5 pts)
- (c) What conclusion was made? And what was the analysis leading to the conclusion? (5 pts)
- (d) What are the open questions to be addressed by future studies? (5 pts)
- (e) coherence, logic and style of the essay (5 pts)

## PHY-110 TENTATIVE SCHEDULE

Topic	Section	Dos, Dues, & (Homework)
<u>Week-1</u>		
First day of class		
Units and Standards	Ch1.1-Ch1.3	
Dimensional Analysis	Ch1.4-Ch1.7	
One-Dimensional Motion	Ch2.1	(HW: Ch1)
<u>Week-2</u>		
Speed and Velocity	Ch2.2	do: Lab-Q1: Graphical Analysis
Velocity as rate of change	Ch2.2, 2.7	
Concept of Derivative	Ch2.7	due: WebQuiz-1: Units ( <u>8/28</u> )
Derivative Rules	Ch2.7	(HW: Ch2)
<u>Week-3</u>		
Derivative Rules-II	Ch2.7	do: Lab-Q2: DataStudio
Concept of Integral	Ch2.7	
Acceleration, Free Fall	Ch2.3-Ch2.6	due: WebQuiz-2: Velocity ( <u>9/4</u> )
Problem Solving	Ch2.1-Ch2.7	(HW: Ch2)
<u>Week-4</u>		
Exam 1 Review		
<b>Exam 1</b> (up to free fall)		
Vector Rules	Ch3.1-Ch3.3	due: WebQuiz-3: 1-D Motion ( <u>9/11</u> )
Unit Vector Notation	Ch3.4	(HW: Ch3)
<u>Week-5</u>		
Projectile, Range-Height	Ch4.3	do: Lab-Q3: Freefall
Two-Dimensional v, a	Ch4.1, Ch4.2	
Circular Motion	Ch4.4-Ch4.5	due: WebQuiz-4: Vectors ( <u>9/18</u> )
Newton's Laws	Ch5.1-Ch5.4, Ch5.6	(HW: Ch4)
<u>Week-6</u>		
Weight, Normal Force	Ch5.5, 5.7	
Tension	Ch5.7	
Constant Friction	Ch5.8	due: WebQuiz-5: 2-D Motion-1 ( <u>9/25</u> )
Friction of Drag	Ch6.4	(HW: Ch5)
<u>Week-7</u>		
Uniform Circular Motion	Ch6.1	do: Lab-Q4: Projectile Motion
Non-Unif Circular, Relativity	Ch6.2, Ch6.3	
Spring Force	Ch5.7	due: WebQuiz-6: 2-D Motion-2 ( <u>10/2</u> )
Problem Solving		(HW: Ch6)
<u>Week-8</u>		
Exam 2 Review		
<b>Exam 2</b> (up to spring force)		
Work by a Constant Force	Ch7.1-7.2, Ch7.4	due: WebQuiz-7: Newton's Laws-1 ( <u>10/9</u> )
Dot Product	Ch7.3	(HW: Ch7), withdrawal with a WX

---

Week-9

---

Work-Energy Theorem, P	Ch7.5-Ch7.8	do: Lab-Q5: Newton's Second Law
Conservative Forces and PE	Ch8.1-Ch8.3	
Energy conservation	Ch8.2	due: WebQuiz-8: Newton's Laws-2 (10/16)
Conservation with NC Forces	Ch8.4-Ch8.6	(HW: Ch7&8)

---

Week-10

---

Momentum Conservation	Ch9.1-Ch9.2	
Collisions in 1 D	Ch9.3	
Collisions in 2 D	Ch9.4	dues: WebQuiz-9: Energy (10/23)
Center of mass	Ch9.5-Ch9.6	(HW: Ch8&9)

---

Week-11

---

Exam 3 Review		
<b>Exam 3</b> (up to center of mass)		
Rotational Motion	Ch10.1-Ch10.3	
Rotational Energy	Ch10.4	(HW: Ch9&10)

---

Week-12

---

Moment of Inertia	Ch10.5	do: Lab-Q6: Momentum & Energy
Torque, Work, Power	Ch10.6-Ch10.8	
Rolling Motion, Vector Prod	Ch10.9	due: WebQuiz-10: Collision (11/6)
Angular Momentum	Ch11.2-11.3	(HW: Ch10)

---

Week-13

---

Ang Momentum Conservation	Ch11.4	do: Lab-Q7: Ballistic Pendulum
Conditions for Equilibrium	Ch12.1-Ch12.2	
Examples of Static Equilibrium	Ch12.3	dues: WebQuiz-11: Rotation (11/13)
Harmonic Motion	Ch15.1-Ch15.4	(HW: Ch11&12)

---

Week-14

---

Simple Pendulum	Ch15.5	
Problem Solving		
Exam 4 Review		(HW: Ch15)
<b>Exam 4</b> (up to pendulum)		Essay (11/20)

---

Week 15

---

Fall Break, no class	Happy Thanksgiving!	
----------------------	---------------------	--

---

Week 16

---

Law of Gravitation	Ch13.1-Ch13.3	do: Lab-Q8: Harmonic Motion
Planetary Motion	Ch13.4,13.6,13.7	
Problem Solving		due: WebQuiz-12: Gravitation (12/4)
Final Review		(HW: Ch13)

---

**Monday, Dec, 7, 2009 Comprehensive Final Exam, 7:50 am, in MLT 214.**