

Monday and Wednesday

12:30 – 1:45 p.m.

Instructor: Prof. Daniel Stein

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Office Hours: Monday, 2:00-3:00

Thursday, 1:00-2:00

Lab Section	Day	Time
2	Tuesday	9:00 – 10:40 a.m.
3	Tuesday	11:00 – 12:40 p.m.
4	Tuesday	1:00 – 4:40 p.m.
5	Tuesday	3:00 – 4:40 p.m.
6	Tuesday	5:00 – 6:40 p.m.
7	Wednesday	9:00 – 10:40 a.m.

Course Description and Goals

Do you know how electricity is generated and transported? How instruments create music? Why the sky is blue and why there are rainbows? Why they are called “cell phones”? What makes refrigerator magnets stick? How clocks keep time? Why ice skating is possible? How your computer monitor and plasma screen TV produce their colors and pictures?

All of the devices that define contemporary living are applications of basic scientific discoveries. The principles underlying these devices are fascinating as well as useful, and explain as well many of the natural features and phenomena of the world around us. This course familiarizes you with some basic principles of physics through their applications to selected devices such as CD and DVD players, radio and cell phones, the basic electronic components of computers, lasers and LEDs, radiation therapy in medicine, and even nuclear weapons. In learning the basic physics behind these modern inventions, you will develop a deeper understanding of how the physical world works and gain a new appreciation of everyday phenomena that are ordinarily taken for granted. The course is designed for non-science students with an interest in the natural world. The basic physical ideas needed to understand how things operate are presented using some mathematics, but none beyond elementary high school-level algebra.

Course texts and accompaniments

1. *How Things Work, 4th Edition* by Louis A. Bloomfield is bundled together with a passcode to use WileyPlus, the website for online homework, John Wiley and Sons.
2. *How Things Work Laboratory Manual*.
3. *Personal Response System Transmitter*; this comes bundled with the textbook at the NYU Bookstore.

Examination Schedule and Student Assessment

Examination 1:	15%	Wednesday, October 13
Examination 2:	15%	Wednesday, November 17
Laboratory:	30%	
Homework:	10%	
Final examination:	30%	Wednesday, December 22, 12:00 to 1:50 p.m.

The three examinations will be in the multiple-choice format.

Important: Excused absences from the exams without prior notice will be given **only** in the case of sudden illness (and will then require a doctor’s note). If you know in advance that you will not be here on an exam date for any reason, such as observance of a religious holiday or a pre-planned trip out of town, *you must notify your instructor in advance, in writing, at least two weeks before the exam date. A different exam date will then be arranged for you. All other absences will be considered unexcused and will result in a grade of zero for that exam.* (So please set a backup alarm or have a reliable friend

call you that morning if there's a chance you might otherwise miss the exam. We will make absolutely no exceptions to this policy.)

Please note: The two in-class examinations, homeworks, labs, final examination, and clicker extra credit provides a more than adequate basis for you to demonstrate how well you've learned the material and for us to determine an accurate course grade. There will be no exceptions in grade assessment made for anyone; in particular, extra credit papers or assignments will not be allowed. Please understand that this is to ensure fairness and uniformity of grading standards for everyone.

Laboratory Sessions

These weekly sessions are an important part of the course. You must be registered for one lab section. You will have to submit a lab report for each experiment performed. The lab report has to include answers to all questions and any data you may have collected. The lab report will be due in lab *one week* after the experiment has been performed. **The laboratory sessions will be held in Silver 203 and will begin the week of September 20.**

Attendance The lab instructor will deduct points from your lab grade for arriving late or leaving early.

Absence Policy As with the exams, excused absences will only be given in the case of illness (with a doctor's note) or observation of a religious holiday. You must notify your lab instructor in advance in writing if you miss a lab due to religious reasons. All other absences will be considered unexcused and will result in a lab grade of zero. **You cannot make up a lab by attending a laboratory session that you are not registered for.**

Late Assignments Late assignments will be penalized for each day late (excluding weekends). If you wish to submit a late lab report you must do so only at your laboratory instructor's office.

Lab Instructors Each lab instructor will hold a weekly office hour where you can discuss lecture and laboratory material. Office locations and office hour schedule will be announced in lab.

Readings

Reading assignments are listed below. It is strongly recommended that you complete the readings before the material is discussed in lecture. In addition to aiding your understanding of the material, the personal response system questions, to be described below, will be based, in part, on the readings.

Homework

We are using an online system for homework supplied by the publisher of the Bloomfield textbook. Problems from the end of the chapters listed in the syllabus are assigned for homework. You will find the list of problems on the Wiley class website.

The WileyPlus class section URL is <http://edugen.wiley.com/edugen/class/cls190454/>

You will need the passcode that came bundled with your book to access this website and complete the homework assignments.

Homework Assignments are due Thursday afternoon at 5:00 pm. The material is based on the chapter and sections indicated below. The actual assignment can be found on WileyPlus.

September 16:	Chapter 1, sections 1 to 3
September 23:	Chapter 3, section 1
September 30:	Chapter 9, section 1
October 7:	Chapter 9, section 2, Chapter 10, section 1
October 14:	No assignment to allow for more study time for exam 1
October 21:	Chapter 10, section 3
October 28:	Chapter 11, section 1
November 4:	Chapter 11, sections 2 and 3
November 11:	Chapter 13, section 1, Chapter 14, section 1
November 18:	No assignment to allow for more study time for exam 2
November 25:	No assignment due.
December 2:	Chapter 12, sections 1 and 2
December 9:	Chapter 14, sections 2 and 3

There is also a Blackboard class website that we will use to send email and to post additional material where relevant.

Extra Credit: Personal Response System (PRS)

In order to promote interaction in lecture you will use your personal response system transmitter to respond to a series of questions each lecture. The results of each question are collected by a computer and displayed on a large screen for all to see. This will gauge your understanding of important topics. Also, you will receive 1/8 of a point for each question answered correctly. With 2 or 3 questions asked per lecture, and about 24 lectures where we use the system during the semester, this means that you can add a maximum of 8 or 9 points (depending on the number of questions asked over the course of the semester) to your grade for the course above that contributed by your lab grade, homework and examinations. Since this is extra credit, it cannot be made up for any reason, medical, personal or technical.

Lec. Date	Readings and Lectures
W Sep 8	Introduction to course and review of policies. 1.1 Skating – motion, inertia, velocity, acceleration.
M Sep 13	1.2 Falling Balls – mass, force, weight, acceleration due to gravity.
W Sep 15	1.2 Falling Balls – more on force, net force, and gravity; Newton's Three Laws of Motion.
M Sep 20	1.3 Ramps – work, kinetic and potential energy, energy conservation, mechanical advantage.
W Sep 22	3.1 Spring Scales – periodic motion, stable equilibrium, Hooke's Law, springs, oscillations.
M Sep 27	9.1 Clocks – time and space, simple harmonic motion, harmonic oscillators, period, frequency, amplitude, anharmonic oscillators.
W Sep 29	9.2 Musical Instruments - traveling and standing mechanical waves, wave velocity, period and frequency, wavelength, transverse waves along a string, fundamental frequency and harmonics (overtones), pitch and timbre.
M Oct 4	9.2 Musical Instruments – sound waves in gases, solids, and liquids, longitudinal waves, water waves, sympathetic vibrations.
W Oct 6	10.1 Static Electricity – electric charge, electrostatic force, Coulomb's law, atomic theory of matter, atomic basis of electricity, ions.
M Oct 11	No class scheduled
W Oct 13	Exam 1
M Oct 18	10.1 Static Electricity – electrostatic potential energy, voltage, charging by contact, chemical potential energy, electrical conductors and insulators, electric polarizability.
W Oct 20	10.3 Flashlights – electric fields, electrostatic potential energy, voltage, capacitance, batteries, incandescent lightbulbs.
M Oct 25	10.3 Flashlights - electric circuits, current, resistance, power, resistance, Ohm's Law, short circuits.
W Oct 27	11.1 Household Magnets – magnetic monopoles and dipoles, permanent magnets, magnetostatic forces, atomic basis of magnetism, ferromagnetism, induced magnetization, magnetic domains, soft and hard magnetic materials, magnetic fields, magnetism of Earth, Ampere's Law: relationship between electric currents and magnetic fields.
M Nov 1	11.2 Electric Power Distribution – direct and alternating currents, Faraday's Law: relationship between changing magnetic fields and electric fields, induced emf, Lenz's law, inductors, magnetic field energy.
W Nov 3	11.3 Hybrid Automobiles – Transformers, generators, AC motors: pp. 405-412
M Nov 8	13.1 Radio – electromagnetic waves, electromagnetic spectrum, polarization, antennas, electrical oscillations, LC and tank circuits, tuning, amplitude modulation, frequency modulation, bandwidth.
W Nov 10	14.1 Sunlight – blackbody spectrum, visible light, color, reflection and impedance mismatch, refraction, index of refraction, Rayleigh scattering ↔ blue skies, dispersion ↔ rainbows.
M Nov 15	12.1 Power Adapters - quantum basis of modern electronic devices, Problems with physics at the end of the 19 th Century, Planck hypothesis, photoelectric effect, photons, diffraction and interference, wave-particle duality.
W Nov 17	Exam 2
M Nov 22	12.1 continued - electrons in atoms, molecules and solids; quantum basis for conductors vs. insulators: energy bands and band gaps, Fermi energy.
W Nov 24	12.1 continued – semiconductors, conduction and valence bands, doping, electrons and holes, n-type and p-type semiconductors; diodes and rectification.
M Nov 29	12.2 Audio Players – analog vs. digital representations of information, transistors, MOSFETs, amplification
W Dec 1	12.2 Audio Players – converting sound to digital format, binary number system, information storage, ASCII, RAM, CMOS, logic elements and functions.
M Dec 6	14.2 Light and Discharge Lamps – color vision, primary colors of light and pigment, radiative transitions, gas discharge tubes, fluorescent lights.
W Dec 8	14.3 Lasers and LEDs – phase of a wave, coherent and incoherent light, absorption, spontaneous and stimulated emission, population inversion, pumping, LEDs, diode lasers.
M Dec 13	15.2 Optical Recording and Communication – CD's and DVD's, diffraction limit, total internal reflection, optical fibers. 16.1 Nuclear Weapons – atomic/nuclear masses, sizes, and densities; neutron stars, nuclear structure, isotopes,
W Dec 15	16.1 Nuclear Weapons – equivalence of mass and energy, the nuclear force, the curve of binding energy, quantum tunneling, radioactivity, half-life, alpha, beta, and gamma decay, transmutation of elements, medical uses of radioactivity. fission, chain reactions, fusion, fallout

Weekly Schedule of Laboratories

<i>Week of</i>	<i>Weekly Lab</i>
September 6	<i>No lab</i>
September 13	<i>No lab</i>
September 20	Math Review
September 27	Kinematics
October 4	Newton's Second Law
October 11	Exam 1 Review
October 18	Simple Harmonic Motion
October 25	Speed of Sound
November 1	Ohm's Law
November 8	Exam 2 Review
November 15	Capacitors
November 22	<i>Thanksgiving Holiday (No Lab)</i>
November 29	Diodes and LED's