Natural Science I: How Things Work V55.0214
Spring 2008 Meyer 121

Tuesday and Thursday
11:00 – 12:15 p.m.
Instructor: Prof. David Grier
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Office Hours: See Blackboard

Lab Section	Day	Time
02	Tuesday	1:00 – 2:40 p.m.
03	Tuesday	3:00 – 4:40 p.m.
04	Tuesday	5:00 – 6:40 p.m.
05	Wednesday	9:00 – 10:40 a.m.
06	Wednesday	11:00 – 12:40 p.m.
07	Wednesday	1:00 – 2:40 p.m.

Course Description and Goals

Do you know how electricity is generated? How instruments create music? Why is it called a "cell phone"? What makes refrigerator magnets stick? For that matter, why is ice skating possible, and why can someone quickly remove a tablecloth without moving any dishes? 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 help to explain many of the features of the world around us. This course familiarizes you with some basic principles of physics by examining selected devices such as CD and DVD players, radio and cell phones, the basic electronic components of computers, lasers and LEDs. 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

1. *How Things Work, Third Edition* by Louis A. Bloomfield is bundled together with a passcode to use WileyPlus, their online website designed for use with the text, John Wiley and Sons.
2. *How Things Work Laboratory Manual.*
3. *Personal Response System Transmitter.* As this device is used for extra credit, purchase is recommended.

Examination Schedule and Student Assessment

Examination 1:	20%	Thursday, February 21
Examination 2:	20%	Thursday, April 3
Laboratory:	25%	
Final examination:	35%	Thursday, May 8, 10:00 to 11:50 am

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

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 January 28.**

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

Absence Policy 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.

Lab Instructor	Day	Time
Tao Xiang	Tuesday	1:00 – 2:40 p.m.
Rakibur Rahman	Tuesday	3:00 – 4:40 p.m.
Ivane Jorjadze	Tuesday	5:00 – 6:40 p.m.
Ivane Jorjadze	Wednesday	9:00 – 10:40 a.m.
Rakibur Rahman	Wednesday	11:00 – 12:40 p.m.
Tao Xiang	Wednesday	1:00 – 2:40 p.m.

Readings and Homework

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 problems from the end of the covered chapters will be assigned and posted on the course's Blackboard website. Homework will not be collected nor graded. It will be assigned to help prepare you for the course examinations. Three lab sessions will be devoted to reviewing material for the examinations. You will have the opportunity to review the homework problems at those laboratory sessions.

Textbook's Website

You can use the online system for homework supplied by the publisher of the Bloomfield textbook by using the passcode that came bundled with books purchased at the NYU Bookstore. It is not required for you to have access to this website.

Problems from the text will be assigned for homework; assignments will be posted on Blackboard. You will also find the list of problems on the Wiley class website.

The Wiley class website address is http://edugen.wiley.com/edugen/class/cls32242/

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 1/9 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 7 or 8 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.

Missed Exams

There are no make-up exams for students who miss the first two examinations. If you miss one of the first two exams because of illness, you must contact Dr. Grier by phone or email **before** the start of the exam and follow up with a doctor's note, if the absence was due to illness. If you miss either of the first two exams, for a valid reason (illness, injury or family emergency), your grade will be based on the following allocations:

Exam:	20%
Laboratory:	25%
Final examination (cumulative):	55%

Final Exam A make-up for the final examination will be given under exceptional circumstances, which must be discussed with Dr. Grier before the examination. A doctor's note must be provided in the case of illness. In this case a grade of incomplete will be assigned and **the make-up will be scheduled for sometime in October 2008**. *Please avoid making travel plans before the date of the final exam. No alternative date for the final examination will be offered before the end of the Spring 2008 semester.*

Religious Holidays If you will be absent for a religious holiday during the semester, you must inform your lab instructor and Dr. Grier in advance.

Date	*Readings*	*Weekly Lab*
T Jan 22	1.1 Skating – Inertia, force, velocity, acceleration, mass, Newton's First and Second Laws of Motion.	No Lab
R Jan 24	1.2 Falling Balls – section entitled "Weight and Gravity"; 1.3 Ramps - net force, Newton's third law.	
T Jan 29	1.3 Ramps - energy, work, energy conservation, potential energy, ramps, mechanical advantage.	Math Review
R Jan 31	3.1 Spring Scales - equilibrium, stable equilibrium, Hooke's law, oscillation, calibration, center of gravity.	
T Feb 5	9.1 Clocks - time and space, natural resonance, harmonic oscillators, simple harmonic motion, frequency.	Kinematics
R Feb 7	9.2 Musical Instruments - sound, music, vibrations in strings, air, and surfaces, higher-order modes, harmonic and nonharmonic overtones, sympathetic vibration.	
T Feb 12	9.2 Musical Instruments - standing and traveling waves, transverse and longitudinal waves, velocity, frequency, and wavelength in mechanical waves, superposition, Doppler effect.	Newton's Second Law
R Feb 14	10.1 Static Electricity - electric charge, electrostatic forces, Coulomb's law, electrostatic potential energy.	
T Feb 19	10.1 Static Electricity - voltage, charging by contact, electric polarization, electrical conductors and insulators.	**Exam 1 Review**
R Feb 21	**Exam 1**	
T Feb 26	10.2 Xerography – electric fields	No lab
R Feb 28	10.3 Flashlights - electric circuits, electrical resistance, voltage rises, voltage drops.	
T Mar 4	11.1 Household Magnets - magnetic pole, magnetostatic forces, Coulomb's law for magnetism, magnetic fields, ferromagnetism, magnetic polarization, magnetic domains, magnetic materials.	Simple Harmonic Motion
R Mar 6	11.1 Household Magnets - magnetic flux lines, relationship between currents and magnetic fields.	
T Mar 11	11.2 Electric Power Distribution - superconductivity, direct and alternating currents, induction, transformers, magnetic field energy.	Speed of Sound
R Mar 13	11.2 Electric Power Distribution - relationship between changing magnetic fields and electric fields, induced emf, Lenz's law, electrical safety.	
T Mar 25	11.3 Electric Generators and Motors - electromagnetic forces, energy, and work, Lorenz force.	Ohm's Law
R Mar 27	11.3 Electric Generators and Motors - electromagnetic forces, energy, and work, Lorenz force.	
T Apr 1	12.1 Power Adapters - quantum physics, wave-particle duality, Pauli exclusion principle, band structure, Fermi level, metals, insulators.	**Exam 2 Review**
R Apr 3	**Exam 2**	
T Apr 8	12.1 Power Adapters - semiconductors, p-n junction, diodes, capacitors.	Capacitors
R Apr 10	12.2 Audio Players - analog vs. digital representations, resistors, MOSFETs, logic elements, series and parallel circuits, amplifiers.	
T Apr 15	12.2 Audio Players - analog vs. digital representations, resistors, MOSFETs, logic elements, series and parallel circuits, amplifiers.	Diodes and LED's
R Apr 17	13.1 Radio - electric field energy, relationship between changing electric fields and magnetic fields, tank circuits, speed of light, wave polarization, amplitude modulation, frequency modulation, bandwidth.	
T Apr 22	14.2 Discharge Lamps - color vision, primary colors of light and pigment, gas discharges, periodic chart, atomic structure and emission, radiative transitions, Planck's constant, fluorescence, radiation trapping.	Young's Experiment
R Apr 24	14.3 Lasers and LEDs - incoherent and coherent light, spontaneous and stimulated emission, population inversion, laser amplification and oscillation, diffraction, laser safety.	
T Apr 29	15.2 Optical Recording and Communication - diffraction limit, plane and circular polarization, total internal reflection.	**Final Exam Review**
R May 1	16. Nuclear Weapons or 16.2 Medical Imaging and Radiation	