

General Education Course Submission Form

Date of Submission: May 5, 2010

1. Check which area(s) this course applies to.

Inquiry – Arts & Creativity	<input type="checkbox"/>	Composition & Communications - II	<input type="checkbox"/>
Inquiry – Humanities	<input type="checkbox"/>	Quant Reasoning – Math	<input type="checkbox"/>
Inquiry – Nat/Math/Phys Sci	<input checked="" type="checkbox"/>	Quant Reasoning – Stat	<input type="checkbox"/>
Inquiry – Social Sciences	<input type="checkbox"/>	Citizenship – USA	<input type="checkbox"/>
Composition & Communications - I	<input type="checkbox"/>	Citizenship - Global	<input type="checkbox"/>

2. Provide Course and Department Information.

Department: Department of Physics and Astronomy

Course Prefix and Number: PHY120 Credit hours: 3

Course Title: PHY120—How Things Work

Expected Number of Students per Section: 30 Course Required for Majors in your Program? No

Prerequisite(s) for Course? None

This request is for (check one): A New Course An Existing Course

Departmental Contact Information

Name: Kwok-Wai Ng Email: kwng@uky.edu

Office Address: CP171 Phone: 257-1782

3. In addition to this form, the following must be submitted for consideration:

- A syllabus that conforms to the Senate Syllabi Guidelines, including listing of the Course Template Student Learning Outcomes.
- A narrative (2-3 pages max) that explains: 1) how the course will address the General Education and Course Template Learning outcomes; and 2) a description of the type(s) of course assignment(s) that could be used for Gen Ed assessment.
- If applicable, a major course change form for revision of an existing course, or a new course form for a new course.

4. Signatures

Department Chair:  Date: 5/13/10

Dean: Anna R. K. Bosch  Date: 8/5/10

College Deans: Submit all approved proposals electronically to:

Sharon Gill Sharon.Gill@uky.edu
Office of Undergraduate Education

PHY 120 “How Things Work”: Learning Outcomes

1. Describe methods of inquiry that lead to scientific knowledge and distinguish scientific fact from pseudoscience.

Experiences and observations from everyday life are explained and discussed in terms of fundamental facts of motion, sound and light and on logical reasoning from those facts. We “lift the lid” from sports, vehicle and projectile motion, music, noise, electromagnetic radiation, light, photography, and so forth to see “what’s going on” of a fundamental nature each one.

2. Explain fundamental principles in a branch of science.

The course begins with mechanical kinematics, dynamics and Newton’s laws of motion and their application on scales from atomic to galactic. We relate sound and music to concepts of oscillation, mechanical vibration and resonance. We show how electromagnetic radiation (radio, microwaves, light, x-rays, etc.) arises from common electric and magnetic effects. We learn how the makeup of stars can be determined without the slightest chance of every visiting them.

3. Apply fundamental principles to interpret and make predictions in a branch of science.

We define and discuss the basic properties of mass, velocity, energy, waves, electric charge and the atomic constitution of matter to understand the motion of satellites and planets, the experience of sound pitch and loudness, the perception of color, and the operation of common technological devices and appliances.

4. Demonstrate an understanding of at least one scientific discovery that changed the way scientists understand the world.

The question “Why is the sky blue?” is used as a vehicle for discussing light scattering from atoms and molecules, the frequency, wavelength and polarization of light and the role of earth’s atmosphere in shaping our environment. Newton’s laws of motion and gravity are invoked to understand why the moon doesn’t “fall down,” why the sun comes up each morning, and why a passenger seems to be thrown outward when his/her vehicle rounds a turn at speed.

5. Give examples of how science interacts with society.

Students in PHY 120 will be equipped to demand reasons and underlying principles in the face of controversy over e.g. the medical hazards of cell-phone usage, the fear that particle accelerators will create uncontrollable black holes, the needs and risks of a various energy sources, and the limits and challenges of technology.

6. Conduct a hands-on project using scientific methods to include design, data collection, analysis, summary of the results, conclusions, alternative approaches, and future studies.

Every student carries out an individual and unique project of measurement on an assigned topic

in sound or light, which involves developing and using suitable materials and simple devices, acquiring appropriate and verifiable numerical data in a non-laboratory setting, organizing the data into appropriate forms (tables, graphs, etc.), relating the measurement outcomes to a larger context based on the study of outside resources or reference to experts, and presenting the entire matter in a well-written final report subject to peer critique by fellow students. Project topics include, for example, the timbre of musical instruments, polarization of reflected light, anomalous color vision, the acoustics and vibrations of bells and other struck objects, and spectra of common light sources. It is not possible to pass PHY 120 without satisfactory completion of this measurement project.

7. Recognize when information is needed and demonstrate the ability to find, evaluate and use effectively sources of scientific information.

Students experience—often for the first time—a personal challenge to initiate and complete the unique and unstructured measurement project, which drives them onto their personal resourcefulness in seeking methodologies, asking for advice, organizing methods of observation and presenting a concise and interesting description of their efforts in the final Project Report.

University Senate Syllabi Guidelines

General Course Information

- | | |
|--|---|
| <input checked="" type="checkbox"/> Full and accurate title of the course. | <input checked="" type="checkbox"/> Course prefix, number and section number. |
| <input checked="" type="checkbox"/> Departmental and college prefix. | <input checked="" type="checkbox"/> Scheduled meeting day(s), time and place. |

Instructor Contact Information (if specific details are unknown, "TBA" is acceptable for one or more fields)

- Instructor name.
- Contact information for teaching/graduate assistant, etc.
- Preferred method for reaching instructor.
- Office phone number.
- Office address.
- UK email address.
- Times of regularly scheduled office hours and if prior appointment is required.

Course Description

- Reasonably detailed overview of the course.
- Student learning outcomes.
- Course goals/objectives.
- Required materials (textbook, lab materials, etc.).
- Outline of the content, which must conform to the Bulletin description.
- Summary description of the components that contribute to the determination of course grade.
- Tentative course schedule that clarifies topics, specifies assignment due dates, examination date(s).
- Final examination information: date, time, duration and location.
- For 100-, 200-, 300-, 400-, 400G- and 500-level courses, numerical grading scale and relationship to letter grades for *undergraduate* students.

N/A For 400G-, 500-, 600- and 700-level courses, numerical grading scale and relationship to letter grades for *graduate* students. (Graduate students cannot receive a "D" grade.)

- Relative value given to each activity in the calculation of course grades (Midterm=30%; Term Project=20%, etc.).
- Note that undergraduate students will be provided with a Midterm Evaluation (by the midterm date) of course performance based on criteria in syllabus.
- Policy on academic accommodations due to disability. Standard language is below:
 If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Course Policies

- | | |
|--|--|
| <input checked="" type="checkbox"/> Attendance. | <input checked="" type="checkbox"/> Academic integrity, cheating & plagiarism. |
| <input checked="" type="checkbox"/> Excused absences. | <input checked="" type="checkbox"/> Classroom behavior, decorum and civility. |
| <input checked="" type="checkbox"/> Make-up opportunities. | <input checked="" type="checkbox"/> Professional preparations. |
| <input checked="" type="checkbox"/> Verification of absences. | <input checked="" type="checkbox"/> Group work & student collaboration. |
| <input checked="" type="checkbox"/> Submission of assignments. | |

How Things Work
PHY 120 – Spring 2011
Dept. of Physics & Astronomy

COURSE SYLLABUS

Class Times: TR 1:00–2:15 p.m. **Credit hours:** 3.0
Location: Room 155 (Lecture Hall), Chemistry-Physics (CP) Building
Instructor: Prof. Keith B. MacAdam
Instructor's Office: CP 391, Tel. 257-3344
Office Hours (CP 391): MW 2:00-2:50 p.m (or by appointment)
Instructor's E-mail: macadam@email.uky.edu
Department Office: CP 177, Tel. 257-6722 (office staff)
Department Web Page: <http://www.pa.uky.edu>

Course Description: “How Things Work,” PHY 120 is an intensive one-semester introductory course in physics intended for students interested in physical science, such as non-science majors in A&S and other colleges, Elementary, Middle School and Secondary Science Education students and UK Honors-Program students. There are no prerequisites. It features a mixture of lectures, interactive demonstrations, discussion and peer evaluation. In the second half of the semester each student carries out an *individual guided project of investigation* on an assigned topic concerning sound or light, which includes experimental measurement (usually at home or outdoors) and analysis of acquired data, and presents the results in a written report. Selected projects may be highlighted by an oral presentation. Only “practical” mathematics is needed. Computer usage is required for homework assignments, report writing and communications, graphics, spreadsheet calculation and Web searching.

PHY 120 covers a range of topics selected from the following and arranged to reveal the underlying physics principles and methods:

- Motion on Earth and in space
- Energy production, transformation and use
- Sound, resonance and music
- The sea: Waves, wind, light and water
- Electromagnetic waves and communication
- Light, optics, photography and vision
- Time, clocks and lasers

Required Textbook: *How Things Work: The Physics of Everyday Life, 4th Ed.*, by Louis A. Bloomfield (John Wiley & Sons, New York, 2010), ISBN 978-0-470-22399-4 (paperback). We will also use other resources, including books recommended in class, library resources, and the Internet. The text author maintains a web site: <http://howeverythingworks.org/>. Another web site of interest is <http://science.howstuffworks.com/physical-science-channel.htm/>. A “universal resource” is <http://www.google.com/>. Students are not required to have their own computers, laptop or desktop (although it is certainly desirable) but easy access to a computer with E-mail, Internet and hard copy printing capabilities is needed for homework and other investigations. The PCs in campus computer labs are available. There is no class website for PHY 120, but the instructor will often send messages and class material to students by E-mail and will hold students responsible for checking their E-mail accounts frequently and ensuring that they are functioning properly. Students should be acquainted with downloading and opening PDF E-mail attachments and sending attachments in Word or PDF format.

Course Objectives: We live in a vast sea of natural physical happenings. Light, sound, motion, heat, space and time are taken for granted and are internalized when we are very young. Other things having a physical nature, such as music, electronics, space travel and photography, are things that we become acquainted with later. The objectives in this course are for its participants to learn the basic physics principles and phenomena and be able to recognize their appearance in

familiar settings, to learn how to investigate and evaluate objects and events from a scientific point of view, and to master the skills of explaining and discussing with others the physics of *how things work*. It is hoped that these skills of observation, questioning, analysis and explication will continue to serve throughout each person's continuing study and further life. The hoped-for outcomes of PHY 120 "How Things Work" are that students will:

- (a) know and be able to explain the basic underlying physics concepts for a number of everyday phenomena and devices,
- (b) be able to apply what they have learned and develop ideas about the underlying physics of something they have never investigated before, and
- (c) appreciate the importance of the scientific approach to investigating phenomena as well as the importance of physics in our everyday lives.

Class Meetings: Regular attendance and full participation in all scheduled classes are required. When material is assigned for reading and study-questions are provided, the material will be discussed in class, so it is necessary for students to prepare in advance. A system of "exit tickets" will be used to facilitate engagement and participation. Respectful and considerate classroom behavior, decorum and civility by all students are understood. UK policy on excused absences and makeup opportunities will be followed. Attendance in the final week of class, during oral presentations, is mandatory.

Homework and Exams: Assignments of written homework (HW) will be given, collected and graded for completeness and correctness. HW assignments are due in class at 1:00 p.m. on the days shown in the attached Class and Assignment Schedule. (If necessary, students may submit homework electronically, by e-mail attachment in Word or PDF format, adhering to the same deadline.) All HW assignments must be submitted as neatly formatted word-processor hard-copy printout (or electronic file), including name, date and HW#, without covers, stapled once in the upper left corner. Correct spelling, proper English grammar, and well-organized and effective written expression are expected in addition to scientific accuracy. Neatly drawn diagrams or mathematics may be inserted by hand if needed. All assignments are expected "on-time" and will be marked and returned promptly. There are two *hour exams* during scheduled class periods: Test 1 on Thursday, Feb. xx, and Test 2 on Thursday, Mar. xx. The Final Exam is on (*tba*) in the lecture hall CP-155.

Grading: Standards for grading (A, B, C, D, E or P/F) will adhere to those published in the *UK 2009-2010 Undergraduate Bulletin* <https://www.uky.edu/Registrar/bulletinCurrent/acreq.pdf>: "A" represents exceptionally high achievement as a result of aptitude, effort and intellectual initiative, and so forth. It is the instructor's responsibility—and professional obligation—to interpret these standards in the light of common expectations for university work at a nationally ranked public research university. Please note that although the College of Arts & Sciences has *no fixed grading scale* relating percentages to letter grades, the instructor guarantees that students who score 90% and above will receive A, 80% B, 70% C and 60% D. These grade thresholds may be lowered but will not be raised.

Grading Basis: Distribution of Points

Test 1, February (<i>tba</i>)	10 %
Test 2, March (<i>tba</i>)	10 %
Written homework (5 @ 2%)	10 %
Exit Tickets (Class Participation)	20 %
Project (progress/data/interim/peer)	20 %
Final Project Report	20 %
Final Exam, May (<i>tba</i>)	10 %
TOTAL	100 %

Plagiarism and Original Work: The best scholarly work makes use of every intellectual resource, including libraries and all that they contain, reliable information obtained on-line, material arrived at by discussion with instructors, other students and outside experts, and careful original investigation and analysis. There are pitfalls if you use only a narrow spectrum of resources, just as there are pitfalls if you invest your money in the stock market without diversifying. *Use a broad selection of resources.* What you claim to be your own work must be truly your own creation, and where you have used the ideas and materials of others you must give full and proper credit to their source. To copy (such as “cut and paste” from on-line Web pages or to copy verbatim from books or to duplicate another student’s work) and to represent implicitly or explicitly as your own work without attribution to its source is to commit the academic and intellectual offense of *plagiarism*, a form of cheating. The instructor of this course will be particularly vigilant concerning *plagiarism*. Students should be aware that penalties for *plagiarism* may include a grade of “E” in the course and that such a penalty in a student’s official university record can have a long-lasting effect on his or her reputation for trustworthiness and honor (for instance, if you choose to run for public office someday, become a school principal, or apply to medical or law school!). Students may work together, certainly, but the instructor will hold each student individually responsible for all parts of work submitted for credit as your own. Students should consult the *Student Rights and Responsibilities, Part II (Secs. 6.3-6.4)* available on line at <http://www.uky.edu/StudentAffairs/Code/> for explanation of all pertinent academic requirements and procedures.

Disability Policy: If you have a documented disability that requires academic accommodations, please see the instructor as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Course Evaluation will be conducted on-line during (*tba*) April: Go to <http://www.pa.uky.edu> and select Online Course Evaluation. A grade *bonus* of 2% will be given for completing the Online Course Evaluation.

Important Dates (Spring 2011):

xx-Feb: Test 1 in class
xx-Mar: Test 2 in class
xx to xx Mar: Spring Break
xx to xx Mar: Individual appointments to discuss project progress
x-Apr: Project Data Report due
xx-xx April: Online Course Evaluation (2% grade *bonus*)
xx-Apr: Interim Project Report (*two copies*) due for peer critique: **paper copy, in class!**
xx-Apr: Peer Critique (*two copies*) due: **paper copy, in class!**
xx-Apr: *All* final written Project Reports due.
xx and xx-Apr: Oral presentations of selected projects. *Attendance is mandatory.*

Class and Assignment Schedule (see attached *2010 dates for GenEd approval May 2010*)

Week#	Class#	Day	Date	Subject	Reading	Assignment	Comment
0							
1	1	R	14-Jan	Introduction			
1	2	T	19-Jan	Motion in 1D, forces, Newton's Laws	Ch.1 (all)	HW0 (Survey) due	
2	3	R	21-Jan	Motion in 1D, energy, work	"		
2	4	T	26-Jan	Motion: Rotation, torque, wheels	Sec.2.1, 2.2	HW1 due	
3	5	R	28-Jan	Springs, bouncing	Sec.3.1, 3.2		
3	6	T	2-Feb	Collisions	Sec.2.3, 3.2		
3	7	R	4-Feb	Motion: Circular, centripetal	Sec.3.3	HW2 due	
4	8	T	9-Feb	Gravity, orbital motion	Sec.4.2		
4	9	R	11-Feb	Test 1			
5	10	T	16-Feb	Oscillations, resonance	Sec.9.1		
5	11	R	18-Feb	Time, clocks, precision measurement	"		
6	12	T	23-Feb	Preliminary Project Work: Assignments, Web resources, graphing, project format		HW3 due	Project topics will be given out in class
7	13	R	25-Feb	Sound: Music, harmony, instruments	Sec.9.2		
7	14	T	2-Mar	Sound: Overtones, beating, interference	"		
7	15	R	4-Mar	Sound reproduction, acoustics	"		
8	16	T	9-Mar	Sounds in Nature, Noise and Hearing	"	HW4 due	8-Mar: Midterm grade submission
8	17	R	11-Mar	Test 2			
Spring Break, Mar. 15-20, 2010							
9	18	T	23-Mar	Waves: Water, wakes, tides, tsunami	Sec.9.3		22-26 Mar: Individual 20-min appts. will be scheduled to discuss progress on project assignments. 5% Grade.
9	19	R	25-Mar	EM waves, radio, microwaves, natural light	Sec.13.1, 13.2, 14.1		
10	20	T	30-Mar	Blackbody radiation, lamps	Sec.7.3	HW5 due	
11	21	R	1-Apr	Light: Reflection, refraction	Sec.14.1		
11	22	T	6-Apr	Spectra	Sec.14.2		
12	23	R	8-Apr	Color and vision	Sec.14.2	Project Data Report due: 5% Grade	
12	24	T	13-Apr	Optics and Photography: Cameras, exposure, light and shadow	Sec.15.1		Online Course Evaluation begins
13	25	R	15-Apr	Appearance of light on water and in the sky		Exchange Interim Project Report for peer critique: Two copies, 5% Grade	BE SURE TO BRING TWO PAPER COPIES OF IPR TO CLASS!
13	26	T	20-Apr	Lasers and LEDs	Sec.14.3		
14	27	R	22-Apr	Light from Space & Visit to the Observatory		Return Peer Critique: Two copies, 5% Grade	BE SURE TO BRING TWO PAPER COPIES OF PeerCrit TO CLASS!
14	28	T	27-Apr	Oral Presentations I		Final written Project Reports due, oral presentations	
14	29	R	29-Apr	Oral Presentations II		Oral presentations (continued)	
Final Exam: Friday, May 7, 2010, 8:00-10:00 am in CP-155							