Essentials of Physics PHYS 101
Spring, 2007

Instructor: **Dr. Dean Livelybrooks**
E-mail: dlivelyb@hendrix2; 346-5855
Office: 225 Willamette Hall
Office hours: U10:00, H14:00

TAs: Anthony Clark
E-mail: aclark@uoregon.edu
Office: 216 Willamette Hall
Office hours: TBA

PHYS 101 Web Page can be found at: http://hendrix2.uoregon.edu/~dlivelyb/phys101/home.html

COURSE OVERVIEW

Scientific endeavor comprises our efforts to understand how things work, and to develop a compact and universally portable set of rules that describe all observable processes. Some times these rules can be used to predict future events— when the next lunar eclipse is to occur, for example. These rules also guide our every day efforts to design our world— how to build a better bicycle that reduces air resistance on the rider. Occasionally we observe an unexpected event and are left scrambling to come up with an explanation… the microwave oven was invented when a scientist left his cold cup of coffee next to a klystron and found that it was warm after microwaves were generated.

Scientists attempt to improve our understanding of how things work by systematically *observing* and *identifying underlying processes*. This involves *determining important variables*, *working out relationships between them* by forming hypothetical relationships (rules) and testing them via experiment. For example, the relationship between an object's mass, its acceleration and the net force applied to it (the important variables) can be guessed at and then tested by applying known forces on objects with measured masses. Many guessed at relationships fail to pass experimental testing. Some times experimentation ends up *refining our understanding of these relationships* and leads to the development of a more comprehensive rule. Finally, *connecting these individual rules together* in a sensible way leads to a set of laws which appear to govern the workings of our complete environment.

The builders of Stonehedge incorporated an understanding of astronomical observations into the structure to keep track of seasons. It is speculated that Stonehedge had great religious significance to these people, but some of the scientific process was evidently incorporated into their religion. In general, science differs from religion in that all laws must be experimentally testable. In Essentials of Physics we will focus on understanding how things work from a conceptual point of view, but we will also spend a great deal of time observing, formulating hypotheses and testing them. Science is an on-going process that anyone can do! To do is to understand.

ESSENTIALS OF PHYSICS - PHYS 101: COURSE INFORMATION

Instructor: Dr. Dean Livelybrooks Office: 225 Willamette Phone: 346-5855
E-mail: dlivelyb_at_uoregon.edu
Office Hours: U14:00, W10:00

TAs:
Anthony Clark, 216 Will., 6-4770, aclark_at_uoregon
Xiaokun Shu, 355 Will., 6-5192, xshu@uoregon.edu

Meeting Times

- 2-hour Lecture is 4-5:50pm Wednesday in Rm. 110 Willamette.
- Labs meet for 2 hours each week in **Rm. 17 Willamette** on either:
  - Thursday from 12:00-1:50pm or
  - Monday from 4:00-5:50pm
- **Attending one of the weekly lab sections (each week) is required.**

Learning Objectives:

Develop conceptual understanding of certain physics principles including:

- how things move in a straight line—inertia, force, velocity, acceleration.
- how things move in circles—at the playground, in the solar system.
- energy, work & power— definitions, types of, conversion of, conservation of…
- electricity, simple electric circuits, magnetism, electricity interacting with magnetism.
- waves, sound and light.
- seasons, phases of the moon, eclipses— a model of the solar system.

Develop an understanding of science as a process involving observation, hypothesis construction, experimentation & hypothesis refinement.

Textbook

Conceptual Physics, 10th Edition (or 9th Edition) by Paul Hewitt, is required.

Web Page

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Class Work

Course work comprises:

1) completing and handing in lecture demonstration materials (see "**ILDs**," below).

2) completing **lab write-ups**, including completion of solar observations.

3) **homework problems**, turn in Exercises only on Fridays by 2 pm.

4) one **project, a report on "physics in the real world.",** For extra points:
   a) Develop of experiment derived from your "physics in the real world" report. Turn in an **outline** of your experiment.
   b) Complete your experiments and write a **short (experiment) report** on it.
   c) Present the experiment outline and results to the class **(presentation)**

Exams

Two exams will be given during the term. These will focus on testing your understanding of physics concepts. Total of exams counts for 30% of the course grade.

Final Exam

The final exam for this class will be given on Thursday, June 14th at 3:15 pm.

Grading Summary

Lecture Demos	10%	(credit given for thoughtfully completed ILD sheets)
Labs	30%	(lab attendance required)
Homework	15%	due on Fridays by 2pm.
Project	15%	15% for project. + 2% each for items a), b), & c) above.
Exams	30%	10% for each exam, including final.

Course Outline: Essentials of Physics- PHYS 101—Hewitt 10th

Meet	Date	Topics	Reading	Assignments
L1	April 2	Introductions. Course questionnaire. Inertia. Motion in a line: position, speed and velocity	Chpt. 2	(RQ *2:* 5,11,18,24)
L2/L3	Weds. April 4	More motion in a line: velocity and acceleration ***ILD***, (solar observation demonstration) Newton's Second Law of Motion. *force, mass and velocity; Newton's Laws*	Chpt. 3 (41-47)/ Chpt. 4 (58-65)	Begin solar observations. (RQ *3:* 3,4,9,13,21)/ RQ *4:* 5, 10, 12, 20, 23, 29
Lab 1	April 5 or 9	*Experimentation: observation, hypothesis, measurement, conclusion*	Lab 1 handout	
L4/L5	Weds. April 11	Vectors, "mg" gravity, work ***ILD*** Work, Energy and power *Energy and Work; Power; Potential and Kinetic Energy*	Chpt. 4 (65-end), Chpt 7 (110-111) / Chpt. 7	**Lab 1 due** (RQ *4:*10,12,20,23,24) / (RQ *7:* 4,6,10,17)
Lab 2	April 12 or 16	*Measuring velocity; acceleration & force; acceleration and mass.*	Lab 2 handout	(on Friday) **Ex: 2:4,12,27; 3:10,17,28,36**
L6/L7	Weds. April 18	Motion in a circle: rotational speed, *rotational inertia (**ILD**);* torque. More motion in a circle: torque, simple machines, centripetal force.	Chpt. 8 (131-150)	**Lab 2 due** (RQ *8:* 3,10,15) / (RQ *8:* 24,28)
Lab 3	April 19 or 23	*Work, Energy & Power*	Lab 3 handout	(on Friday) **Ex: 4:3,9,52,54; 7:13,19,36,44**
Exam/L 8	Weds. April 25	**Exam 1** physics in the real world demonstration.	Chpts. 2, 3, 4, 7, 8 / Real-world physics handout	**Lab 3 due**
Lab 4	April 26 or 30	*Rotational Motion— Playground Physics:*	Lab 4 handout	(on Friday) **Ex 8:3,4,12,26,34,37**
L9/L10	Weds. May 2	Exam results, gravity and satellite motion Static electricity	Chpt. 9 / Chpt. 22	**Lab 4 due** (RQ *9:* 3,10,13,14) / (RQ *22:* 2, 11,12,17,25,26,30)
Lab 5	May 3 or 7	*Movie physics*	Lab 5 handout	

L11 / L12	Weds. May 9	Electric current and circuits ***(ILD)*** Magnetism	Chpt. 23 / Chpt. 24	**Lab 5 due** , **Project due, 5pm** (RQ *23:* 3,11,23,27) / (RQ *24:* 11,17,26
Lab 6	May 10 or 14	*Solar observations/lunar model lab (bring your solar observations to lab!)*	Lab 6 handout	***(bring your observations to lab!)***
L13 / L14	Weds. May 16	Electromagnetic induction Waves & sound	Chpt. 25 / Chpts. 19 & 20	**Lab 6 due)** (RQ *25:* 2,5,20,21) / (RQ *19:* 8,9,18; 20:5, 15,17,20)
Lab 7	May 17 or 21	*Electric Circuits (circuits, batteries & bulbs, etc.)*	Lab 7 handout	(on Friday) **Ex: 22:3,14,20,35; 23:7,16,38,40**
Exam	Weds. May 23	Exam 2	Chpts. 9, 10 22-25 (not 19/20)	**Lab 7 due, Project experiment outline due, 5pm.**
Lab 8	May 24	*Magnets, generators and motors*	Lab 8 handout	(on Friday) **Ex: 24:7,15,26; 25:8,12,22**
No lab!	May 28	***Memorial Day, no lab, please attend May 24 lab***		**Lab 8 due** (on Tuesday, 29th)
L15 / L16	Weds. May 30	Waves & sound ***(ILD)***, Light Color	Chpt 26 / Chpt. 27	**Project experiment report due by 5pm.** (RQ *26:* 6,7,9,14) / (RQ *27:* 8, 11, 18, 19, 20)
Lab 9	May 31, June 4	*Waves & sound*	Lab 9 handout	
L17	Weds. June 6	Final Exam Review		**Lab 9 due**
Project reports	June 7	NO LAB— Project reports presented at this lab time		**Project presentations.**
	Thurs. June 14	**Thursday, Final Exam (3:15 pm in Rm. 15 Pacific)**		

Essentials of Physics— PHYS 101— Course Project Information

Fifteen percent of the course grade is devoted to a course project. It is in the form of a "physics in the real world report"

"Physics in the Real World" Report

Believe it or not, physics is happening around you all the time. When a basketball is dribbled, Hook's law describes how the deformation of the ball on the floor causes a force on the floor (by the ball), and Newton's third law ("for every action there is an equal an opposite reaction") says that there must be a force on the ball by the floor, which results in the ball bouncing back up to your hand. A bike rider turning a corner leans into the turn to counteract the torque on the bike and rider caused by the road pushing on the bike tires (which enables it to turn). The rider purposely creates a torque caused by gravity to counteract the frictional force of the road on the turning bike tires.

To complete your "Physics in the Real World" report, you should watch for every day examples of the physics concepts you learn in class. The report should be three pages long and include either a photograph or a diagram depicting the phenomenon. Either should be annotated so that important forces, velocities, torques, etc are noted (and labeled). The purpose of the report is both to demonstrate a real-world "application" of physics and your understanding of how the concept applies to the situation. Any relevant physics rule (stated as words or as a formula) should be included and interpreted in the context of the phenomenon under consideration. The course instructor will present his own "Physics in the Real World" report in class so that you understand what is expected.

For extra credit after completion of the "physics in the real world" report:

- Develop of experiment derived from your "physics in the real world" report. Turn in an **outline** of your experiment for approval and extra points.
- After approval of your outline, complete your experiments and write a **short (experiment) report** on it.
- Present the experiment (outline and results) to the class **(presentation)**

Extra credit will be awarded for each of these steps if properly completed. The first two of these extra-credit assignments are due Weds. by 5pm. Presentations will be made during regular lab times during week 10 of term.