Intermediate Physics Lab

Physics 357

Figure 1 Robert A. Millikan

Syllabus for Spring 2018

Class:

Tu and Th 8:30 – 11:20am in Bowers 139

Required Texts:

- Physics 357 Lab manual (experiments available for free on course website)
- *Foundations and Applications of Statistics*, Randall Pruim ISBN: 9780821852330.
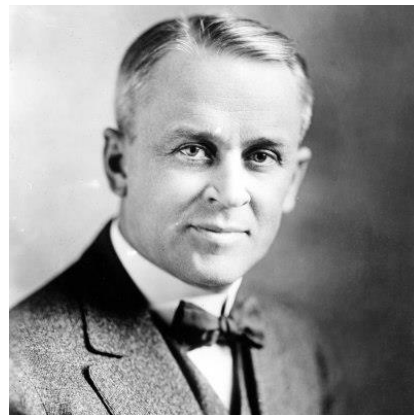
Course website:

http://facultyweb.cortland.edu/douglas.armstead/S18/Intermediate.html

Instructor:

Doug Armstead- Department of Physics
Bowers 127, phone (607) 753-2919
douglas.armstead@cortland.edu

Office Hours:

Tuesday and Thursday 2 – 3pm, Wednesday 9:30-10:30am, otherwise by appointment.

Attendance Policy:

Attendance in the laboratory is mandatory. Four or more unexcused classes (or two experiments) *will be grounds for failing the course.*

Complimentary Courses:

This laboratory complements Physics 203 and 410. Both are useful but neither is a requirement.

Grading:

Student Grades will be tallied as follows:

Introduction to error analysis and statistics	5 %
Wave motion lab	5 %
Papers from Seven Advanced Laboratories	60%
Two Lab notebook inspections	10%
Two Laboratories Re-writes	10%
Two In-class Presentations	10%

- For each advanced lab (labs after wave motion), each week you will either submit either
  - your lab notebook for inspection or
  - a paper written based on your time in the laboratory. It should pose and answer a question and that answer should be justified using statistics. You will need to be judicious in choosing your question and I strongly recommend that you consider what that question will be before you start your experiment, and that you double check that the question with me before you write your paper.
- You will submit your notebook/paper for the experiment(s) one week after finishing your experiment. All papers should be in both paper and electronic form (email me a pdf copy).
- The paper should stand on its own and be readable by any physics student at your level. A few important considerations include:
  - present the data with appropriate units and all applicable calculations
  - necessary graphs should follow the calculations and should be done in R, Excel or similar programs
  - graphical analysis should be used to do regression analysis of data and error analyses should be made for *every* calculated quantity, and
  - conclusions should be drawn and should be clearly supported by your experimental results.
- The best discussion of my expectations/rubric is available here: http://facultyweb.cortland.edu/douglas.armstead/S18/Intermediate/IntermPaperExpectations.pdf
- You must revise your work based on feedback at least twice during the semester. This can take one of two forms:
  1. On two separate papers, rewrite new drafts of each paper based on the feedback given and turn each new draft in for a grade (along with the old).
  2. On one paper go through two feedback iterations.

  In either case what is important is that you show significant improvement from one graded draft to the next (turn in both the original copy with comments and your revision).

The presentations will be ten minutes long. We will follow standard conference formality. Dress semi-casual or formal (no shorts, flipflops or the like) and address your audience as if you have never met them before in your life and they have no idea what you did. You may choose your favorite medium (blackboard, PowerPoint slides, pdf's made out of your written lab reports' files etc. Each choice has its pros and cons – talk to me if you are unsure). You will be graded based on many factors, including but not restricted to: the clarity of your discussion, the accuracy of your work, your ability to engage your audience etc.

The Schedule:

(Please arrive prepared and read ahead. You are encouraged to use your laptop in class)

There are four blocks in this course:

1. The introduction to data analysis and running independent experiments (white)
2. A suite of experiments concerning light (green)
3. A suite of experiments concerning thermodynamics (pink)
4. A suite of experiment concerning modern physics (blue)

Date	*Group Meter*	*Group Kilogram*	*Group Second*	*Group Ampere*
Jan. 23, 25	Data Distributions and Goodness of Fit	Data Distributions and Goodness of Fit	Data Distributions and Goodness of Fit	Data Distributions and Goodness of Fit
Jan. 30, Feb 1	Method of Least Squares	Method of Least Squares	Method of Least Squares	Method of Least Squares
Feb. 6, 8	Wave motion	Wave motion	Wave motion	Wave motion
Feb. 13, 15	Speed of light (path-length method 1st)	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	Speed of light (circuit method 1st)
Feb. 20, 22	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	Speed of light	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)
Feb. 27, Mar. 1	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	Speed of light	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)	One of three (Light and the Laser, Properties of Lenses, Microwave Optics)
Mar. 6	*Complete Inquiry Based Extension for Previous Weeks Lab*			
Mar. 8	*1st Re-write Due./ Prep for In-Class Presentations*			
Mar. 13, 15	*Spring Break - No class*			
Mar. 20, 22	*In-Class Presentations of chosen Lab*			

Mar. 27, 29	Three Thermodynamics Experiments	Three Thermodynamics Experiments	Three Thermodynamics Experiments	Three Thermodynamics Experiments
Apr. 3, 5	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)
Apr. 10, 12	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)	One of four (Viscosity, Sterling Engine, Peltier, Meteor Crater)
Apr. 17, 19	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)
Apr. 24, 26	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)
May 1, 3	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)	One of four (Frank Hertz, Millikan Oil, e/m ratio, x-rays)
May 3	*2nd Re-write due.*			
May 8 8:30-10:30am	*In-Class Presentations of chosen Lab*			