Course Description and Tentative Syllabus

Lecture: Mon. 11:00 AM – 12:15 PM Room 121 Meyer Hall
Prof. Allen Mincer
708 Meyer Hall
212-998-7707
allen.mincer@nyu.edu
Office Hours: By appointment

Laboratory Sections, Room 222 Meyer Hall:

<table>
<thead>
<tr>
<th>Section</th>
<th>Instructor</th>
<th>Email</th>
<th>Meyer Hall Office</th>
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<tbody>
<tr>
<td>2 Mon.</td>
<td>12:30 PM – 3:30 PM</td>
<td>Ali Mohsen</td>
<td><a href="mailto:ahm302@nyu.edu">ahm302@nyu.edu</a></td>
</tr>
<tr>
<td>3 Tue.</td>
<td>2:00 PM – 5:00 PM</td>
<td>Zhongxu Zhai</td>
<td><a href="mailto:zz681@nyu.edu">zz681@nyu.edu</a></td>
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<td>4 Wed.</td>
<td>9:00 AM – 12:00 Noon</td>
<td>Ali Mohsen</td>
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<tr>
<td>5 Tue.</td>
<td>9:15 AM – 12:15 PM</td>
<td>Zhongxu Zhai</td>
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Office Hours: To Be Determined.

BASIC IDEA OF THE COURSE:

Progress in science is made possible by comparison of the measured behavior of our world (experiment) with expectations from understanding of it (theory). Critical to this process is the understanding of how to make measurements and of the properties of data that determine what conclusions can be reached. This course is the first of a two-semester introduction to experimental physics. It will cover some basic measurement techniques, quantification of uncertainty, statistical analysis of data, and some computer programming using the Python language.

Required Materials:

- Laboratory Notebook, National Brands. This notebook has a carbon copy of each page, so do not use a different notebook without this feature.
- Introduction to Python for Science, D. Pine, can be found at http://physics.nyu.edu/~physlab/Lab_Main/PythonMan.pdf
- The instructions for reach of the laboratory experiments can be found at: http://physics.nyu.edu/~physlab/GenPhysI_PhysII/phys1.html
Course Components:

The lecture will focus primarily on experimental uncertainty and statistical analysis of data. Not everything covered in lecture appears in you textbook, so if you miss a class make sure to obtain notes from a classmate.

Laboratory will introduce experimental techniques and also provide the opportunity to apply the ideas covered in lecture. As computers allow use of techniques that would otherwise be difficult or impossible, some programming will also be introduced during the laboratory. The first 3 weeks of laboratory are a programming “boot camp” designed to provide you with some basic tools you will need throughout the semester. Starting in week 4, you will use these tools, and new ones that you will continue to learn, to aid in analyzing results from experiments.

After the first 3 weeks, each laboratory will start with a brief quiz about the experiment(s) you will be conducting that day. Quizzes will not stress details; they are designed to check that you have read the laboratory procedures ahead of time.

At the end of each lab, hand in to your instructor the carbon copy of your lab notebook pages. Lab reports are due the week following the one in which the lab was conducted. Your laboratory instructor will explain the format to be used for handing in laboratory reports and working programs.

COURSE GRADING:

• Laboratory:
  o Laboratory reports 55%
  o Laboratory notebook 5%
  o Laboratory quizzes 5%
  o There are no makeup labs. To make allowance for possible illness or family emergencies, the lowest lab score of the semester will be dropped.
  o If you know ahead of time that you must miss a lab, notify the course professor and your laboratory instructor a week in advance in order to arrange to do the lab in another section that same week.

• Exams:
  o Final exam 35%
COURSE SCHEDULE

*********************************** WEEK 1:  Sep. 2  ***********************************
Classes begin Sep. 2. NO LECTURE OR LAB THIS WEEK
Homework due Week 2:
  •  Read Pine Ch. 1 - 2
  •  Try installing Python on your portable computer following Pine Appendix A

*********************************** WEEK 2:  Sep. 7 – Sep. 9  ***********************************
Sep. 7 is Labor Day, so there is no lecture this week.
Laboratory:
  •  Keeping a laboratory notebook, writing a laboratory report, scientific integrity.
  •  Install Python following Pine Appendix A
  •  Launch Python using Pine Ch. 2, and go through this chapter.
  •  Do the exercises at the end of Pine chapter 2.
  •  As you learn new useful things, enter them into your lab notebook for future reference.
  •  Lab Report due Week 3:
    o  Complete any exercises not finished in lab.
    o  Submit the working programs.
  •  No Monday section lab.
Reading for Week 3:
  •  Pine Ch. 3

*********************************** WEEK 3:  Sep. 14 – Sep. 16  ***********************************
We will not have lecture on Sep. 14, so there is no lecture this week.
Laboratory:
  •  Go through Pine Ch. 3
  •  Do the exercises at the end of Pine Ch. 3
  •  Lab Report due Week 4:
    o  Complete any exercises not finished in lab.
    o  Submit the working programs.
  •  Monday section does previous week’s lab: Install Python, Pine Ch. 2
Reading for Week 4:
  •  Pine Ch. 4
  •  Taylor Ch. 1

*********************************** WEEK 4:  Sep. 21 – Sep. 23  ***********************************
  •  Reading covered: Taylor Ch. 1
Laboratory:
  •  Go through Pine Ch. 4
  •  Do the exercises at the end of Pine Ch. 4
  •  Lab Report due Week 5:
    o  Complete any exercises not finished in lab.
    o  Submit the working programs.
  •  Monday section does previous week’s lab: Pine Ch. 3
Homework due Week 5:
  •  Read Taylor Ch. 2
  •  Bring a can of soda or another beverage to the week 5 lab
Lecture: Experimental uncertainty, significant figures, discrepancy, provisional uncertainty rules for sums and differences,
  - Reading covered: Taylor Ch.2 pp. 13 – 24
Laboratory: Measurements and Uncertainties
  - Lab Report due Week 6:
  - Monday section does previous week’s lab: Pine Ch. 4
Reading for Week 6:
  - Taylor Ch.3 up to p. 57
  - Pine Ch. 5

Lecture: Other provisional uncertainty rules, propagation of uncertainties.
  - Reading covered: Taylor Ch. 2 pp. 28-35; Ch.3 pp. 45-57
Laboratory:
  - Go through Pine Ch. 5
  - Do the exercises at the end of Pine Ch. 5
  - Lab Report due Week 7:
    - Complete any exercises not finished in lab.
    - Submit the working programs.
  - Monday section does previous week’s lab: Measurements and Uncertainties
Reading for Week 7:
  - Taylor Ch. 2 pp. 24 – 28, Ch. 3 pp. 48 - 49
  - Pine Ch. 6

Lecture: Checking relationships with a graph, counting experiments, numerical differentiation and integration.
  - Reading covered: Taylor Ch. 2 pp. 24 – 28, Ch. 3 pp.48 - 49
Laboratory:
  - Go through Pine Ch. 6
  - Do the exercises at the end of Pine Ch. 6
  - Lab report due Week 8
    - Complete any exercises not finished in lab.
    - Submit the working programs.
  - The only class doing this lab this week is the Wednesday section
  - Lab section usually scheduled for Monday meets on Tuesday because Tuesday Oct. 13 has Monday schedule. This section does the previous week’s lab, Pine Ch. 5
  - No lab for class usually scheduled Tuesday because Tuesday Oct. 13 has Monday schedule
No reading for Week 8.

Lecture: Discrete probabilities and continuous probability distributions
Laboratory: Motion 1 and 2.
  - Starting this week, all sections do the same lab
  - Lab report due Week 9
Reading for week 9:
  - Taylor Ch.3 pp. 57-79
*************** WEEK 9: Oct. 26 – Oct. 28 ***************
Lecture: Addition in quadrature, the general propagation of uncorrelated uncertainties
  • Reading covered: Reading covered: Taylor Ch.3 pp. 57-79
Laboratory: Equilibrium of a particle
  • Lab report due Week 10
Reading for week 10:
  • Taylor Ch. 4

*************** WEEK 10: Nov. 2 – Nov. 4 ***************
Lecture: Statistical analysis of random uncertainties, systematic uncertainties.
  • Reading covered: Taylor Ch. 4
Laboratory: Conservation of Energy
  • Lab report due Week 11
Reading for week 11:
  • Taylor Ch. 5 pp. 121-137

*************** WEEK 11: Nov. 9 – Nov. 11 ***************
Lecture: Gaussian (or Normal) distribution
  • Reading covered: Taylor Ch. 5 pp. 121 - 137
Laboratory: Collisions in one dimension
  • Lab report due Week 12:
Reading for week 12:
  • Taylor Ch. 5 pp. 137 – 153

*************** WEEK 12: Nov. 16 – Nov. 18 ***************
Lecture: Estimating parameters of and using the Gaussian distribution
  • Reading covered: Taylor Ch. 5 pp. 137 - 153
Laboratory: Ballistic pendulum
  • Lab report due Week 13
Reading for week 13:
  • Taylor Ch. 8 pp. 181 – 192
  • Pine Ch. 7
  • Monday, Tuesday also read Pine Ch. 6

*************** WEEK 13: Nov. 23- Nov. 25 ***************
Thanksgiving week
Lecture: Least-squares fitting linear dependence
  • Reading covered: Taylor Ch. 8 pp. 181 - 192
Laboratory:
  • Go through Pine Ch. 6
  • Do the exercises at the end of Pine Ch. 6
  • Lab report due Week 14
    o Complete any exercises not finished in lab.
    o Submit the working programs.
  • No lab for Wednesday class.
Reading for week 14:
  • Taylor Ch. 8 pp. 193 – 199
  • Pine Ch. 8 pp. 141 – 146
WEEK 14: Nov. 30 – Dec. 2

Lecture: Least-squares fitting non-linear dependence
- Reading covered: Taylor Ch. 8 pp. 193 – 199 Pine Ch. 8 pp. 141 – 146

Laboratory: Work-Energy
- Lab report due Week 15

Reading for Week 15:
- Taylor Ch. 12

WEEK 15: Dec. 7 – Dec. 9

Lecture: Chi-squared
- Reading covered: Taylor Ch. 12 pp. 261 - 274

Laboratory: Review for Final

WEEK 16: Dec. 14 – Dec. 15

Dec. 15 is the last day of classes
No Lab this week.
The Final Exam will be given during the lecture period on Monday Dec. 14.