Spring 2020

PHYS 114-002: Introduction to Data Reduction with Applications

Dale Gary

Course Syllabus

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Physics 114 (https://catalog.njit.edu/search/?P=PHYS%20114) Introduction to Data Reduction with Applications

Spring 2020

Location/Time: 111 Tiernan Hall -- 8:30-9:50 am Tuesdays and Thursdays

Topics :

An introduction to both the theory and application of error analysis and data reduction methodology. Topics include the binomial distribution and its simplification to Gaussian and Poisson probability distribution functions, estimation of moments, and propagation of uncertainty. Forward modeling, including least-squares fitting of linear and polynomial functions, is discussed. The course enables students to apply the concepts of data reduction and error analysis using data analysis software applied to real data sets found in the physical sciences.

Objectives:

By the end of the course, students should

1. Be able to address the pros and cons of various methods of measurement
2. Be conversant with the data reduction and error analysis concepts mentioned above,
3. Be able to analyze 1D and 2D data sets to find computational estimates of PDFs, moments, and to address the appropriateness of various forward models,
4. Be familiar with various measurement techniques so as to best experimentally determine PDFs, moments, and the appropriateness of various forward models,
5. Be able to devise an experiment capable of making a measurement to a pre-determined level of precision,
6. Be able to create figures that are journal-quality,
7. Be extremely familiar with the Python software and related packages so as to utilize it in subsequent classes and research endeavors.

Instructor:

Dale E. Gary, Ph.D.
Email: dgary@njit.edu, Office: 101 TIER, Phone: 7878
Office Hours: MW 1:00-2:00 pm

Co-requisite: MATH 111 or MATH 132

Course Materials:

Bevington, P.R. and D. K. Robinson, ***Data reduction and error analysis for the physical sciences, 3rd ed.*** (https://www.amazon.com/Reduction-Error-Analysis-Physical-Sciences/dp/0072472278), McGraw-Hill, Boston, 2003.

ISBN-13: 978-0072472271
ISBN-10: 0072472278

Anaconda Python 3 (https://www.anaconda.com/distribution/) (Jupyter notebooks)

Syllabus (https://web.njit.edu/~gary/114/assets/PHYS114_SPR10_Syl.pdf) PDF

Course Requirements and Grading Policy :

Homework: 30%

Homework is given every week and is considered an important part of the class. The homework usually consists of reading the text, short answer questions, and numerous mathematical calculations. An assignment is given on the first lecture of the week [when theoretical material is covered] and will require measurements to be performed during that week either at the second lecture or outside of class. Students *are encouraged to work together* on the homework problems, though each student is responsible for handing in an *individual* homework set.

3 Exams (2 during the semester, worth 15% each, and 1 final, worth 30%): 60%

The purpose of the exams is to test the *individual* student's progress in the class. Exams are closed book/notes. Exams will be announced ahead of time.

In-class quizzes and class participation 10%

There will be short, in-class quizzes at random times roughly every 2-3 weeks. In addition, attendance at lecture is expected and will be rewarded.

Grade Distribution: For each exam, and for the total of your homework grade, the grade distribution will be determined according to the gaussian (normal) distribution. This is called grading on a curve. It will also be determined on an absolute scale, as shown in the last column of the table below. We will discuss as a class which grading scheme is fairest, and why. If your final grade according to the Statistical Placement is worse than in the Absolute placement, then the latter will be used.

Letter Grade	Statistical Placement	Absolute alternative placement
A	$\text{score} > 2\sigma$(above mean)	score > 85%
B+	$1.5\sigma < \text{score} < 2\sigma$ (above mean)	80% < score < 84%
B	$1\sigma < \text{score} < 1.5\sigma$ (above mean)	70% < score < 79%
C+	$0.5\sigma < \text{score} < 1\sigma$ (above mean)	65% < score < 69%
C	within $-1\sigma < \text{score} < 0.5\sigma$ of mean	55% < score < 64%
D	$-2\sigma < \text{score} < -1\sigma$ (below	50% < score < 54%

	mean)	
F	$-2\sigma <$ score (below mean)	< 50%

THE NJIT INTEGRITY CODE WILL BE STRICTLY ENFORCED AND ANY VIOLATIONS WILL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE DEAN OF STUDENTS.

Course Summary:

Date	Details	
Thu Jan 23, 2020	Lecture 1 Reading and Resources (https://njit.instructure.com/courses/10578/assignments/33005)	due by 8:30am
Tue Jan 28, 2020	Lecture 2 Reading and Resources (https://njit.instructure.com/courses/10578/assignments/34873)	due by 8:30am
	Lect. 2b in-class assignment (https://njit.instructure.com/courses/10578/assignments/36569)	due by 11:59pm
Thu Jan 30, 2020	Week 1 Homework (https://njit.instructure.com/courses/10578/assignments/34819)	due by 8:30am
	Lect. 3 in-class assignment (https://njit.instructure.com/courses/10578/assignments/36966)	due by 11:59pm
Tue Feb 4, 2020	Lecture 3 Reading and Resources (https://njit.instructure.com/courses/10578/assignments/36903)	due by 8:30am
Thu Feb 6, 2020	Week 2 Homework (https://njit.instructure.com/courses/10578/assignments/36901)	due by 8:30am
Thu Feb 13, 2020	Lecture 5 Reading and Resources (https://njit.instructure.com/courses/10578/assignments/38477)	due by 8:30am
	Week 3 Homework (https://njit.instructure.com/courses/10578/assignments/37865)	due by 8:30am
	Roll Call Attendance (https://njit.instructure.com/courses/10578/assignments/34817)	