# Ae/APh 104a: Experimental Methods

**Course Syllabus – Fall 2019**

GALCIT, California Institute of Technology

## Course Instructor

Prof. Beverley McKeon  
mckeon@caltech.edu

## TA

Yuting Huang  
yhuang1@caltech.edu

## Course Description

**Monday/Wednesday/Friday 11.00-11.55am, 384 Firestone**

Lectures on experiment design and implementation. Measurement methods, transducer fundamentals, instrumentation, signal processing, noise theory, analog and digital electronic fundamentals, data acquisition and processing systems. *Pre-requisites: ACM 104 and ACM 95/100 ab or equivalent (may be taken concurrently) and Ae/APh/CE/ME 101 abc or equivalent (may be taken concurrently) or Ae/AM/CE/ME 102 abc or equivalent (may be taken concurrently). 9 units (3-0-6)*

## Course Outline

1. Introduction to Scientific Experiments
2. Basic Concepts of Measurement Systems
3. Response of Linear Systems
4. Measurement Accuracy
5. Electronics for Data Acquisition and Conditioning
6. Statistical and Spectral Analysis
7. Sampling Theory and Digital Techniques
8. Modern Measurement Techniques and Transducers

## Learning Outcomes

By the end of this course, students will be able to:

- Understand and implement design strategies for a successful experiment
- Identify and quantify sources of error in experimental measurements
- Acquire, classify and analyze experimental data

## Associated Texts (On reserve at Sherman Fairchild Library)

- **J. P. Holman** “Experimental methods for engineers”
- **J.S. Bendat & A.G. Piersol** “Random data: analysis & measurement procedures”

Texts for additional reading listed on Course References Sheet

## Course Website and Learning Management System

**Overview**  
[http://mckeon.caltech.edu/teaching/104/index.html](http://mckeon.caltech.edu/teaching/104/index.html)

**Piazza**  

Sign-up for a Piazza account at [https://piazza.com/caltech/fall2019/aeaph104a](https://piazza.com/caltech/fall2019/aeaph104a)

## Attendance and Participation

*All students are expected to attend lectures and participate in class discussions.*
Assessment Rubric  

**Homework 50%, Midterm 15%, Final 35%**

Students will be assessed on a combination of weekly problem sets, a mid-term and a final exam. The mid-term will be closed notes and books, and the final exam will be open notes and closed books (full rules for the exams will be circulated in advance). Homework will be assigned in class and due in class the following week, unless otherwise stated. The TA will grade the homework and return it by the following week. Homework submitted late will not be accepted unless you have emailed Dr. McKeon to request an extension in advance of the due date.

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<tr>
<th>Assessment</th>
<th>Issue Date</th>
<th>Due Date</th>
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<tr>
<td>Homework 1</td>
<td>7-Oct</td>
<td>14-Oct</td>
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<td>Homework 2</td>
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<td>21-Oct</td>
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<td>Homework 3</td>
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<td>28-Oct</td>
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<tr>
<td>Mid-term</td>
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<td>Homework 4</td>
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<td>Homework 5</td>
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<td>Homework 6</td>
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<td>Homework 7</td>
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<td>Final exam</td>
<td>11-Dec</td>
<td>13-Dec, by 5pm</td>
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Honor Code

"No member of the Caltech community shall take unfair advantage of any other member of the Caltech community."

Collaboration Policy

Collaboration on assignments other than the paper (Homework 4) is encouraged. You may consult outside reference materials, other students, the TA, or the instructor, but you cannot consult homework solutions from prior years and you must cite any use of material from outside references. In the latter case, be sure to write a full solution and list of assumptions. You will receive a suitable fraction of the full marks for this effort. All solutions that are handed in should be written up individually and should reflect your own understanding of the subject matter at the time of writing. MATLAB scripts and plots are considered part of your write-up and should be done individually (you can share ideas, but not code).

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with Caltech Accessibility Services for Students (CASS). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact CASS as soon as possible, since timely notice is needed to coordinate accommodations. [http://cass.caltech.edu/](http://cass.caltech.edu/). Undergraduate students should contact Dr. Lesley Nye, Associate Dean of Undergraduate Students (administrative contact: Beth Larranaga) and graduate students should contact Dr. Kate McAnulty, Associate Dean of Graduate Studies (administrative contact: Angelica Medina-Cuevas).