SYLLABUS

DESCRIPTION

This course will give you "hands-on" experience with building systems and expose you to the fundamentals of measurements, instrumentation, data acquisiton, and data analysis. Our measurements and experiments will allow evaluation of building construction material, electrical equipment, lighting systems, heating and cooling systems, and solar energy devices, among others. Through these systems, the basic principles of electrical circuits, radiation exchange, thermodynamics, fluid dynamics, and heat transfer will be demonstrated and analyzed. You are also likely to further develop your ability to recognize and rationalize the differences between academic theory and the real world.

LECTURES   3:30 – 4:20 Tuesday, Thursday
                      Room ECCR 150

LABORATORY   4:30 – 6:30 Thursday   *(Preliminary)*

INSTRUCTOR   Michael J. Brandemuehl
                       ECCE 246A, 303.492.8594
                       michael.brandemuehl@colorado.edu

                       Office Hours: 11:00 – 12:30 Tuesday   *(Preliminary)*
                                         1:30 – 3:00 Wednesday

TEXT   J. P. Holman: *Experimental Methods for Engineers (7th ed.)*, McGraw-Hill, 2001

WEB PAGE   http://ceae.colorado.edu/classes/aren3130/

EVALUATION   Lab Reports and Homework   40%
                        My Call   10%
                        Hour Exams   30%
                        Final Project   20%   Saturday, May 6, 7:30 – 10:00 am

GENERAL INFORMATION

1. All exams will be open book and closed notes. Official class handouts will be allowed.
2. The university will make reasonable accommodations for persons with documented disabilities, including physical, psychiatric, and learning disabilities. Students with disabilities who qualify for academic accommodations must provide a letter from Disability Services (DS) and discuss specific needs with the instructor during the first two weeks of class. DS determines accommodations based on documented disabilities (303-492-8671, Willard 322, http://www.colorado.edu/sacs/disabilityservices/)
3. Any incident of academic dishonesty will lead to automatic failure of the course. A written report will be submitted to the Academic Discipline Committee of the College and a copy placed in the student's permanent file. Academic dishonesty includes both claiming another persons work as your own and allowing another to claim your work as their own.
4. The university will make reasonable and appropriate accommodations for students who have conflicts between religious observance dates and course examinations or assignments. A recently revised, somewhat more flexible, campus policy has been drafted and approved. The campus policy can be viewed at http://www.colorado.edu/policies/index.html.

OBJECTIVES

The overall objective of this course is to introduce students to experimental methods for analyzing building systems. In the process, students will develop an improved understanding of mechanical, electrical, and lighting fundamentals through the real-world operation of building systems.

Upon successful completion of the course, students will have:

1. The ability to measure basic energy-related quantities in buildings. Measurements include temperature, pressure, humidity, flow, power, illuminance, and luminance.
2. The ability to identify and apply common instrumentation and data acquisition systems. The instrumentation will focus on electronic devices that can be integrated with automatic recording and monitoring equipment.
3. The ability to analyze measured data using statistical methods and regression techniques. Data analysis will focus on evaluation of uncertainty and regression methods to develop generalized models.
4. The ability to evaluate the performance of building systems using measured data.
5. The ability to design and conduct an experiment to characterize building system performance.

SCOPE

There are three main elements of the course: engineering measurements, data analysis, and the behavior of building systems. These three elements will be addressed through a series of lectures, homework, and experiments. Engineering measurements include temperature, humidity, pressure, solar radiation, illuminance, luminance,, fluid flow, heat flux, and electrical power. Data analysis techniques will include uncertainty analysis, regression, filtering, and data presentation. The measurements and analysis elements of the course will be delivered through experiments both on building system and with human perception of environmental conditions.

Experiments and measurements will be performed in a variety of contexts, including the Larson Building Systems Laboratory, the Integrated Teaching and Learning Laboratory, the CU Solar Decathlon house, and in real building environments. In general, we will work towards the types of experiments that might be performed on existing buildings to characterize their performance. Traditional laboratory "bench-top" experiments will only be used to learn about instrumentation and develop measurement and analysis techniques.

EVALUATION

Your understanding of the course material and your ability to apply the material to engineering problems will be evaluated through homework assignments, laboratory reports and examinations. Homework will focus on system performance and data analysis techniques, while laboratory reports will involve application of engineering methods to experiments. In addition, a portion will be based on individual participation.

COURSE OUTLINE

The first half of the course will focus more on measurement methods and techniques. The second half will focus more on building system performance.

UNDER DEVELOPMENT

1. Labs will be performed in teams. However, each student must submit an individual report for each lab using the data obtained by the team.
2. All students are required to maintain a laboratory notebook for planning experiments, recording data, making notes about unusual circumstances and observations, and sketching trends in results. The notebooks may be collected at anytime during the semester.
3. Lab reports will be due at the _beginning_ of first lab time following the reported lab session (typically one week later). They are to be typewritten and of professional quality.
4. Students will select and design a laboratory or field experiment. The project topics are somewhat open-ended and options will be discussed early in the semester.
5. Late homework will not be accepted.
6. Late reports are very much discouraged and will be appropriately penalized. Reports submitted within 96 hours of schedule will be penalized 25 points (out of 100 maximum). Reports submitted after 96 hours but within one week of schedule will be

penalized 35 points. Later reports will not be accepted and the report grade will be 0. Absolutely no late reports will be accepted after May 5.

ACCREDITATION THROUGH ABET

The Accreditation Board for Engineering and Technology (ABET) is a professional accrediting organization that accredits specific academic programs to assure quality in education. Accreditation is a voluntary, non-governmental process of peer review. It requires an educational program to meet certain, defined standards or criteria. More information can be found on the ABET website at http://www.abet.org.

ABET A-K OUTCOMES

As part of the accreditation process, ABET sets general criteria for students, faculty, facilities, educational objectives, and institutional support, as well as program criteria for specific engineering disciplines. One major criterion is a set of desired program outcomes, the so-called "a-k" outcomes. These are listed in their entirety below.

Engineering programs must demonstrate that their graduates have:

a) an ability to apply knowledge of mathematics, science, and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs
d) an ability to function on multi-disciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

MAPPING OF COURSE OBJECTIVES TO ABET A-K OUTCOMES

Course Objective	Outcomes
The ability to measure basic energy-related quantities in buildings.	b, e, k
The ability to identify and apply common instrumentation and data acquisition systems.	b, k
The ability to analyze measured data using statistical methods and regression techniques.	a, b, e, g, k
The ability to evaluate the performance of building energy systems using measured data.	a, d, e, g, h, j
The ability to design and conduct an experiment to characterize energy performance in buildings	b, d, e, g, i