University Of California, Berkeley
Department of Mechanical Engineering

ME 102A: Introduction to Measurements (4 units)

Undergraduate Required/Undergraduate Elective/Graduate Course

Syllabus

CATALOG DESCRIPTION

The objectives of this course are to introduce students to modern experimental techniques for mechanical engineering, and to improve students' written and oral communication skills. Students will be provide exposure to, and experience with, a variety of sensors used in mechatronic systems including sensors to measure temperature, displacement, velocity, acceleration and strain. The role of error and uncertainty in measurements and analysis will be examined. Students will also be provided exposure to, and experience with, using commercial software for data acquisition and analysis. The role and limitations of spectral analysis of digital data will be discussed. Working as part of an effective team will be emphasized in all aspects of the laboratory exercises, including set-up, data collection, analysis and report writing.

COURSE PREREQUISITES

Engineering 10 and 28, English R1A or equivalent course, Mechanical Engineering C85 and Electrical Engineering 40 or 100.

COURSE OBJECTIVES

Introduce students to modern experimental techniques for mechanical engineering; provide exposure to and experience with a variety of sensors used in mechatronic systems, including sensors to measure temperature, displacement, velocity, acceleration and strain; examine the role of error and uncertainty in measurements and analysis; exposure to and experience in using commercial software for data acquisition and analysis; discuss the role and limitations of spectral analysis of digital data; provide experience in working in a team in all aspects of the laboratory exercises, including set-up, data collection, analysis and report writing.

DESIRED COURSE OUTCOMES

By the end of this course, students should: Know how to use, what can be measured with, and what the limitations are of the basic instruments found in the laboratory: oscilloscope, multimeter, counter/timer, analog-to-digital converter; know how to write a summary laboratory report; understand the relevance of uncertainty in measurements, and the propagation of uncertainty in calculations involving measurements; understand the physics behind the instruments and systems used in the laboratory; know how to program effectively using LabVIEW for data acquisition and analysis; understand the use of spectral analysis for characterizing the dynamic response of an instrument or of a system.

TOPICS COVERED

Introduction to probability and statistics; error analysis; uncertainty analysis; analog and digital signal processing; discretization of data using analog-to-digital converters; spectral analysis of discrete data; dynamic response of sensors and systems; operating principles for selected sensors; report writing.

CLASS/LABORATORY SCHEDULE

Two hours of lecture and three hours of laboratory per week.

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

This course exposes students to key elements of the profession such as team work and effective communication through a series of laboratory exercises and subsequent reports.

RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

[Please select from the following list the outcomes that will apply to your course]

(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
(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, economic, environmental, 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.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Laboratory reports (3 during the semester); written midterm exam on lecture material, and One oral group presentation

Report #1	**10%**
Report #2	**20%**
Report #3	**30%**
Midterm	**20%**
Presentation	**20%**

PERSON(S) WHO PREPARED THIS DESCRIPTION

George Anwar, 10/11/2013

SAMPLE WEEKLY SCHEDULE

1/13/14		Week 1		Introduction to Measurement
1/20/14	Holiday	Week 2	Standards and	Dimensional Units
1/27/14		Week 3	Writing the Lab Report	Statistics
2/3/14		Week 4	Error Analysis	Propagation of Error
2/10/14		Week 5	Significant Digits	Structuring Effective Writing I
2/17/14	Holiday	Week 6	Analog Signals	Signal Conditioning
2/24/14		Week 7	Structuring Effective Writing II	Digital Signals
3/3/14		Week 8	Frequency Measurement and Nyquist	
3/10/14		Week 9	FFT	Writing--Analyzing Audience Needs
3/17/14		Week 10	Midterm Review	Midterm
3/24/14	Spring	Week 11	Spring Break	Spring Break
3/31/14		Week 12	Writing--Coherence & Style	Force Measurements
4/7/14		Week 13	Displacement Measurements and Velocity Measurements	
4/14/14		Week 14	Temperature Measurements and Pressure Measurements	
4/21/14		Week 15	Introduction to Presentations	Presentations--Aligning Voice, Purpose & Audience
4/28/14		Week 16	Group Presentations	
5/5/14	RRR			
5/12/14	Final			

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): INTR MEC SYS MCHTRN
TIE CODE: LABS
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Staff
DURATION OF COURSE: 14 Weeks
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 12
IS COURSE REPEATABLE FOR CREDIT? No
CROSSLIST: None