Instructor: Megan T. Valentine, Assistant Professor, Mechanical Engineering  
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Office Hours: Weds. 11:30AM – 1:00PM

Required Textbooks:  

**Writing Style and Standards in Undergraduate Reports** by S. Jeter and J. Donnell;  

**Introduction to Engineering Experimentation** by A.J. Wheeler and A.R. Ganji;  

Course Description:  
The course provides an introduction to fundamental laboratory measurement techniques, data acquisition and analysis, and technical report writing in the form of engineering reports and executive summaries. Experiments are drawn from thermal sciences, fluid mechanics, dynamics, solid mechanics and materials science.

Prerequisites:  
Upper division standing. Successful completion of coursework in Thermosciences (ME 151A-B), Fluid Mechanics (ME 152 A-B), Vibrations (ME 163) and Structures and Properties of Materials (Materials 100B).

Course Objectives: This course should enable students to:  
1. Learn the principles of, and good practice for, measuring force, displacement, temperature, pressure, flow, and acceleration using modern engineering instruments and digital data acquisition hardware.  
2. Select appropriate instrumentation for engineering experiments.  
3. Perform static and dynamic calibrations.  
4. Identify sources of measurement uncertainty and quantify measurement errors.  
5. Present methods and results professionally in laboratory reports and executive summaries.
Assignments/Grading:

Each experiment will be worth 25% of your final grade, and will have the following grade breakdown:

- Prelab Exercises and Outline: 20%
- Rough Draft: 20%
- Final Report/Summary: 60%

In the laboratory, students will typically work in groups of three. For each of the first three experiments, one student will serve as a ‘leader’ and will write a long narrative report (typically 5-10 pages), while the other two students will write executive summaries (typically 1-2 pages). For the final experiment (the vibrating beam experiment) each student will submit a long report.

More detailed information regarding due dates and format will follow.

Other important information:

- You are expected to attend all lectures and laboratory sessions. In the case of an emergency or illness, please contact your TA and Professor Valentine prior to your scheduled class or lab.
- Late assignments will not be accepted without prior approval, and may be subject to penalty.
- Students are encouraged to discuss the problems and work on data analysis in groups, but prelab exercises, outlines, rough drafts, summaries and reports should be generated by individuals and copying will not be tolerated.
- If you are a student with a disability and would like to discuss special academic accommodations, please feel free to contact me at your convenience.
Department and Course Number: Mechanical Engineering ME105

Course Title: Mechanical Engineering Laboratory

Total Units: 4 Course Designation: Required

Class/Laboratory Schedule

2 units of lecture, 150 min/week; 2 units of laboratory, 180 min/week

Course Description

Introduction to fundamental laboratory measurement techniques, data acquisition and analysis, and report writing. Experiments are drawn from thermal sciences, fluid mechanics, mechanics, and materials science.

Prerequisites for Course

ME 151A-B, ME 152 A-B, ME 163 and Materials 100B

Text, References & Software

Required Texts:

Course Assignments

Weekly pre-lab assignments
4 Engineering Reports (2 Full Reports, 2 Executive Summaries)

Course Website: http://me.ucsb.edu/~me105

Course Learning Outcomes (Short–term goals, i.e. skills that students should possess at the end of the course):

During this course, students will be provided with information to better enable them to:

1. Learn the principles of, and good practice for, measuring force, displacement, temperature, pressure, flow, and acceleration using modern engineering instruments and digital data acquisition hardware.
2. Select appropriate instrumentation for engineering experiments.
3. Perform static and dynamic calibrations.
4. Identify sources of measurement uncertainty and quantify measurement errors.
5. Present methods and results professionally in laboratory reports and executive summaries.

Major Topics Covered in Course: (lecture and lab/discussion, with no. of hours for each topic)

In Lecture (25 hours total):
1. Introduction to Experimental Science and Engineering 2.5 h
2. The principles of, and good practice for measuring temperature, pressure, flow, force, displacement, strain, acceleration and position using modern instrumentation 7.5 h
3. Use of modern digital data acquisition hardware and signal conditioning 2.5 h
4. Analysis of measurement uncertainty 7.5 h
5. Technical writing of engineering reports 5 h
In Laboratory (24 hours total):
1. Use a bench-top tensile testing machine to determine the Young’s modulus, yield stress, ultimate tensile stress, ductility, and toughness of aluminum, brass and steel.
2. Measure the heat transfer coefficient for an aluminum sphere for a variety of conditions including both free and forced convection in air and water.
3. Measure the major and minor losses for a simple pipe network using a pressure transducer, paddlewheel flowmeter, and orifice-plate flowmeter.
4. Measure the dynamics of a vibrating beam using a strain gauge and MEMS-based accelerometer.

Contribution of course to meeting requirements of Criterion 5 – Curricular Requirements
This course contributes to item (b), in that it counts as four (4) units of an engineering science topic appropriate to the student’s field of study, mechanical engineering.

Relationship of course to the Program Outcomes
This course most closely ties into program outcome #1, that a student should possess a solid foundation in, and be able to apply the principles of, mathematics, science, and engineering to solve problems and have the ability to learn new skills relevant to the discipline. Additionally, this course will give students the ability to:
- design and conduct experiments; analyze and interpret data
- design a system or process to meet desired needs within realistic constraints
- function on multidisciplinary teams
- identify, formulate, and solve engineering problems
- communicate effectively
- use the techniques, skills, and modern engineering tools necessary for engineering practice

Prepared by: Megan Valentine                                      Date: 26 March, 2010