ME103:: Experimentation and Measurements

Lecturer:	George Anwar
Classroom:	Hearst Field Annex A1
	MW 2:00 PM – 3:00 PM
Office:	50B Hesse
Office Hrs:	MWF 9:00 AM – 11:00 PM or By appointment

GSI: Larry Hui1
GSI: Steph Akakabota

Topics covered

Probability & statistics (and propagation of

uncertainty)

Methods of data acquisition

Sensor characteristics

Dynamic models of measurement systems

Technical communication (written & oral)

Design of experiments

ME 103 Goals

To enable you to design, conduct, report and/or evaluate an experiment.

Know how to design an experiment including choosing relevant sensors

Know how to calculate uncertainty in calculations and measurements

Know how to conduct an experiment and take measurements

Know how to analyze data and interpret results

Communicate

Know how to write a laboratory report and communicate results

Work independently and together with a team

Understand

Understand modern experimental techniques in Mechanical Engineering including sensors to measure displacement, temperature, velocity, acceleration, strain, and more.

Understand how to use modern software and hardware for data collection and analysis

ME 103 Goals

In Summary:

- As an engineer or researcher, you may be often called upon to conduct measurements AND report the results in such a manner that the data and its uncertainties can be understood by any other skilled professional.

- As a manager / leader you will likely be required to evaluate experimental data reported by others.

- Either way, YOU need to know the basics.

Lab Sections

Meeting in 122 Hesse
(*Note you* <u>*MUST*</u> *attend your assigned lab section*).

Tuesdays	2-5pm	(Lab 201, Steph)
Thursdays	2-5pm	(Lab 202, Steph)
Tuesdays	8-11am	(Lab 203, Larry)
Wednesdays	9am-12pm	(Lab 204, Larry)

Grading

- Homeworks: 15%, equally weighted between the 5 homeworks

- Midterms: 35%, equally weighted between the 2 midterms

    Midterm 1 Lab Based: 17.5%
    Midterm 2 Lecture/Homework Based: 17.5%

- Labs: 20%, equally weighted between 6 labs

- Measurement project: 30%, of which:
    o Milestone A: 1% of overall course grade
    o Milestone B: 1%o Milestone C: 1%
    o Milestone D: 2%o Milestone E: 12.5%
    o Milestone F: 12.5%

There is no final exam in this class.

ME103:: Experimentation and Measurements

What are measurements ?

Measurements are the process or result of determining the **quantity, size, amount, or degree** of something using a standard units. They allow us to **describe and compare** objects and phenomena in a consistent, precise way.

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Key Components of a Measurement:

- **Quantity being measured** – What you're measuring (e.g., length, mass, time).

- **Numerical value** – The number that tells you how much.

- **Unit** – The standard you compare against (e.g., meters, kilograms, seconds).

Examples:

- **Length**: 2 meters (means the object is two times as long as the standard meter)
- **Mass**: 5 kilograms
- **Time**: 10 seconds
- **Temperature**: 100 degrees Celsius

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Why Measurements Matter:

- In **science**, to perform experiments and compare results.

- In **engineering**, to build and design accurately.

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What is the True Value of a Measurement ?

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What does the term "error" mean in the context of measurements of a particular quantity?

Error = difference between the **measured value** and the **true value** of the quantity of interest.

Rarely known, as true value is hardly ever known.