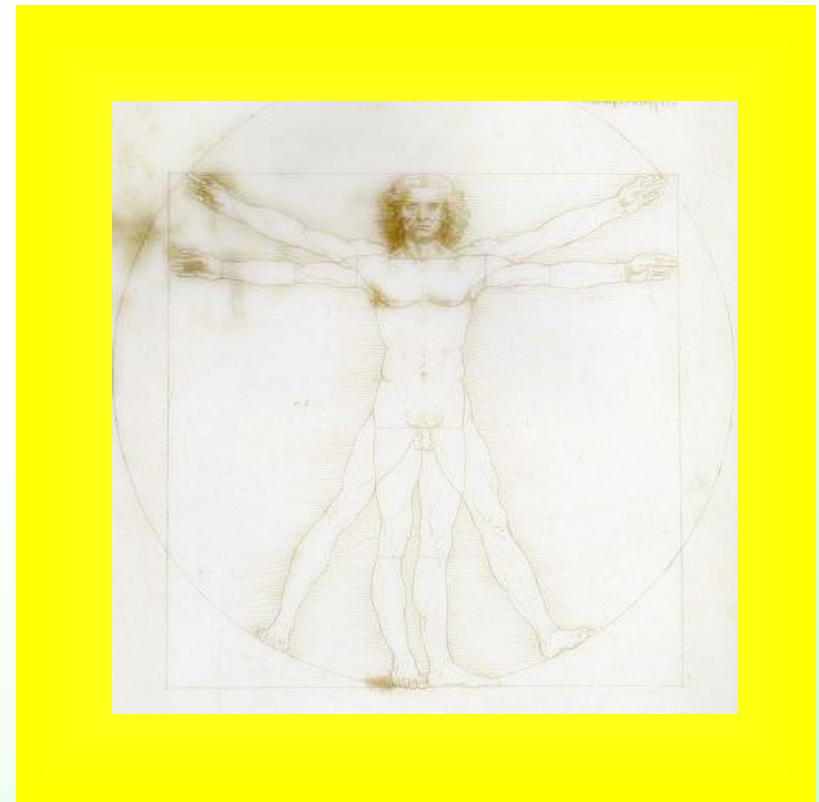


# Welcome to Biomedical Instrumentation

- ECE445: Biomedical Instrumentation
- Today's Agenda
  - Course motivation
  - Scope of this course
  - Role of instrumentation in medicine
  - Course goals
  - Course elements
  - Syllabus
  - Expectations

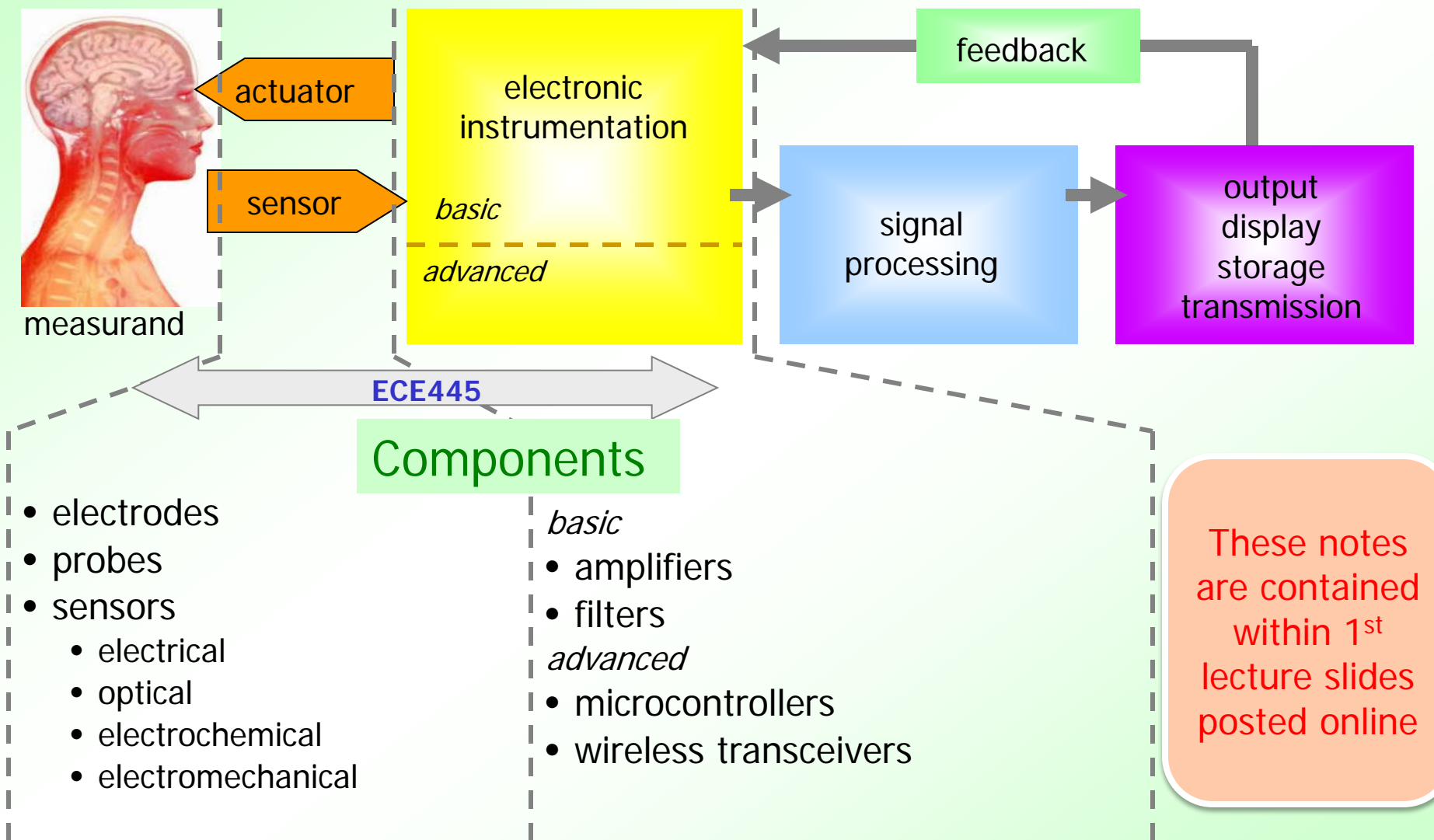


# Course Motivation & Scope

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- Course Motivation
  - bio/micro/nano technology for healthcare improving rapidly
  - role of EEs in biomedical field becoming more important
  - ECE Department has a new UG “concentration” in BME
    - concentration: take 15 credits from select list; receive mark on transcript
    - 3 new ECE-BME courses have been introduced
  - ECE445 will introduce methods for acquiring biological/physiological information into electrical (analog/digital) format
- Scope of Course
  - review basic EE principles
  - overview physiology
  - biomedical sensors
  - instrumentation electronics
  - entrepreneurship & innovation
  - research/design/business project
  - preview of other BME courses & elements

# Role of Instrumentation



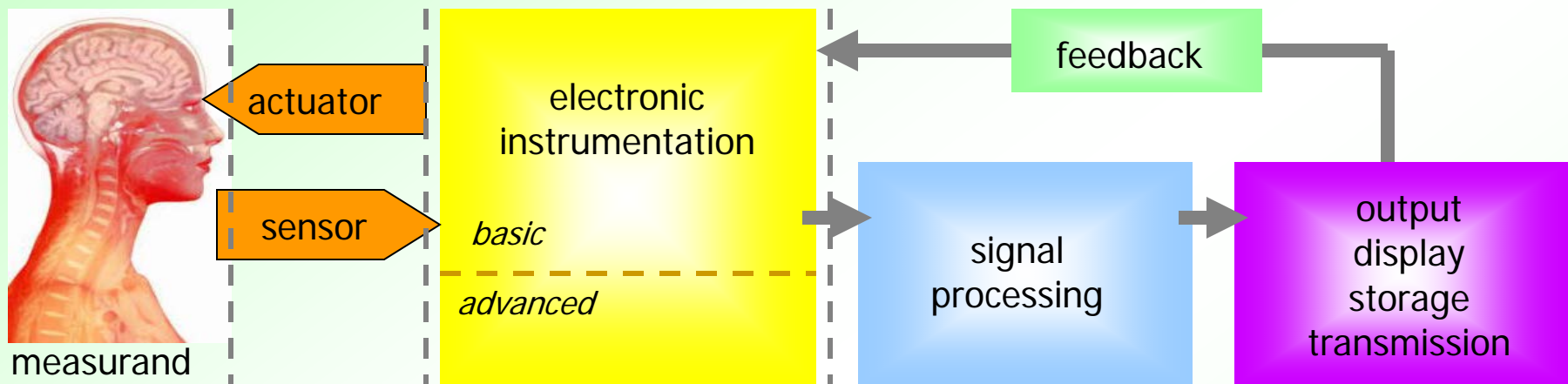
- electrodes
- probes
- sensors
  - electrical
  - optical
  - electrochemical
  - electromechanical

## Components

- basic*
  - amplifiers
  - filters
- advanced*
  - microcontrollers
  - wireless transceivers

These notes are contained within 1<sup>st</sup> lecture slides posted online

# Role of Instrumentation



- biological/physiological-to-electrical transduction
  - change non-electrical energy/phenomena to electrical signal

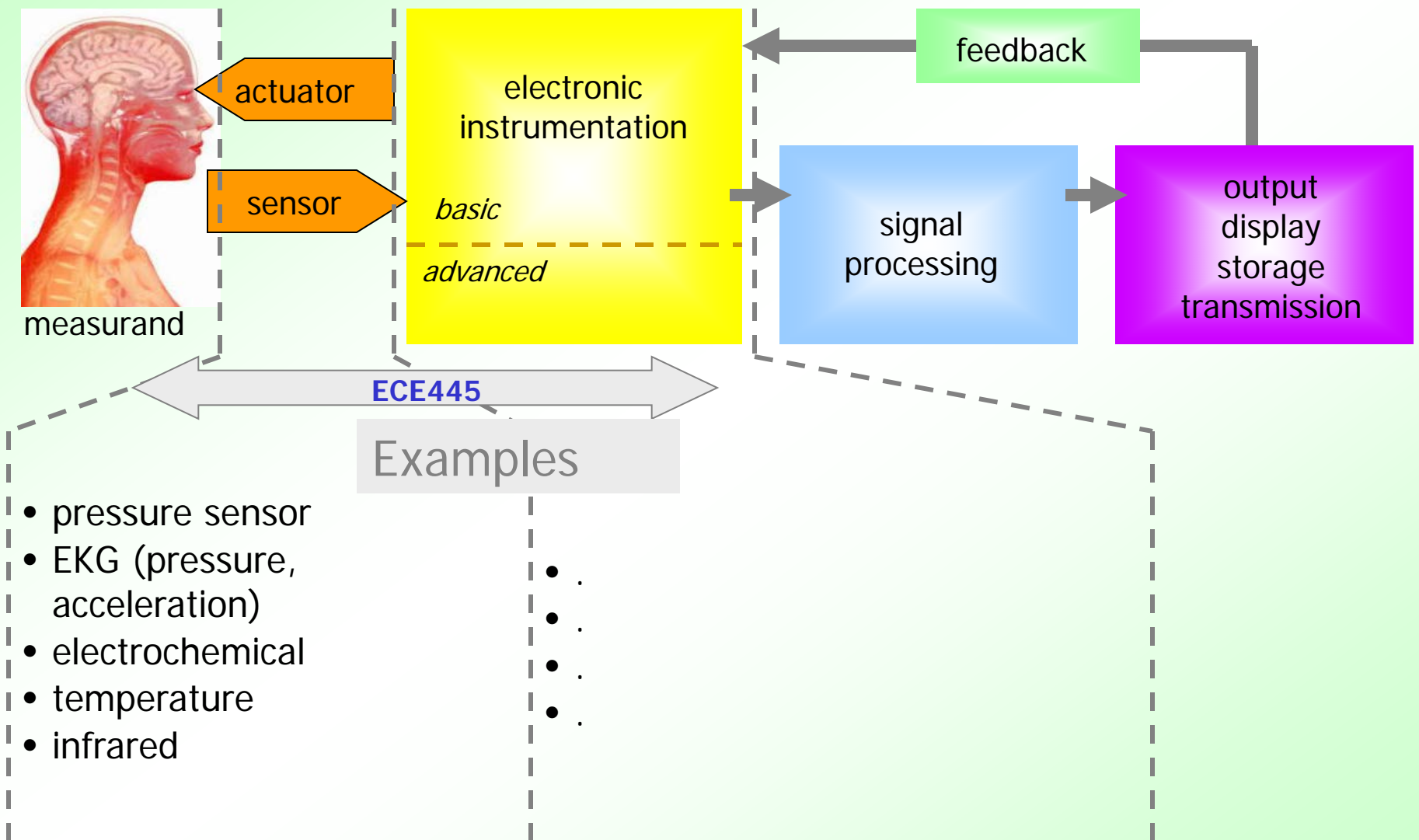
*basic*

- signal acquisition & amplification
- signal "conditioning"
- data upload (A/D, comm.)

*advanced*

- calibration & compensation
- sensor fusion
- networking, user interface

# Role of Instrumentation



- pressure sensor
- EKG (pressure, acceleration)
- electrochemical
- temperature
- infrared

- .
- .
- .
- .

# Course Goals & Elements

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- Course Goals: learn/understand...
  - how medical measurements are made
  - role of electronics in biomedical monitoring
  - how to design & test biomedical electronics
  - use of PC hardware/software to interface with electronics
  - explore business & technology side of BME industry
  
- Course Elements
  - lectures: 2x/wk
  - homework: ~6/semester
  - exams: 2/semester
  - labs: 9/semester
  - projects
    - research, innovation, design
    - technology & business
    - presentation & report
  - participation: ! ideas !
    - present 2-min BME news
      - ~2x/semester
    - rating student news presentations
    - add to online content via Piazza
    - other?

# Syllabus

- **Lecture:** MW, 11:30-12:20, 1279 Anthony Hall
- **Lab:** Th 11:30-2:30 or 3:00-6:00, EB 3230A
- **Instructor:** Dr. Andrew Mason, EB 1217, [mason@msu.edu](mailto:mason@msu.edu)
- **Office Hrs.:** Mason: Mon 10:30-11:30 or email for additional appointments
- **410 Lab TA:** Yuning Yang, [yangyuni@msu.edu](mailto:yangyuni@msu.edu)
- **Office Hrs.:** To be posted on class website; email for additional appointments
- **Course Website:** <http://www.egr.msu.edu/classes/ece445/mason>
  - A significant amount of material for this class will be posted on the course website, including assignments, lab tutorials, and lecture notes. Please check regularly throughout the semester.
  - **{discuss lecture notes}**
- **Preferred Prerequisite:** ECE 302/303 or ECE 345
- **Reference Text –not required:**

*J. Webster, Medical Instrumentation: Applications and Design, John Wiley & Sons, 1998. ISBN 0-471-15368-0*
- **Course Description:**
  - Fundamentals of biomedical measurements; sensor instrumentation electronics; biomedical devices; applications and case studies; hands-on experience with sensors, instrumentation electronics, and biomedical devices.

# Syllabus

## • Attendance and Conduct in Class:

- Students are expected to attend and participate in class. Attendance will not be taken, but a portion of your grade will be based on participation, and you can't participate if you're not there! It is the student's responsibility to get notes and handouts for any missed class. For excused absences (illness, professional travel, etc.) please notify Dr. Mason ([mason@msu.edu](mailto:mason@msu.edu)) before class.

## • Grading:

- 30% 2 Exams
  - 10% Homework
  - 5% Participation
  - 25% Lab Assignments
  - 30% Project
- Tentative dates for the midterm exams are shown on the Course Schedule. This course has a final project but no final exam. 3-4 homework assignments will be given between each exam, typically due a week after assigned.

## • Other Policies:

- Cheating in any form will not be tolerated! This includes copying homework, copying labs, cheating on exams, or any other form of unethical behavior. Direct copying of homework will result in a zero-point score for all people involved.
- Homework must be turned in at the beginning of class on the date it is due. ***No late homework will be accepted.***
- Lab check offs and reports must be completed by their due data. Extensions for extreme situations should be arranged with the instructor.
- Makeup exams will only be allowed for excused absences and only when the instructor is informed before the exam.



# Syllabus

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- **Lab Assignments:**

- Students must complete several lab assignments covering physiological measurements and design and testing of instrumentation. Labs will typically include a **pre-lab** portion, which **must be completed before attending lab**, and an in-lab portion to be completed within the lab session. The lab will only be open during the designated lab section times when a TA will be available, so please come prepared or you will not have time to complete the lab.

- **Project**

- Teams (nominally of 3 students) will choose a biomedical instrument/application to research, analyze and invent a product. Teams will study their selected topic, gain an understanding of the relevant technology and what companies are currently involved in that market. They will also research up and coming technology and make an analysis of existing and near-future solutions. Students will propose a new instrument to address a vacancy in the commercial market. Projects will be summarized into a written report and an illustrated presentation to be delivered to the class. Projects will be graded as follows:

50% Project Quality      25% Report      25% Presentation

- **Planned Course Schedule:**

- see handout
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# Expectations

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- Newer course (445 only taught once)
  - Instructor: new lectures, new labs, new homework, new exams
  - Students: a little confusion, some bugs & glitches –please be patient!
- What can you expect from the course
  - introduction to basic elements of biomedical instrumentation
  - exposure to new material on important topic
  - knowledge & training in field with good job potential
    - e.g., Texas Instruments new Medical Technology division
  - chance to engage in participation-heavy course
  - but...
    - some lecture notes a bit unpolished {[discuss posting of lecture notes](#)}
    - labs may have some rough edges
  - please be patient and point out any problems you see & I will try to keep the workload comfortable

# Homework 1

- Due: Monday September 10

1. Find internet resources for BME news: Search the web to find at least 3 sources for news/reports about biomedical instruments. Look for sites that cover both technical issues as well as business issues (market analysis, company activity reports, etc.). Please avoid company-specific sites. List the sources and URLs that you find.
  2. Summarize BME news report: Locate a technical news article related to biomedical instruments (from an independent news source, not a company data sheet). Read the article and write a brief (1 paragraph, ~1/2 page) summary of the article. List the source (e.g. URL) after/within your summary.
  3. Find more sources related to your report summary: Search the web for other information related to the topic of the article you summarized in part 2. List these resources (that's all, *just list the sources*).
- Note: to get started you might want to check out <http://www.spectrum.ieee.org/Bioengineering> but don't limit yourself to this site.