Medical Electronics [0903561]

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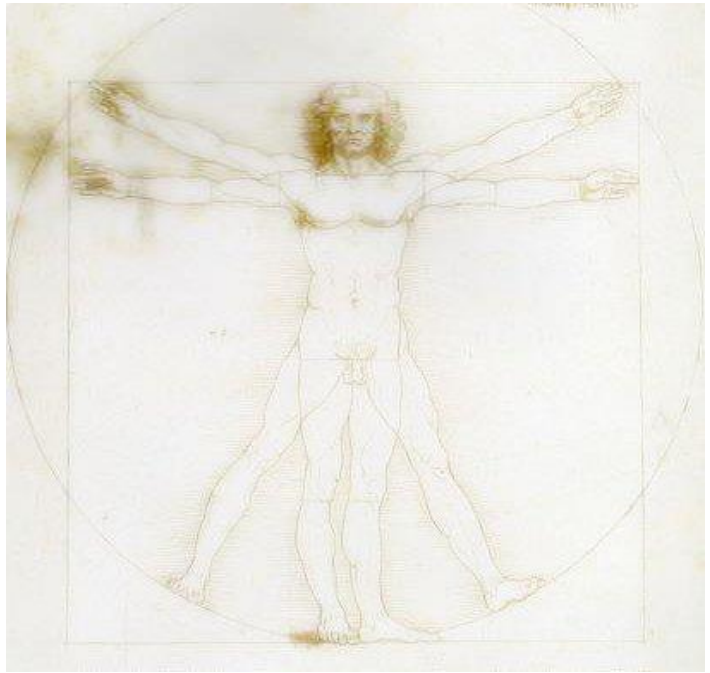
Welcome to Medical Electronics

- 0903**561** : Medical Electronics
- Today's Agenda
  - Course motivation
  - Scope of this course
  - Role of instrumentation in medicine
  - Course goals
  - Course elements
  - Syllabus
  - Expectations



Course Motivation

- bio/micro/nano technology for healthcare improving rapidly role of EEs in biomedical field becoming more important.
- EE561 will introduce methods for acquiring biological/physiological information into electrical (analog/digital) format.

Scope

- Scope of Course review basic Electronics principles
- Overview physiology
- Biomedical sensors
- Instrumentation Electronics
- Research/design/business project

Role of Instrumentation

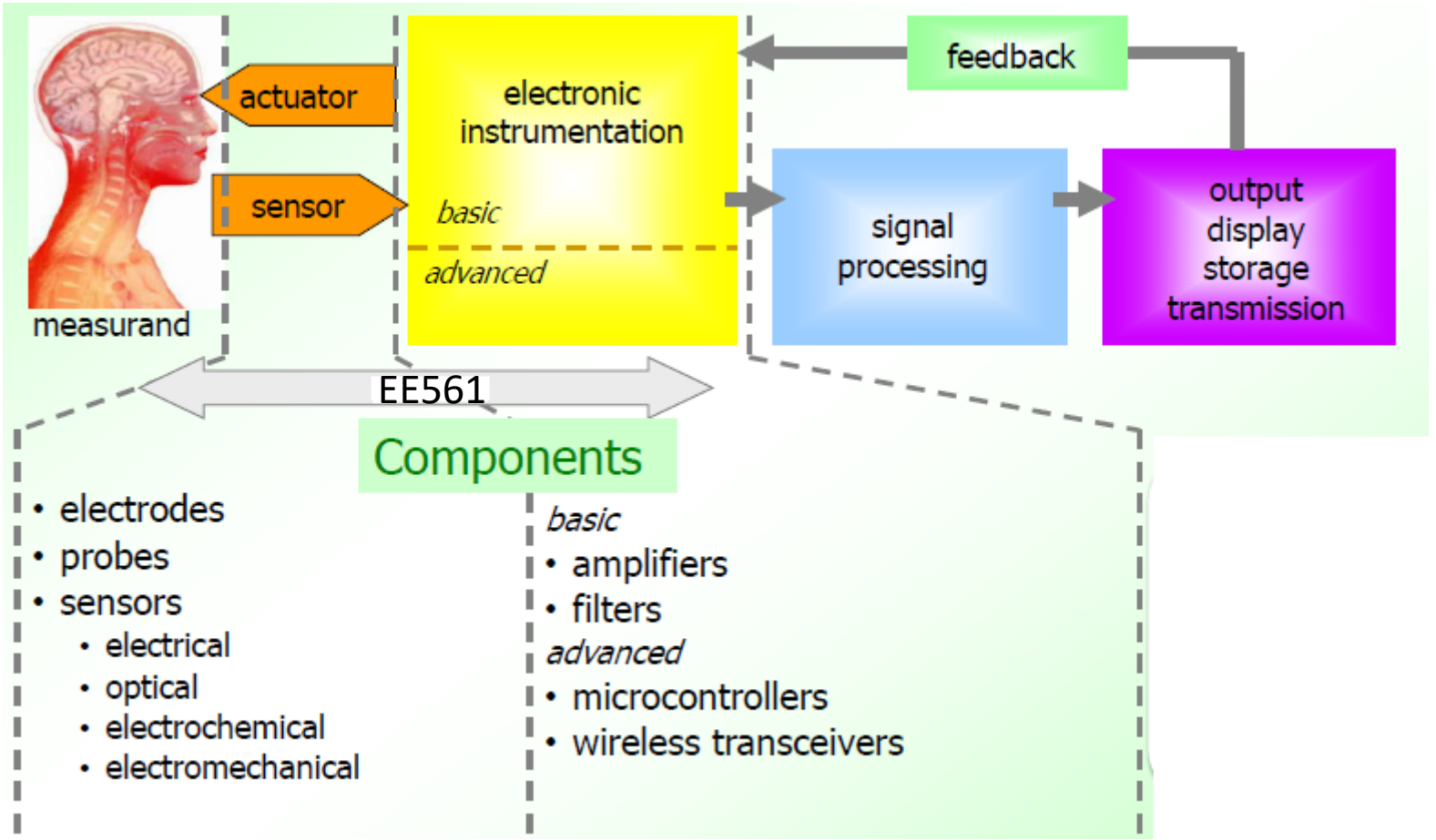


*Image courtesy of Prof. A. Mason

Role of Instrumentation

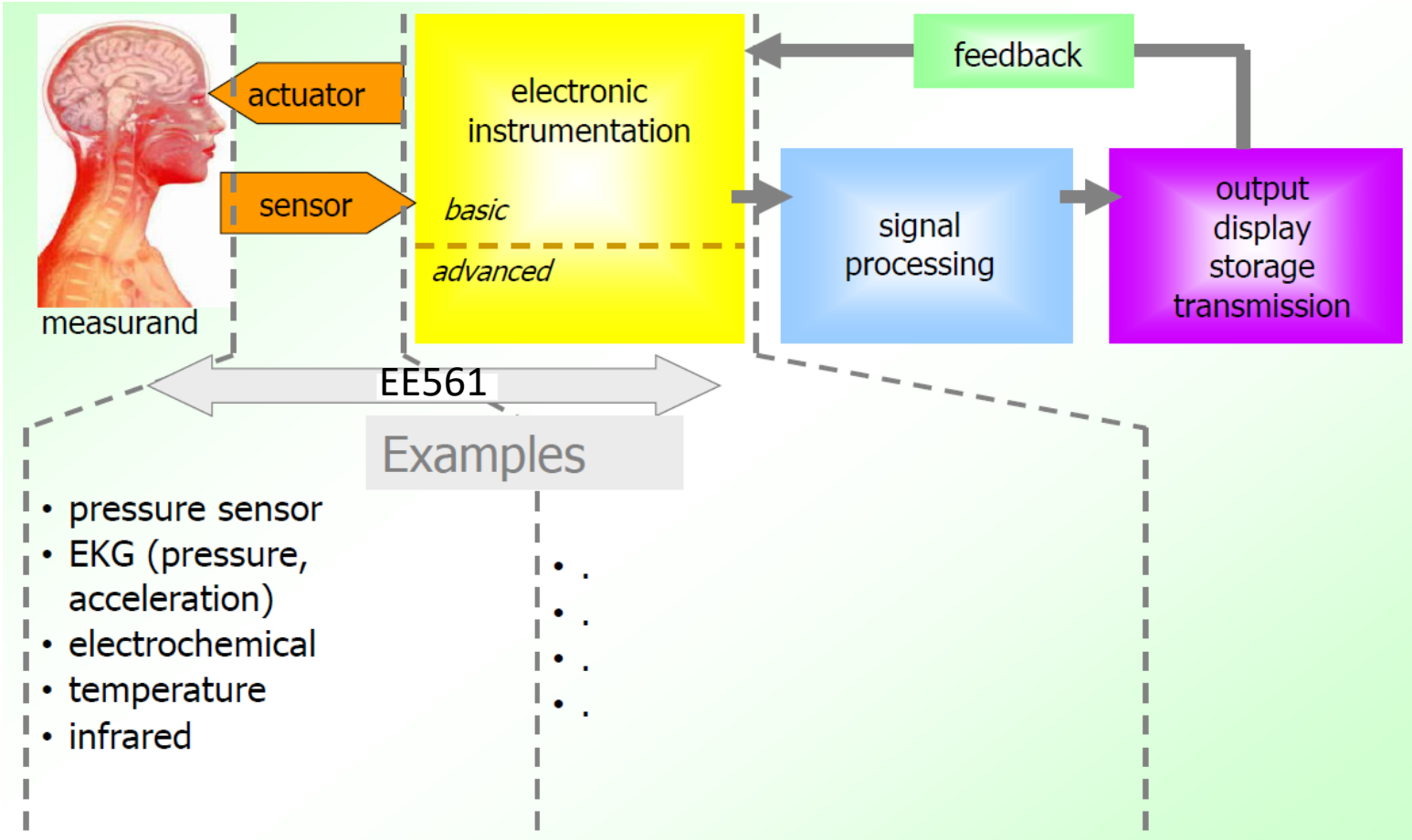


*Image courtesy of Prof. A. Mason

Course Goals & Elements

- 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

Syllabus

- Lecture: Sunday, Tuesday, and Thursday, 8:00-9:00, EE104.
- Course Website: Medical Electronics @ JU 2018-2019-1 

- Office Hrs.: To be posted on my office's door; email for additional appointments on: h.jamleh@ju.edu.jo
- 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:**
  - In accordance with the University Regulations, it is the student responsibility to be punctual and to attend all classes.
  - An absentee withdrawal notice will be issued and the student will be deemed to have withdrawn from the course if a student is absent for more than 15% of the total contact hours.
- **Grading:**

1st Exam	20 %
Midterm Exam	30 %
Term Project	10 %
Final Exam	40 %
Total	100%

Syllabus

- **Term 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:
    - $4\ points$ **Project Quality**
    - $3\ points$ **Report**
    - $3\ points$ **Presentation**
    - $3\ points$ **EXTRA for Hardware**

Syllabus [Topic 1]

- Practical Operational Amplifiers
  1. Op-Amp Circuits (Inverting and non-inverting, summing amplifiers, Op Amp circuit design).
  2. Biomedical Instrumentation Amplifier, Integrators, and Differentiators.
  3. Medical Isolation Amplifiers.
  4. Active filters and its applications.
  5. Digital Interfaces in measurement systems; Sampling Theorem; Quantization Noise; Digital to Analog converters (DACs); Analog to digital converters (ADCs).

Syllabus [Topic 2]

- Measurement systems.
  1. Origin of Biopotential Signals.
  2. Measurement of Electrical potentials from the Body surface Electrodes.
  3. Half-Cell Potential and its Equivalent Circuit.
  4. Noise and coherent interference in measurements.
  5. Analog signal conditioning.
  6. Biopotential amplifiers.

Syllabus [Topic 3]

- Electrical Functioning of the heart, the muscles, and the neural system.
  1. The Electrocardiography (ECG); Electrode placement;
  2. The ECG; Vector cardiography; Driven-Leg ECG amplifiers; Design Example: QRS complex segmentation
  3. The Electromyography (EMG).
  4. The Electroencephalography (EEG).

Syllabus [Topic 4]

- Sensors commonly encountered in biomedical applications:
  1. Temperature sensors.
  2. Automatic non–invasive blood pressure measurements.
  3. Design Example: Design a non-invasive blood pressure measurement system.
  4. Optical sensors–Pulse Oximetry.

Homework

- *Please do the following three steps*
- 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.).
  - 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 (≈ 2 pages) 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:

IEEE SPECTRUM https://spectrum.ieee.org/biomedical