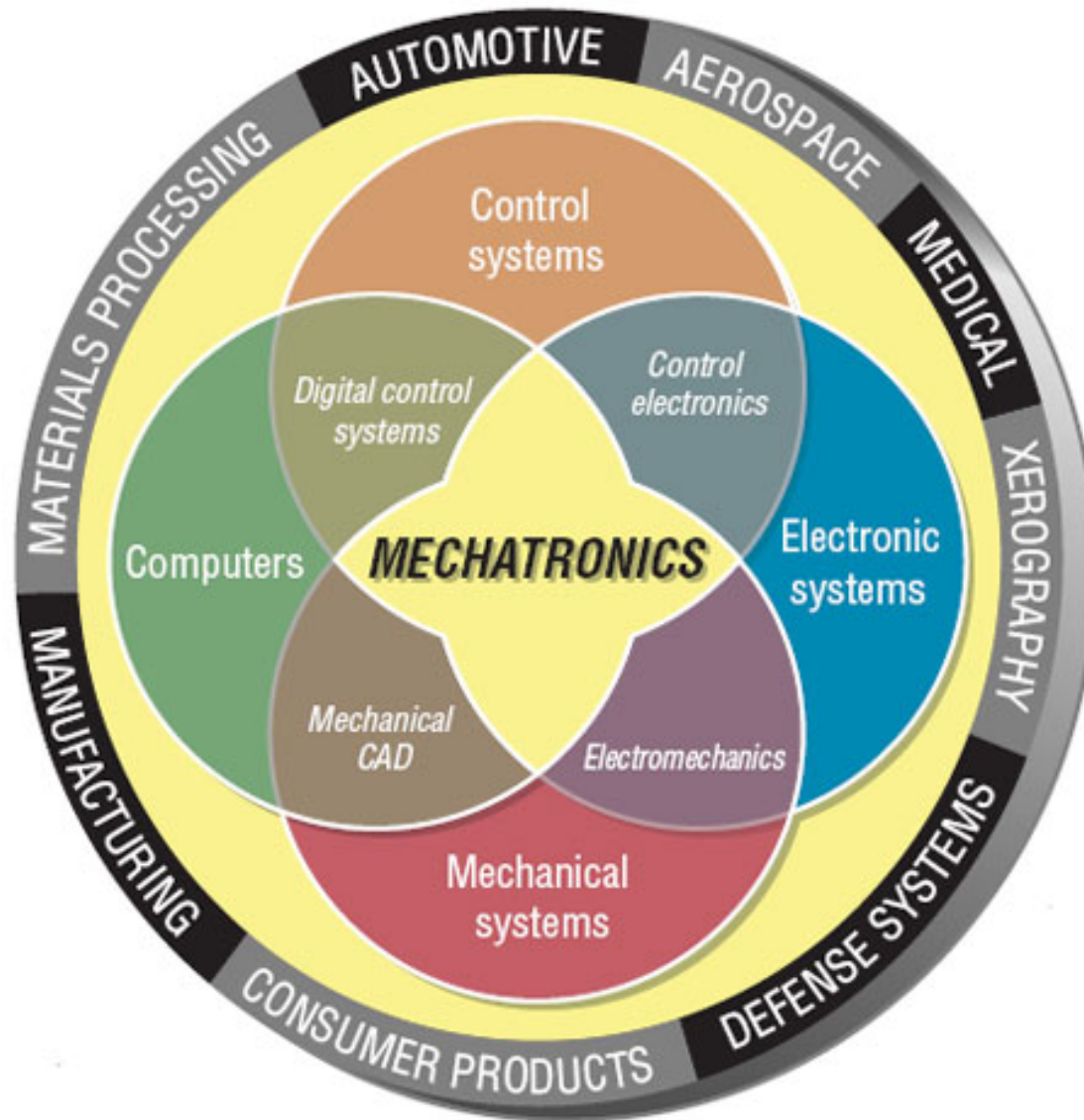# Mechanical & Industrial Engineering Course and Option Talk - **Mechatronics**

Mechatronics - Overview

What is Mechatronics? What will you learn?
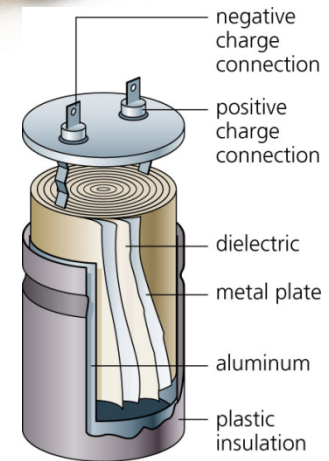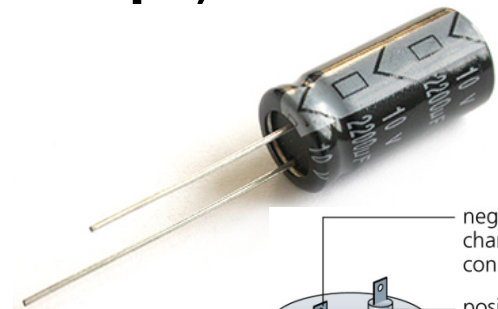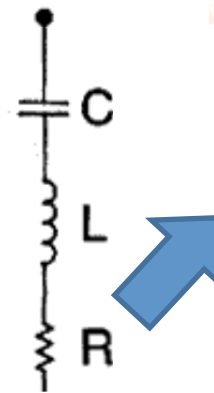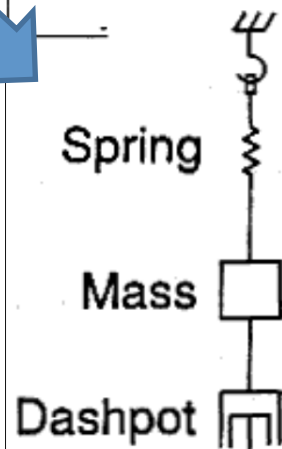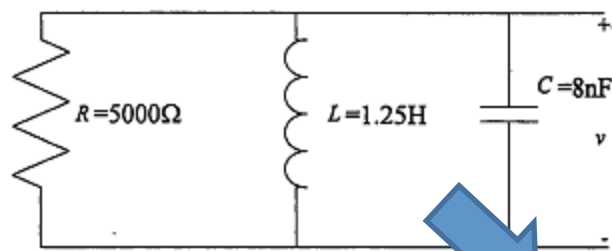
- **Interdisciplinary** – Mechanical, Electrical, Computer Science

- Design of complete, **modern mechanical systems** which require integral electronic components

- **Examples**: Robots, Appliances, Cars, Aircraft, Spacecraft, etc...

Third Year – **Core** Mechatronics-Related

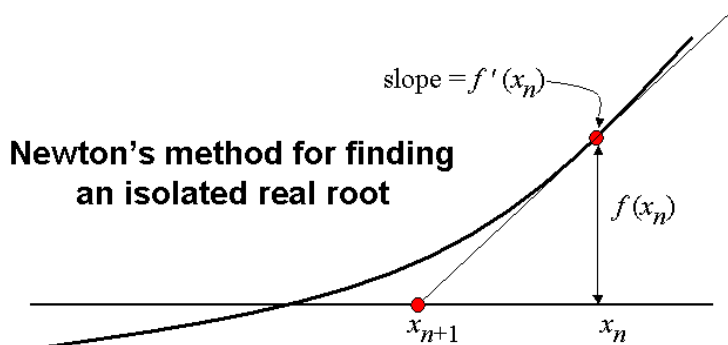**Third Year, Fall Term – MIE342 – Circuits w/ Appl. To Mech**

- Teaches **basic techniques for analyzing circuits** (things like current and voltage laws) and **circuit components** (such as sources, inductors, capacitors, and **op-amps**)
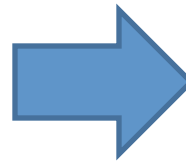
$R = 5000\Omega$ $L = 1.25H$ $C = 8nF$

Spring

Mass

Dashpot

C

L

R

negative charge connection

positive charge connection

dielectric

metal plate

aluminum

plastic insulation

Third Year – **Core** Mechatronics-Related

Third Year, Fall Term – **MIE334 – Numerical Methods I**

- Teaches **MATLAB**; review and extension of **programming** methods from first year – used in many 4th year and graduate courses

slope $= f'(x_n)$

Newton's method for finding an isolated real root

$f(x_n)$

x_{n+1} x_n

$$x_{n+1} = x_n - \frac{f'(x_n)}{f(x_n)}$$

Third Year – First **Stream Course**

Third Year, Winter Term – **MIE346 – Analog & Digital Electronics**

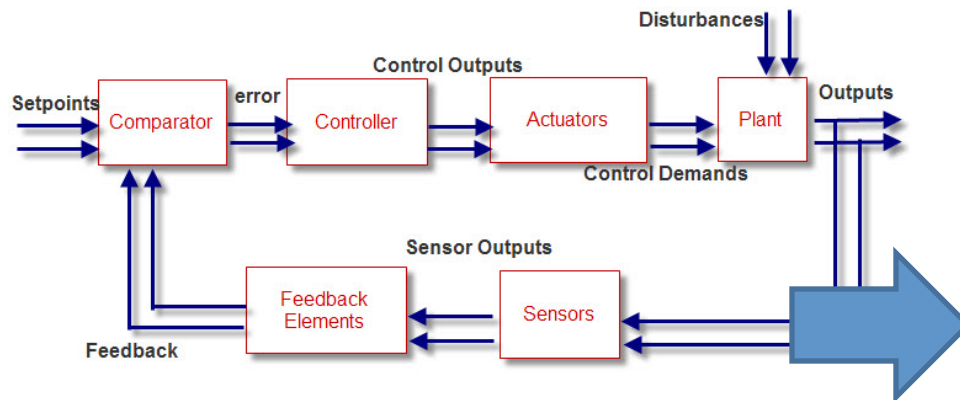- Teaches **advanced circuits** – motor drivers, oscillators, filters, plus new **semiconductor devices** (diodes, MOSFETs, BJTs), plus **real world design and analysis**
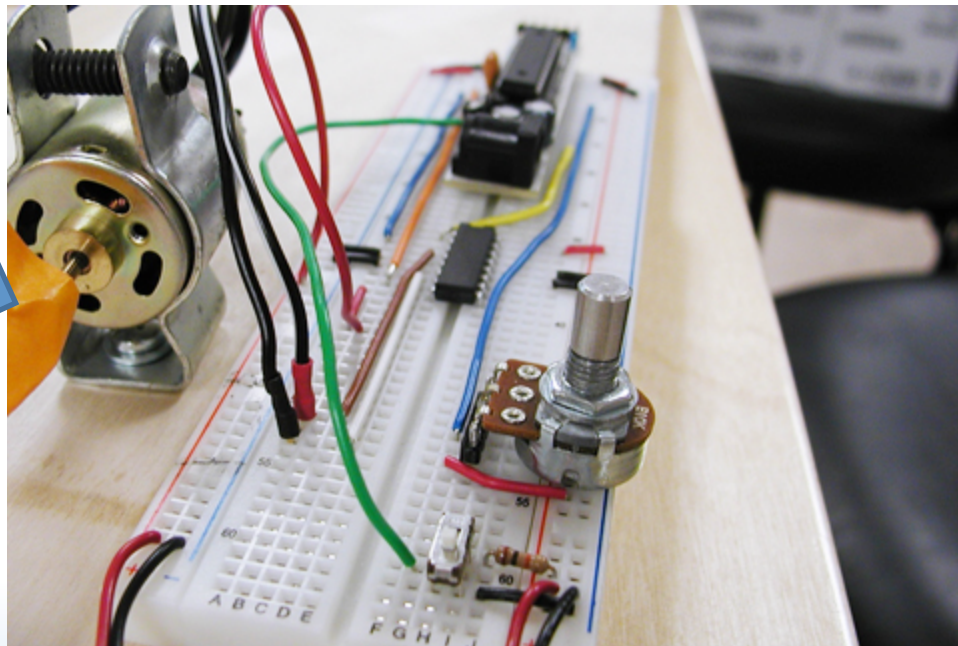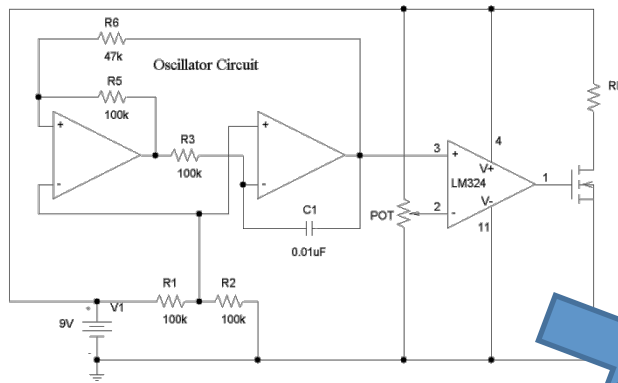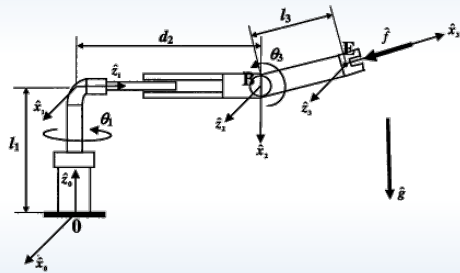
Fourth Year – Second **Stream Course**

Fourth Year, Fall Term – MIE404 – Control Systems I

- Teaches **general methods to control a feedback system**; both mathematical and practical (i.e.: Magnetic Levitation control lab)
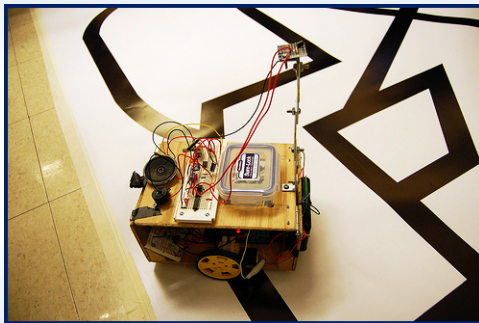
Technical Electives – Fall Term

AER525 – Mechatronics Principles (excl. MIE422)

- Math involved with **controlling a robot** (for./rev. kinematics), and **practical project** (i.e., build and control a robot arm, etc.)

**MIE444 – Mechatronics Principles

- **Eng. Design Course** – Smart Systems, Interfacing and Control, Modeling, and a **practical project** (build a line follower)
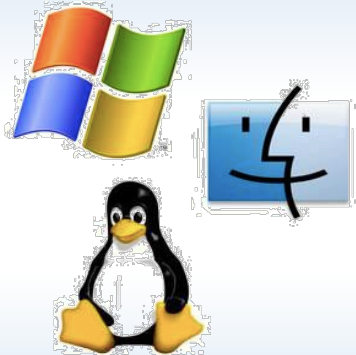
ECE344 – Operating-Systems

- **Computer and programming**; teaches high-level operating-systems concepts, computer organization and mgmt.

Technical Electives – Winter Term
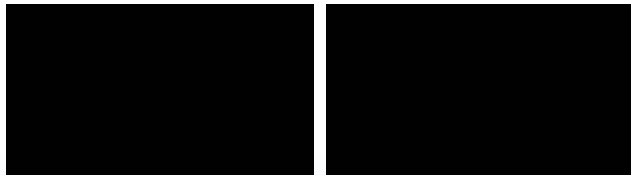
"Classical" Mechatronics Courses

**MIE443 – Mechatronics Systems: Design & Integration

- **Design Course** – Teaches the **design process**, **automation**, and **integration** of real-world Mechatronics systems

MIE438 – Microprocessors and Embedded Microcontrollers

- Teaches how to use **microcontrollers** in real-world Mechatronics systems; project focused

Technical Electives – Both Terms
Courses with Mechatronics focus or strong tie-ins

**MIE506 – MEMS Design and Microfabrication

- Teaches Micro**electromechanical** Systems (MEMS)

MIE464 – Smart Materials and Stuctures

- Study on electrical, magnetic, and optical smart structures

MIE517 – Fuel Cell Systems

- Study on control, charging, and electronics of fuel cells

These are **just a few examples** – many courses have Mechatronics tie ins, **particularly if you initiate**!

Mechatronics – Jobs

"Every mechanical system is waiting to be smarter, and the way to do it is through electronics…"