Electrical and Computer Engineering Concentrations

Presenters:  Adam Funkenbusch  aefunken@mtu.edu
            Andy Deckert  ajdecker@mtu.edu
            Andy Hoekstra  ajhoekst@mtu.edu
Eta Kappa Nu

- Electrical and Computer Engineering Honors Society
- Join Sophomore, Junior, or Senior year
- Official Honor Society of IEEE—Professional Society for Electrical and Computer Engineers

IEEE

HKN
Today we will be outlining the different concentrations available in the ECE Department.
Certificate, Concentration, Focus
Oh My!

- Control
- DSP
- Communication
- Electronics
- Computer Systems
- Computer Engineering—Major
- Power & Energy—Certificate
- Electromagnetics
- Photonics—Concentration
Controls Focus
What is Controls?

- Real-world systems are yours to command!
  - Understand it, model it, control it
- Multidisciplinary – mechanical, chemical
- Pervasive – body temperature, home heating, industrial, automotive, power distribution
What’s in it for me?

- Automotive
  - Electric vehicles
  - Steering (Nexteer)
- Power systems*
- Manufacturing
- Robotics
- Biomechanical*

- Aircraft autopilot*
- Satellite pointing*
- Consumer electronics
- Grad school
Controls Courses:

- Introduction to Electric Machinery & Drives
- Communication Theory
- Introduction to Control Theory
- Digital & Non-Linear Control
- Distributed Embedded Control Systems
What’s in it for me?
Digital Signal Processing Focus
What is DSP?

A field of engineering that deals with the manipulation of time-varying signals.

Examples:
- Video/Audio/Image Processing
- RADAR
- Dr. Ambardar Magic!
DSP Courses:

- Digital Signal Processing and Its Applications
- Real-Time Signal Processing
- Digital Image Processing
\[ C = B \cdot \log_2 \left( 1 + \frac{S}{N} \right) \]
What is Communication?

A field of engineering that deals with reliable transmission and receiving of data over different media.

Examples:
- Encoding/Decoding Data
- Transmission/Receiver Hardware Design
- Bluetooth, 4G, Phone
- Computer Networks
- IEEE 802.11g standards (WiFi)
Communication Courses:

- Communication Theory
- Wireless Communications
- Computer Networks
- Computer and Network Security
Electronics Focus
What is the study of Electronics?

A field of engineering that deals with implementation of new and innovative circuit techniques, analysis of complex electronic systems, and integrated circuit design.
Electronics Courses:

- Physical Electronics
- Electronic Applications
- VLSI Design
- Introduction to MEMS
Computer Systems Focus
What is Computer Systems

A field of engineering that deals with the conception, analysis, design, integration, and evaluation of embedded systems, computing networking, and high-assurance systems employing modern microprocessor and microcontroller devices.

Examples:
- GPU & Multicore Programming
- Logic Design (Verilog/VHDL)
- Embedded Systems
Computer Systems Courses:

- VLSI Design
- Computer Networks
- Computer and Network Security
- S/H Design of Multimedia Systems
- GPU and Multicore Programming
- Embedded System Programming using Sensor Networks & Mobile Robots
Computer Engineering
What is Computer Engineering?

- Computer engineers bridge the gap between electrical engineering and computer science by working with both computer hardware and software.

- Students take classes from both the Electrical Engineering department, and the Computer Science department.

- Computer engineering is a major, not a concentration.
Computer Engineering Courses:

- Introduction to Programming
- C Programming
- Data Structures
- Computer Organization
- Hardware/Software Integration
- Systems Programming
- Computer System Architecture
- Introduction to Algorithms
- Computer Networks
Electric Power Engineering Certificate
What is Electric Power Engineering?

A field of engineering that deals with the generation, transmission and distribution of electric power. In addition, electrical devices connected to such systems including generators, motors and transformers.

**Generation:** Converting energy from various forms into electrical energy

**Transmission:** Transporting electricity from power plant through transmission system

**Distribution:** Transfer power from transmission to customer
Electric Power Engineering At Michigan Tech

- Electric Power Engineering Certificate
  - Take set of focused classes specific to power engineering

- Michigan Tech IEEE PES Student Chapter
  - Plant Tours
    - Wind Farm
    - MTU Steam Plant
    - Etc.
  - Lectures from business professionals
  - Meet people in your concentration
Electric Power Engineering Courses:

- **Required:**
  - Power System Analysis I / II
  - Power Engineering Lab

- **Electives:**
  - Circuits and Instrumentation
  - Electric Energy Systems
  - Introduction to Motor Drives
  - Power System Protection
  - Power System Protection Lab
  - Distribution Engineering
Electric Power Engineering Courses (Continued):

- (Optional)
  - Power Electronics
  - Power Electronics Lab
  - Special Topics in Electrical Engineering
  - Advanced Methods in Power Systems
  - Transient Analysis Methods
  - Computer Modeling of Power Systems
Electromagnetics Focus
A field of engineering that deals the generation and manipulation of electromagnetic waves.

Examples:
- Wireless Communication
- Power Generation (Motors)

Career Areas:
- RF Design
- Electromagnetic System Interference
- Antenna Designer
- Metamaterials
Electromagnetics Courses:

- Engineering Electromagnetics
- Laser Types, Laser Design, Modeling Techniques and Nonlinear Optics
Photonics Concentration
What is Photonics?

Career Areas:
- Laser Design
- Remote sensing
- Optical information processing
- Optical communications

Professional Organizations:
- SPIE
- Optical Society of America
Photonics Courses:

- **Required**
  - Introduction to Photonics
  - Optical Sensing and Imaging
  - Photonic Material and Devices
  - Photonics Laboratory
  - Laser Types, Laser Design, Modeling Techniques, and Nonlinear Optics

- **Optional**
  - Digital Signal Processing and its Applications
Photonics Courses (Continued):

- (Optional)
  - Real Time Signal Processing
  - Fourier Optics
  - Optical Communications
  - Light and Photonic Materials
  - Optics
  - Introduction to Solid State Physics
  - Biomedical Optics
Questions?

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