Communication: The transmission of information including voice, data, location (GPS), and sensor networks.

Skills of the communication engineer: how signals are transmitted, improve transmission performance, simultaneous communication of one point with multiple points, wireless communication technology

**Prerequisites:** EE3160, Signals and Systems, EE3180 Probability and Random Signal Analysis

**Courses:** EE3250, EE5525, EE4272, EE4365, EE4253

Other courses/areas: Electromagnetics, Signal Processing

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Job types:
- GPS applications; Satellites
- Computer networks
- Radio, television, telephone
- Wireless communication

Faculty:
- Dr. Aurenice Oliviera, 712
- Dr. Reza Zekavat, 825
Controls: The design of electrical systems that control a mechanical system.

Skills of the controls engineer: control algorithm development, mathematical modeling of physical systems

Prerequisites: EE3160, Signals and Systems

Courses: EE3261, EE4262, EE4219/20, EE4777, EE5750, EE3373, EE4373

Other courses/areas: EE4252, Signal Processing and It’s Applications

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Job types:
- Autonomous vehicles, drones, satellites
- Cruise control, auto-pilot systems
- Defense – missile guidance
- Robotics – factory automation

Faculty:
- Dr. Jeffrey Burl, 710
- Dr. Bo Chen, MEEM 824
- Dr. Jeremy Bos, 623
Computer Systems: The design of computer systems considering hardware design and interface

Skills of the computer systems engineer: Micro-controller applications, algorithm development, programming, hardware/software interface, HDL

Prerequisites: EE2174, Digital Logic C or java programming

Courses: EE3171 or EE3173, EE4173, EE4272, EE4271, EE4735

Other courses/areas: EE4252, Signal Processing and It’s Applications, EE4231 Physical Electronics, CS3421, Computer Organization, CS3411, Systems Programming, CS4321, Algorithms

Job types:
- Computer hardware design
- Firmware development
- Data or image processing
- Computer networks
- Embedded systems

Faculty:
- Mr. Kit Cischke, 520
- Dr. Zhou Feng, 513
- Dr. Timothy Havins, 504
- Dr. Shiyan Hu, 518
- Dr. Roger Kieckhafer, 713
- Dr. Saeid Nooshabadi, 512
- Dr. Zhaohui Wang, 506
Electromagnetics: The study of electromagnetic fields and waves, and devices that control and employ them, from DC to Optics: radar, radio, TV broadcasting, MRI, maglev trains, generators, transformers, etc...

Skills of the electromagnetics engineer: Understanding concepts of electromagnetic radiation, including AM & FM, cell phone, GPS; EM problem solving for developing and operating EM devices

Prerequisites: PH2200, MA3160, EE2112

Courses: EE3140, EE4411, EE4490

Other courses/areas: Signal Processing, Communications, Physics, Power electronics, Photonics

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Job types:
- EMC Engineer in hybrid electric vehicle design
- Electromagnetic interference/compatibility
- Antenna design
  - Phased array antennas
  - Steerable antenna
  - RF antenna design
- Microwave communications
- Develop EM devices for use in defense, medicine and communications

Faculty:
- Dr. Warren Perger, 819
- Dr. Elena Semouchkina, 711
Electronics: The study of electronic devices, systems, and equipment that use the effects produced by electrons

Skills: Understanding of electronic processes and functionalities of electronic devices, measure and control electronic systems.

Prerequisite: EE3131

Courses: EE4231, EE4271, EE4240

Other courses/areas: Photonics, Electronics Materials, Solid State Devices, Power Electronics

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Job types:
- Design and maintain embedded electronic controls
- Electronic hardware design engineer
- New product development in military and aerospace electronics
- Develop electronic devices and components
- Operate and control electronic devices and systems

Faculty:
- Dr. Duane Bucheger, 731
- Dr. Elena Semouchkina, 711
- Dr. Wayne Weaver, 236
**Photonics:** The control of photons in terms of generating and harnessing light and other forms of radiant energy.

Skills of the photonics engineer: light emission, transmission, deflection, amplification and detection by optical components; lasers; fiber optics; electro-optical instrumentation.

**Prerequisites:** PH2200, EE2112, MA3160, EE3140 (Co-requisite)

**Courses:** EE3090, EE3190, EE3290, EE4490, EE4290, EE4256

Other courses/areas: Electronics, Electromagnetics

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**Job types:**
- Design robotic vision system
- Outer-space photography technology
- Satellite design
- Laser applications engineer
- Develop photonic IC-based telecommunication products
- Fiber-optics
- Design and test optical transponders and transceivers

**Faculty:**
- Dr. Durdu Guney, 729
- Dr. Chris Middlebrook, 628
- Dr. Mike Roggemann, 503

**Student chapter:** SPIE/OSA International Society for optics and photonics

MTU lab: SB 24
Power & Energy: The generation, transmission, distribution and utilization of electric power and electrical devices

Prerequisites: EE3120

Courses: EE4221, EE4222, EE4226, EE5223, EE5250, EE4227, EE4219, EE4295, EE4296

Other courses/areas: Controls, Electronics

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Job types:
- Develop technologies to make our power grid more efficient, reliable and secure
- Integrate solar, wind energies into the power grid
- Design wind turbines
- Transmission line engineer
- Utilities and electrical power engineer consultant

Faculty:
- Dr. Leonard Bohmann, M7M 707
- Dr. Lucia Gaucia, 612
- Mr. Trever Hassell, 131
- Mr. John Lukowski, 233
- Dr. Bruce Mork, 614
- Dr. Sumit Paudyal, 611
- Dr. Joshua Pearce, M&M 504
- Dr. Chee-Woii Ten, 613
- Dr. Wayne Weaver, 236

Student chapter: IEEE-PES Power & Energy Society   ieee.org MTU lab: EERC 809
Signal Processing: The analysis, interpretation, and manipulation of sound, radar, images, video, digital data and other signals.

Skills of the signal processing engineer: Modeling and simulations of systems, algorithm development, probability

Prerequisite: EE3160

Courses: EE4252, EE4253, EE5522

Other courses/areas: Wireless communication, Control Systems, Probability & Random Signal Analysis

Job types:
- Design signal processor systems
- Detect and exploit radar signals
- Data and signal analysis
- Sensor systems development

Faculty:
- Dr. Daniel Fuhrmann, 118
- Dr. Michael Roggemann, 503
- Dr. Timothy Schulz, 505
- Dr. Reza Zekavat, 825