



Concentration

vs.

Focus Area

1. Listed on the Diploma
2. Get appropriate flowchart
3. See Judy or Trever, EERC 131 for questions
4. Submit request to add a concentration in MyMichiganTech

BSEE concentrations:

- Biomedical Applications
- Environmental Applications
- Photonics (join SPIE/OSA)
- Engineering Enterprise
- Electric Power Engineering (Fall 2017)

BSCpE concentration:

- Engineering Enterprise

1. Not listed on diploma
2. Formed with EE Electives or CpE Tech electives you choose (mix and match)
3. Highlight on resume
4. Leads to job type(s)

Focus Areas: (areas of specialization)

- AI
- Controls/Robotics and Embedded Systems & Control
- Cyber Security
- Data Mining
- Electromagnetics
- Electronics
- Photonics
- Power and Energy
- Signal Processing

“The purpose of a **concentration** is to give recognition that the student has actively and consciously engaged the intellectual issues central to the concentration”

ECE Focus Areas

Communication and Signal Processing: The transmission of information including voice, data, location (GPS), and sensor networks. The analysis, interpretation, and manipulation of sound, radar, images, video, digital data and other signals.

Skills of the communication/signal processing engineer: how signals are transmitted, improve transmission performance, simultaneous communication of one point with multiple points, wireless communication technology; Modeling and simulation of systems, algorithm development, probability

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

Courses: EE3250, EE5527, EE5525, EE4252, EE4253. CpEs: EE4272, EE4723

Other courses/areas: Electromagnetics, Signal Processing

Fall	Spring	Fall	Spring	5 th year Fall
EE3160	EE3180	EE3250	EE5527	EE5525
EE3140		EE4272 (CpE)	EE4723 (CpE)	
		EE4252	EE4253	

Job types:

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

Faculty:

- Dr. Ashok Ambardar
- Mr. Christopher Cischke, 520
- Dr. Aurenice Oliviera, 712
- Dr. Mike Roggemann, 503
- Dr. Tim Schulz, 505
- Dr. Zhaohui Wang, 506
- Dr. Reza Zekavat, 825

ECE Focus Areas

Controls/Robotics, Embedded Systems & Control: 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

CpE's: Take EE3160 as semester 5 choice

Courses: EE3261, EE4262, EE4219/20, EE4777, EE3373, EE4373, EE4737

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

Fall	Spring	Fall	Spring	Fall	Spring
MA2321/ MA3521	EE2112	EE3160	EE3261	MEEM4707* If approved	EE4262
		EE3373	EE4373	EE4777	EE4219/20
CS1111/ CS1142			EE3171/ EE3173		EE4737

If approved: *MEEM4707 – CpE-Technical Elective; EE-Approved Elective

Job types:

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

Faculty:

- Dr. Jeffrey Burl, 710
- Dr. Jeremy Bos, 623
- Dr. Roger Kieckhafer, 713

ECE Focus Areas

Computer Systems: The design of computer systems considering hardware design and interface; Computer system performance

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, EE4723, EE4271, EE4737

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

Fall	Spring	Fall	Spring
	EE3171 EE	EE4173 CpE	EE4737
	EE3173 CpE	EE4272 CpE	EE4723 CpE
		EE4271	EE5496 level
CS3421	CS3411	EE4252	CS4321

Job types:

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

Faculty:

- Mr. Christopher Cischke, 520
- Dr. Zhou Feng, 513
- Dr. Timothy Havens, 504
- Dr. Roger Kieckhafer, 713
- Dr. Saeid Nooshabadi, 512
- Dr. Tony Pinar, 731 (EE, Robotics)
- Dr. Zhaohui Wang, 506

ECE Focus Areas

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

	Spring	Fall	Spring
EE3140		EE4411	EE4490
		Antenna Design on demand	
		EE4227	Fall
EE3090	EE3190	EE3290	

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

ECE Focus Areas

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

Fall	Spring	Fall	Spring
EE3131		EE4271	EE4231
		EE4240 alt	
		EE4227	

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. Tony Pinar, 731
- Dr. Elena Semouchkina, 711
- Dr. Paul Bergstrom, 630

ECE Focus Areas

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

Spring	Fall	Spring	Fall	Spring
	EE3140			EE4290
EE2190	EE3190	EE3290	EE4490 or	EE4490
	EE3131			EE4231

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

ECE Focus Areas

Power & Energy: The generation, transmission, distribution and utilization of electric power and electrical devices such as motors, power generators, and transformers.

Prerequisites: EE3120

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

Other courses/areas: Controls, Electronics

Fall	Spring	Fall	Spring
EE3120		EE4221	EE4222
	EE4219/20	EE4227/8	EE5223/4 alt
		EE4295	EE5250 alt
		EE4296	EE4226

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-Wooi Ten, 613

CpE Focus Areas from CS Dept

CpE Technical Electives

- Artificial Intelligence
- Computer Networks
- Computer Science
- Cyber Security
- Data Mining
- Game Development
- Software Application Development

CS/CpE Focus Areas

Artificial Intelligence: Computing systems that can behave like humans, perform human tasks, and make human-like decisions. Computing systems that learn and remember in a human-like way.

Skills problem solving using AI, reasoning, heuristics, search heuristics, machine learning formal models, algorithm development

Prerequisite: CS2311, CS2321

Courses: CS3311, CS4811, CS5811 (Fall of 5th year, w/instructor permission)

Other courses/areas: robotics, controls, embedded systems



Fall	Spring	Fall	Spring	Fall	Spring
	CS2311	CS3311	CS4811	CS5811	
	CS2321				

Job types:

- Develop flight simulators
- Design drones
- Develop humanoids for NASA
- Computer analysis of OCT scans – speed up treatment start date – macular degeneration

Faculty:

- Dr. Timothy Havens, 504
- Dr. Laura Brown

CS/CpE Focus Areas

Computer Science: General computer science focus provides basic topics, and a high level of programming skills to develop software applications across all industries, develop software for the CPU, or work in scientific programming.

Skills Concurrent programming, Formal Models, OS, DB systems, Compiler design & optimization

Prerequisite: CS1142, CS2311, CS2321, CS3331, CS3421

NOTE: Take CS3331 as semester 5 choice

Courses: CS3331, CS3311, CS4411, CS3425, CS4121, CS4130

Other courses/areas: System performance, architecture

Fall	Spring	Fall	Spring	Fall	Spring
CS1142	CS3421	CS3331	CS3411	CS3425	CS4411
CS2311	CS2321	CS3311		CS4121	CS4130

Job types:

- Application programmer
- Scientific programmer
- Develop operating systems
- Database design

Faculty:

- Dr. Jean Mayo
- Dr. Ching-Kuang Shene
- Dr. Shuai Wang
- Dr. Zhenlin Wang
- Dr. Jianhui Yue
- Dr. Ruihong Zhang

CS/CpE Focus Areas

Cyber Security: Develop secure systems; protect data and systems from cyber attacks.

Skills Computer security, programming, cryptography

Prerequisite: CS3411, CS3311, CS3141

NOTE: Take CS3331 as semester 5 choice

Courses: EE4272, EE4723, CS4471, MA3203, CS4710, CS4711

Fall	Spring	Fall	Spring	Fall	Spring
CS1142	CS3421	CS3331	CS3411	EE4272	EE4723
CS2311	CS2321	CS3311	MA3203	CS4471	
			CS3141	CS4711	CS4710

Job types:

- Detect and solve security threats
- Design systems that deter cyber attacks
- Secure confidential databases (health; financial)

Faculty:

- Mr. Kit Cischke
- Dr. Ali Ebneenasir
- Dr. Jean Mayo
- Dr. James Walker
- Dr. Shuai Wang
- Dr. Jianhui Yue

CS/CpE Focus Areas

Data Mining: Develop systems to warehouse and access large datasets, for use in decision making and analytics. Analyze data for patterns, trends, and other useful information.

Skills Database management and database systems; analysis; statistics

Prerequisite: CS2311, CS2321

NOTE: Consider taking CS3331 as semester 5 choice

Courses: CS3425, CS4821, CS4425

Other courses/areas: Statistics, machine learning, algorithms, multiple-processor computing

Fall	Spring	Fall	Spring
	CS2311	CS3425	CS4821
MA3710	CS2321	CS4321	CS4425 (on demand)

Job types:

- Data Science Analyst
- Database system development
- Big data analytics

Faculty:

- Dr. Ruihong Zhang
- Dr. Laura Brown
- Dr. Jianhui Yue

CS/CpE Focus Areas

Game Development: Develop video and device-specific gaming systems for the entertainment industry.

Skills Team software build, 3-D Computer graphics, database systems

Prerequisite: MA2320, CS2311, CS2321

NOTE: Consider taking CS3331 as semester 5 choice

Courses: CS3141, CS4760, CS3425, CS4425, EE5496

Other courses/areas: Art, music, computer architecture, software processes and management, HCI

Fall	Spring	Fall	Spring	Fall	Spring	Fall (yr 5)
MA2320	CS2311			CS3141	CS4760	
	CS2321			CS3425	CS4425 (on demand)	
			CS3411	CS4611	EE4173	EE5496

Job types:

- Video game design and development
- Develop multi-platform production software
- iOS engineer
- Virtual reality

Faculty:

- Dr. Scott Kuhl
- Dr. Laura Brown
- Dr. Saeid Nooshabadi

CS/CpE Focus Areas

Software Application Development: Design and build software applications for a wide array of applications in business and industry

Skills: Programming, Formal Models, Team Software development, DB, S/W Processes & Mgmt

Prerequisite: CS2311, CS2321, CS1142, CS3421

NOTE: Take CS3331 as semester 5 choice

Courses: CS3141, CS3311, CS3425, CS4425, CS4121, CS4710, CS4711, CS4411, iOS Development (EE4870?)

Other courses/areas: Software Quality Assurance, Data Mining, Algorithms, Scientific & Technical Writing (HASS)

Fall	Spring	Fall	Spring	Fall	Spring
MA2320	CS2311	CS3311	CS4121	CS3141	CS4760
	CS2321		CS3141	CS3425	CS4425 (on demand)
CS1142	CS3421	CS3331	CS3411	CS4711	CS4710
			CS4411		EE.... iOS

Job types:

- Application Programmer
- Programmer/Analyst
- Software Engineer

Faculty:

- Dr. Ruihong Zhang
- Dr. Ali Ebneenasir
- Dr. Jean Mayo
- Dr. James Walker
- Dr. Shuai Wang

Which focus area is for me?



Taking core classes and inquire about elective courses which follow

Take a co-op or internship experience; talk with industry professionals and inquire at career center events

Join an enterprise project team that involves an area(s) you are considering

Look for undergraduate research opportunities

Talk with professors