**B.S. Electrical Engineering Advising**

**Focus Areas and Concentrations (or not!)**

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**Degree Audit Form**

Defines degree requirements

What is “catalog year”?  
- 202208 for academic year 2022-2023

Degree Services [webpage](#):  
- degree audit forms  
- minor requirements

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**EE Elective courses**

Required number of credits vary 3 – 21 depending on your catalog year and concentration or not

- Biomedical Applications: 6 - 12 credits
- Electric Power Engineering: 3 - 9 credits
- Enterprise: 12 - 18 credits
- Environmental Applications: 6 - 12 credits
- Photonics: 3 - 9 credits
- No concentration: 15 – 21 credits

Refer to appropriate degree audit .pdf form

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**Flowchart example:**

[Diagram of EE Elective course examples]

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**.pdf degree audit forms:**

Prior to fall 2022:

*Degree Audit Form*

- Defines degree requirements

What is “catalog year”?  
- 202208 for academic year 2022-2023

Degree Services [webpage](#):  
- degree audit forms  
- minor requirements

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**Fall 2022 and later:**

*EE Technical Electives: 21 credits*

Any EE course except CS1000, EE3010, EE3173, EE4000, EE4805, EE4901, EE4910, and those listed in major requirements. No more than six credits of EE2000 – EE2999 are allowed. Department approval is required for EEnXXe.
### Concentration vs. Focus Area

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Focus Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Listed on the Diploma</td>
<td>1. Not listed on diploma</td>
</tr>
<tr>
<td>2. Get appropriate flowchart</td>
<td>2. Formed with EE Electives you choose (mix and match)</td>
</tr>
<tr>
<td>3. See Judy or Trever, EERC 131 for questions</td>
<td>3. Highlight on resume</td>
</tr>
<tr>
<td>4. Submit request to add a concentration in MyMichiganTech</td>
<td>4. Leads to job type(s)</td>
</tr>
</tbody>
</table>

**BSEE concentrations:**
- Photonics (join SPIE/OSA)
- Electric Power Engineering
- Engineering Enterprise
- Biomedical Applications
- Environmental Applications

**Focus Areas: (areas of interest)**
- Communication
- Controls/Robotics/Automation
- Electromagnetics
- Electronics
- Photonics
- Power and Energy
- Signal Processing

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**Minor requirements (audit forms).** Details about minors are found [here](#).

“The purpose of a **concentration** is to give recognition that the student has actively and consciously engaged the intellectual issues central to the concentration”
Number of credits of “EE Electives” by Concentration:

- Biomedical Applications: 6-12 credits
- Electric Power Engineering: 3-9 credits
- Enterprise: 12-18 credits
- Environmental Applications: 6 - 12 credits
- Photonics: 3 - 9 credits
- No concentration: 15 – 21 credits

Student Degree Audit Report area:

Not yet filled:

- 2) Electrical Engineering Electives: 15 credits
  - Select any course not already used, except EE3010, EE4000, EE3005, EE4901 and EE4910.
  - Not allowed: EE3010, EE 4000, EE 4005, EE 4901, EE 4910
  - Course list: EE 1000 to EE 4999

Optional course work is complete

- 2) The ee elective course work is complete
- 4.0 credits added 5 courses taken

Electronics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Crs. Requirements</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 4271</td>
<td>VLSI Design</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4272</td>
<td>VLSI Computer Networks (based w/ CDC6600)</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4273</td>
<td>IoT Applications and Design</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4274</td>
<td>Computer Security</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4275</td>
<td>Embedded System Interfacing</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
</tbody>
</table>

Electromagnetics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Crs. Requirements</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 5435</td>
<td>High-Speed Circuit Design</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
</tbody>
</table>

Computer Systems

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Crs. Requirements</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 4276</td>
<td>Computer Networks</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4277</td>
<td>TCP/IP &amp; Internetworking</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4278</td>
<td>Computer Security</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
<tr>
<td>EE 4279</td>
<td>Embedded System Interfacing</td>
<td>3</td>
<td>Instructor permission</td>
</tr>
</tbody>
</table>


**Note:** Choose courses at will. You do not need to take all courses from an area.
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: EE4250, EE5527, EE5525, EE EE4365, EE4253. CpEs: EE4272, EE4723

Other courses/areas: Electromagnetics, Signal Processing

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Fall</th>
<th>Spring</th>
<th>5th year Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 3160</td>
<td>EE 3180</td>
<td></td>
<td>EE 4250</td>
<td>EE5525</td>
</tr>
<tr>
<td>EE 3140</td>
<td></td>
<td>EE 4272 (CpE)</td>
<td>EE4723(CpE)</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>EE4365</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>EE 4252</td>
<td>EE4253</td>
</tr>
</tbody>
</table>

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

Faculty:
- Prof. Aurenice Oliviera, 234
- Prof. Lan (Emily) Zhang, 623
- Prof. Christopher Cischke, 520
- Prof. Zhaohui Wang, EERC 506
Controls: encompassing Robotics, Controls, & Automation: The design of electrical, electronic and computer systems that control physical devices.

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

Prerequisites: EE3160, Signals and Systems  
CpE’s: Take EE3160 as semester 5 choice

Courses: EE2180, EE3261, EE4262, EE4219/20, EE4777, EE5750, EE3373, EET4373, EE4737, EE4375
Other courses/areas: EE4252, Signal Processing and It’s Applications

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

Faculty:
- Prof. Hongyu An, 612
- Prof. Jeremy Bos, 623
- Prof. Jeffrey Burl, 710
- Prof. Shane Oberloier, 518
- Prof. John Pakkala, 824
- Prof. Tony Pinar, 731

Consider joining Robotic Systems Enterprise (RSE) L15
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, EE4271, EE4737

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:

- Dr. Hongyu An, 612
- Mr. Christopher Cischke, 520
- Dr. Zhaohui Wang, 506
- Dr. Lan (Emily) Zhang, 623

Job types:

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

Faculty:

- Dr. Hongyu An, 612
- Mr. Christopher Cischke, 520
- Dr. Zhaohui Wang, 506
- Dr. Lan (Emily) Zhang, 623
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... The foundation for much of what we do in the ECE field.

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Spring</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 3140</td>
<td></td>
<td>EE 4411</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Antenna Design on demand</td>
<td></td>
</tr>
<tr>
<td>EE 3190</td>
<td>EE 3290</td>
<td>EE 4490</td>
<td>EE 5525</td>
</tr>
</tbody>
</table>

Job types:
- EMC Engineer in hybrid electric vehicle design
- Electromagnetic interference/compatibility
- Electric power engineering applications
- Antenna design
  - Phased array antennas; Steerable antenna; RF antenna design
- Microwave communications; radio; cell phone; TV
- Develop EM devices for use in defense, medicine and communications

Faculty:
- Dr. Paul Bergstrom, 630
- Dr. Durdu Guney, 729
- Dr. Chris Middlebrook, 628
- 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, EE4232, EE4271, EE4240, EE4227

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

<table>
<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>EE 3131</td>
<td>EE 4271</td>
<td>EE 5460</td>
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</tr>
<tr>
<td>EE 4240</td>
<td>EE 5435</td>
<td></td>
<td></td>
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<tr>
<td>EE 4231</td>
<td>EE 4232</td>
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<td></td>
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<tr>
<td>EE 4227</td>
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</tr>
</tbody>
</table>

Job types:

- Design and maintain embedded electronic controls
- Electronic hardware design engineer
- New product development in military and aerospace electronics
- Develop electronics for GPS or cell phones; any electronic device
- Operate and control electronic devices and systems

Faculty:
- Dr. Hongyu An, 612
- Dr. Paul Bergstrom, 630
- Dr. Tony Pinar, 731
- Dr. Elena Semouchkina, 711
Photonics & Optics: Photonics is 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 or prereq)

Courses: EE2190, EE3190, EE3290, EE4490, EE4235, EE4290

Other courses/areas: Digital Signal Processing, Electronics, Electromagnetics

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

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

Student chapter: SPIE/OSA International Society for optics and photonics
MTU lab: SB 24
contact: Mike at mamaurer@mtu.edu or Evan at ejgawron@mtu.edu
ECE Focus Areas

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

Prerequisites: EE3120
Courses: EE4221, EE4222, EE4226, EE5223, EE5250, EE4227, EE4219, EE4295, EE4296
Other courses/areas: Controls, Electronics, grad courses

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
• Electric vehicle design

Faculty:
• Prof. Flavio Costa, 613
• Prof. Trever Hassell, 131
• Prof. Yunting Liu, 611
• Prof. John Lukowski, 233
• Prof. Bruce Mork, 614
• Prof. Chee-Wooi Ten, 235

Student chapter: IEEE-PES Power & Energy Society ieee.org MTU lab: EERC 809
ECE Focus Areas

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, EE3180
Courses: EE4250, EE4252, EE4253
Other courses/areas: Digital Communications, Control Systems, Probability & Random Signal Analysis

Job types:
- Radar, sonar, communications
- Intelligence, surveillance
- Detect and exploit radar signals
- Data acquisition and signal analysis
- Sensor systems development
- Biomedical signal processing
- Cell phone technology

<table>
<thead>
<tr>
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<th>Spring</th>
<th>Fall</th>
<th>Spring</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE3 160</td>
<td>EE 4252</td>
<td>EE 4253</td>
<td>EE 5257 (on dmd)</td>
<td></td>
</tr>
<tr>
<td>EE 3180</td>
<td>EE 4250</td>
<td>EE 5365</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Which focus area is for me?

Taking core classes and inquiring

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
Partial list:

Christopher Kiri Ciochko  
Senior Lecturer, Electrical and Computer Engineering  
Areas of Interest:  
- Parallel computing and UPC  
- Engineering education  

Duarte Gumeny  
Associate Professor, Electrical and Computer Engineering  
Areas of Interest:  
- Nanomaterials and Nanoelectronics  
- Solar Cells  
- Quantum Computing, Communications, and Cryptography  
- Photonic/Plasmonic Materials and Devices  
- Acoustic Bandgap Materials

Trever Hassell  
Senior Lecturer, Electrical and Computer Engineering  
Areas of Interest:  
- Power Electronics Systems  
- Electric Drives and Machinery  
- Hybrid and Electric Vehicle Systems  
- Microrobots

Nagash Hatti  
Professor of Practice, Electrical and Computer Engineering  

Yunying Liu  
Assistant Professor, Electrical and Computer Engineering  
Areas of Interest:  
- Renewable energy integration  
- Converter aging and reliability  
- Energy storage, supercapacitors, battery  
- Power systems  
- Distributed energy resources
BSEE - Photonics Concentration

Bachelor of Science in Electrical Engineering
Classes begin in Spring of 2nd year:  (may begin in spring of 3rd year)

1. Get a copy of the EE-Phonics Concentration flowchart and .pdf degree audit that pertain to your catalog year.

2. In 2nd year spring, Take EE2190 and postpone EE3120 into future semester. It is not required with the photonics concentration.

3. Complete EE3140, Electromagnetics in Fall of 3rd year to stay on track. Important Prereq.

4. Take EE3190 in fall of 3rd year, EE3290 in Spring of 3rd year and EE4490, Laser systems in fall or spring of 3rd or 4th year (check the Schedule of Classes each semester for EE4490).

5. Select two concentration elective courses, plan for prerequisites, and semester offered.

Faculty:
• Prof. Durdu Guney, 729
• Prof. Chris Middlebrook, 628
• Prof. Mike Roggemann, 503
BSEE - Biomedical Applications Concentration
Bachelor of Science in Electrical Engineering
Classes begin in 2nd year:

1. Get a copy of the EE-Biomedical Applications Concentration flowchart and .pdf degree audit that pertain to your catalog year.

2. Take Anatomy & Physiology I (BL2010) AND Cellular & Molecular Biology (BE2400) in Fall of 2nd year.


4. In Spring of 2nd year, decide whether to take Biomechanics I or Biomaterials I. Plan in 3rd year, for your Biomedical Applications Concentration “focus”. Become familiar with concentration elective courses and semester offered.

5. Take BE3700 and BE3701, Bioinstrumentation and Lab in Spring of 3rd year or 4th year.

Faculty:
- Prof. Chris Middlebrook, 628
- Prof. Sean Kirkpatrick, M&M 301
BSEE - Environmental Applications Concentration

Bachelor of Science in Electrical Engineering

Classes begin in 3rd year:

1. Get a copy of the EE-Environmental Applications Concentration flowchart and .pdf degree audit that pertain to your catalog year.

2. First 2 years of coursework are the same as the BSEE.

3. Take Environmental Engineering Fundamentals (CEE3501) in Fall of 3rd yr. (or take CEE3503 in spring which may replace CEE3501); Take Environmental Monitoring and Measurement Analysis (CEE3502) in Spring of 3rd year. (may be taken in reverse order: CEE3502 in spring 3rd year, then CEE3501 in fall of 4th year)

4. In Fall of 2nd year or Spring of 3rd year, decide which remote sensing sequence you prefer: 1) EE4252 and GE4250 OR 2) EE2190 and EE3190

5. Become familiar with the Environmental Engineering Quality elective courses and semester offerings. Choose two courses from the list.

Faculty:
- Dr. Flavio Costa, 613 (DSP)
- Dr. Durdu Guney, 729
- Dr. Chris Middlebrook, 628
- Dr. Tony Pinar, 731 (DSP)
1. Electric Energy Systems (EE3120) is the prerequisite course to the Electric Power Engineering courses. This can be taken in Spring of 2\textsuperscript{nd} year, Summer or during 3\textsuperscript{rd} year.

2. Take Power Analysis 1 (EE4221) in Fall of 4\textsuperscript{th} year; Take Power Analysis 2 (EE4222) and Power Engineering Lab (EE4226) in Spring of 4\textsuperscript{th} year.

3. In your 3\textsuperscript{rd} year, become familiar with concentration elective courses, prerequisites and semesters offered. You will choose two electric power engineering elective courses which are typically taken in the 4\textsuperscript{th} year.

Faculty:
- Prf. Flavio Costa, 613
- Prf. Yunting Liu, 611
- Prf. John Lukowski, 233
- Prf. Chee-Woii Ten, 235
Concentrations

BSCpE and BSEE - Enterprise Concentration

Bachelor of Science in Computer Engineering
Bachelor of Science in Electrical Engineering

1. Choose an Enterprise to join. May begin as early as Spring of 1st year (ENT1960 is optional), but is not required until Fall of 3rd year - begin in ENT3950.

2. Minimum *required project work* is 4 semesters in 3rd and 4th year: ENT3950, ENT3960, ENT4950 and ENT4960.

3. Take Teaming in Enterprise (ENT2961) in Fall of 2nd or 3rd year; Take Communication Contexts (ENT2962) in Spring of 2nd or 3rd year.

4. In your 3rd year, become familiar with concentration elective courses. A list of these Enterprise Instructional modules are included in your degree audit report. Add your course selections to your academic plan.

Faculty: the Enterprise Advisor of the enterprise you join. Enterprise office: M&M722
How to Add a concentration

Request to change major/minor/concentration

To drop a concentration – send email request to degree@mtu.edu

That’s all folks!