Electronic Engineering Technology

College of Science, Engineering & Technology
Department of Electrical & Computer Engineering and Technology
242 Trafton Science Center N • 507-389-5747
Website: www.cset.mnsu.edu/eect

Chair: Vincent Winstead, P.E., Ph.D.
Program Coordinator: Vincent Winstead, P.E., Ph.D.

Gale Allen, Nannan He, Tom Hendrickson, Han-Way Huang, Harry Jones, Muhammad Khaliq, Julio Mandojana, Puteri Megat-Hamari, Vincent Winstead, Xuanhui Wu, Qun Zhang

Accreditation. The Electronic Engineering Technology program is accredited by the Engineering Technology Accreditation Commission of ABET, 415 N. Charles Street, Baltimore, MD 21201, 410.347.7700, www.ABET.org

Electronic Engineering Technology is a technological field requiring the application of scientific and engineering knowledge and methods, combined with technical skills, in support of engineering activities. An electronic engineering technologist is a person who is knowledgeable in electronics theory and design and who understands state-of-the-art practices in digital and analog circuits and systems. Computers, controls/ automation, robotics, instrumentation, and communications are just a few fields open to engineering technologists.

Overall the program strives to prepare students for entry into the technical workforce with well-developed skills. In particular, the department strives to ensure that its graduates have an ability to:
1. Apply knowledge of science, mathematics, and engineering
2. Design, and conduct experiments as well as analyze and interpret data
3. Design a system, component, or process to meet specified needs
4. Function effectively in teams
5. Identify, formulate, and solve engineering problems
6. Have an understanding of professional and ethical responsibilities
7. Communicate effectively

The Educational Objectives for our Bachelor’s Degree in Electronic Engineering Technology program area:
1. Function as responsible members of society with an awareness of the social, ethical, and economic ramifications of their work.
2. Become successful practitioners in electronic engineering technology and other diverse careers.
3. Pursue continuing and life-long learning opportunities.
4. Provide necessary skills to advance technically and/or managerially
5. Provide foundational education that allows for personal growth and flexibility through their career.

Our metrics for determining success in meeting these objectives will include:
1. Assessment of societal, economic awareness, and ethical performance of our graduates by the graduate and employer.
2. Monitoring of the success of our graduates in the workforce.
3. Assessment of continuing and life-long learning by the graduate (and their employer as applicable).
4. Ongoing contact with graduates to determine career paths and challenges confronted.

POLICIES/INFORMATION

Admission to Major

- a minimum of 32 earned semester credit hours.
- a minimum cumulative GPA of 2.00 (“C”).

Contact the department for application procedures.

Graduation Policy. Students graduating with a degree in Electronic Engineering Technology must have:
1) completed a minimum of 20 semester credit hours of upper division EET courses;
2) have a cumulative GPA of 2.0 or higher for all Minnesota State Mankato coursework; and
3) have completed their senior design sequence (EET 461 and EET 462) at Minnesota State Mankato.

P/N Grading Policy. A student who majors or minors in EET must elect the grade option for all required courses including general education courses listed by number even if offered by another department.

If the credits earned for composition, technical writing and communication studies courses equal less than 9 credits, either an advanced communication studies course or a course in English language literature must be selected as a general elective.

In addition to the transfer of credit policy described in this catalog for students transferring to Minnesota State Mankato from other schools, the electronic engineering technology program has additional policies:
1. All transfer student must take EET 221.
2. For courses taken at technical colleges/vocational technical schools and pertinent courses taken in the military the student may receive up to 8 credits upon review of course materials, grades and written approval by the program coordinator. The credit can be used for EET 112, EET 113 and EET 114. The student may also attempt to test out of EET 114, EET 222, and EET 223.
3. For courses taken at community colleges and four-year colleges, up to 25 credits may be accepted if the transcript is from an ABET-accredited program. If the program is not accredited by ABET, up to 20 credits may be accepted. Grades of transfer credits must be “C” or better to be acceptable for substitution for required courses.
4. Grades must be “C-” (1.67) or better for courses taken at Minnesota State Mankato.

Petition to evaluate transfer credits must occur no later than the first semester the student is enrolled in or declared a major housed in the Department of Electrical and Computer Engineering and Technology.

All international students wishing to have transfer credits granted from non-U.S. schools will be required to use the ECE evaluation service to be completed no later than first semester at Minnesota State Mankato.

Testing for course credit will be available via prior application made with the program coordinator. Students may not apply for credit by examination for an EET course in which they were previously enrolled at Minnesota State Mankato or for any EET course above EET 223.

Grades must be 1.65 “C-” or better for courses taken at Minnesota State Mankato to be accepted.

ELECTRONIC ENGINEERING TECHNOLOGY BS
Degree completion = 128 credits

Students who do not have the required background for MATH 115 may have to take additional preparatory coursework as well. Consult with your major advisor to plan your general education and major requirements.

All students must complete a minimum of 12 semester credits of mathematics starting with Precalculus math and a minimum of 24 semester credits of combined mathematics and science courses.

Required General Education

Students in this degree program must complete 21 additional general education course hours to meet university general education and diverse cultures requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMST 102</td>
<td>Public Speaking</td>
<td>(3)</td>
</tr>
<tr>
<td>ENG 101</td>
<td>Composition</td>
<td>(4)</td>
</tr>
</tbody>
</table>

Pre-requisites to the Major

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EET 113</td>
<td>DC Circuits</td>
<td>(3)</td>
</tr>
<tr>
<td>EET 114</td>
<td>AC Circuits</td>
<td>(3)</td>
</tr>
<tr>
<td>EET 141</td>
<td>Integrated Computer Technology</td>
<td>(4)</td>
</tr>
</tbody>
</table>
ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EET 492</td>
<td>Integrated Circuit Technology (4)</td>
<td></td>
</tr>
<tr>
<td>EET 455</td>
<td>Power Electronics (3)</td>
<td></td>
</tr>
<tr>
<td>EET 452</td>
<td>Operational Amplifiers (choose one of the following)</td>
<td></td>
</tr>
<tr>
<td>EET 223</td>
<td>Electronics II (4)</td>
<td></td>
</tr>
<tr>
<td>EET 254</td>
<td>Microprocessors I (4)</td>
<td></td>
</tr>
<tr>
<td>MATH 115</td>
<td>Calculus I (4)</td>
<td></td>
</tr>
<tr>
<td>MATH 121</td>
<td>Calculus II for Engineering Technology (2)</td>
<td></td>
</tr>
<tr>
<td>PHYS 211</td>
<td>Principles of Physics I (4)</td>
<td></td>
</tr>
<tr>
<td>PHYS 212</td>
<td>Principles of Physics II (4)</td>
<td></td>
</tr>
</tbody>
</table>

**Major Common Core**
Three (3) credits of EET 497 may be used to satisfy common core requirements.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 104</td>
<td>Introduction to Chemistry (3)</td>
<td></td>
</tr>
<tr>
<td>EET 340</td>
<td>Programmable Hardware Technology (4)</td>
<td></td>
</tr>
<tr>
<td>EET 341</td>
<td>Electronic Shop Practices (2)</td>
<td></td>
</tr>
<tr>
<td>EET 355</td>
<td>Electrical Power Systems (3)</td>
<td></td>
</tr>
<tr>
<td>EET 452</td>
<td>Operational Amplifier Applications (3)</td>
<td></td>
</tr>
<tr>
<td>EET 456</td>
<td>Analog Communications (4)</td>
<td></td>
</tr>
<tr>
<td>EET 461</td>
<td>Industrial Automation I (4)</td>
<td></td>
</tr>
<tr>
<td>EET 462</td>
<td>Industrial Automation II (4)</td>
<td></td>
</tr>
<tr>
<td>EET 484</td>
<td>Microprocessors II (4)</td>
<td></td>
</tr>
<tr>
<td>EET 497</td>
<td>Internship (3)</td>
<td></td>
</tr>
<tr>
<td>MET 427</td>
<td>Quality Management Systems (3)</td>
<td></td>
</tr>
</tbody>
</table>

**Major Restricted Electives**
Choose a minimum of 6 credits from 300-level and 400-level courses with advisor's approval.

**Major Unrestricted Electives**
Choose one of the following:

- STAT 154 Elementary Statistics (3)
- STAT 354 Concepts of Probability and Statistics (3)

**Other Graduation Requirements**
EE 450 Engineering Economics (3)

**Required Minor:** None.

**RENEWABLE ENERGY CERTIFICATE PROGRAM**
Renewable Energy certificate includes targeted courses in power systems, instrumentation and fluid power intended to supplement the contents of a technical Associate of Science (AS) degree or Technician program in Wind Turbine Technology or AS/BS degree in Renewable Energy. The certificate includes three courses for a total of nine credits.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AET 334</td>
<td>Fluid Power (3)</td>
<td></td>
</tr>
<tr>
<td>EET 315</td>
<td>Programmable Instrumentation (3)</td>
<td></td>
</tr>
<tr>
<td>EET 355</td>
<td>Electrical Power Systems (3)</td>
<td></td>
</tr>
</tbody>
</table>

**ELECTRONIC ENGINEERING TECHNOLOGY MINOR**

**Required for Minor**

- EET 112 Elementary Electricity and Electronics (3)
- EET 113 DC Circuits (3)
- EET 114 AC Circuits (3)
- EET 222 Electronics I (4)

**Required for Minor (Elective Options, 7-8 credits)**

<table>
<thead>
<tr>
<th>Option</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital</td>
<td>EET 254</td>
<td>Microprocessors I (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EET 141</td>
<td>Integrated Computer Technology I (4)</td>
<td></td>
</tr>
<tr>
<td>Electronics</td>
<td>EET 223</td>
<td>Electronics II (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(choose one of the following)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EET 452</td>
<td>Operational Amplifier Applications (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EET 455</td>
<td>Power Electronics (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EET 492</td>
<td>Integrated Circuit Technology (4)</td>
<td></td>
</tr>
</tbody>
</table>

**Networking Option**

- EET 254 Microprocessors I (4)
- EET 430 Computer Networking I (4)

**Communications Options**

- EET 223 Electronics II (4)
- EET 456 Analog Communications (4)

**Power Option**

- EET 223 Electronics II (4)
- EET 355 Electrical Power Systems (3)

**COURSE DESCRIPTIONS**

**EET 112 (3) Elementary Electricity and Electronics**
The basic elements of electricity and electronics are explored in an internet enabled, self paced course. Laboratories make use of a Virtual Laboratory environment to provide experience with issues in wiring, power, circuits, and digital electronics.
Pre: MATH 115, or concurrent
Fall, Spring
GE-3

**EET 113 (3) DC Circuits**
A study of DC electrical circuits, Kirchhoff’s laws, series and parallel circuits, inductors, capacitors, circuit response to RL, RC and RLC circuits. Thevenin’s equivalent circuit theorem, and other network analysis theorems. Use of dependent sources in DC circuits.
Pre: MATH 115, or concurrent
Fall, Spring
GE-3

**EET 114 (3) AC Circuits**
Use of dependent sources in AC circuits.
Pre: EET 113
Fall, Spring
GE-3

**EET 115 (3) Understanding Computers**
A self-paced, interactive, multi-media course, for nonengineering students, exploring the basics of computer hardware. The course will cover concepts behind computer design and operation, including issues such as the need for RAM, hard drive, memory, ROM, etc.
Fall, Spring
GE-13

**EET 116 (3) Communications-Past, Present & Future**
This is an introductory course in the use of technology for communication. During the semester students will study the evolution of communications technology from early days to the present. This course will cover wireless, analog, and digital techniques including telephony, the internet, and mobile formats. The student will study theory and principles involved in the different types of communications. Modern techniques in digital communications will be discussed and demonstrated through simulation. A consumer example of digital communication will be given.
Variable
GE-13

**EET 117 (3) Introduction to Digital Electronics**
Hands-on experiences in the use of digital integrated circuits and logic families. Students will study logic gates, number systems, flip flops, latches, registers, computer arithmetic and memory. A self paced format with an open laboratory format.
Variable
GE-3, GE-8

**EET 118 (3) Electricity - Generation, Usage & Green Alternatives**
This course covers the development and status of electrical power as a global resource. This includes usage, generation, and impact on societies through out the world. Finally, the course will examine the many renewable generation options.
Variable
GE-3, GE-8
EET 125 (3) Perspective on Technology
Historical, cultural, ethical, philosophical, developmental, and creative aspects of engineering and technology as a discipline are explored. The course also examines concepts and events leading to important innovations of recent times; microwave ovens, FAX machines, personal computers, traffic signals, and video games. Available for general education and cultural diversity offered as self-paced online format. Fall
GE-6, GE-8
Diverse Cultures - Purple

EET 141 (4) Integrated Computer Technology I
Digital circuit, logic, and C programming skills needed for electronic and computer engineering technology. Covers binary arithmetic, clock distribution, timing, TTL, CMOS, logic gates, Boolean algebra, multiplexer, counter, adder, logic simulation, C language elements, C programming techniques and use of digital test equipment. Students design and build an Arithmetic Logic Unit (ALU) from small-scale logic components and simulate each block in C. Coreq: EET 113
Fall

EET 142 (4) Integrated Computer Technology II
Continues building digital circuit, logic, and C programming skills needed for electronic and computer engineering technology. Covers comparators, decoding, encoding, multiplexers, flip-flops, Schmitt Trigger, C functions, arrays, variables, recursive functions, structures, and strings. Students design, build and test a microprocessor using TTL gates and simulate each block in C. Pre: EET 141
Spring

EET 143 (4) Integrated Computer Technology III
Sequential circuits, logic timing, clock distribution, counter, LED display, shift register, transceiver, 555 timer, 555 oscillator, D/A converter, RAM, ROM, mass memory, synchronous logic, asynchronous logic, microprocessor-interfacing, testability, and simulation. Pre: EET 142
Fall

EET 221 (3) Electronic CAD
Drafting principles involving use of computer-aided design software in laying out block diagrams, schematic diagrams, production drawings, graphical presentation of data, and printed circuit board layout and construction. Pre: EET 113
Fall

EET 222 (4) Electronics I
An introduction to semiconductor theory and circuits: includes characteristics curves, biasing techniques and small signal analysis of FETs and MOSFETs, feedback concept, BJTs and FETs frequency response. Pre: EET 113
Fall

EET 223 (4) Electronics II
An introduction to differential amplifier, linear and nonlinear operational amplifiers, power amplifiers, linear digital ICs, oscillators, power supplies, D/A conversion, four layered devices and their applications. Pre: EET 222
Coreq: EET 114
Spring

EET 254 (4) Microprocessors I
A study of microcomputer hardware and software fundamentals, the instruction set and the addressing modes of a microprocessor/microcontroller, assembly programming, basic I/O concepts, parallel I/O methods, asynchronous serial I/O methods, synchronous serial I/O methods, A/D conversion, and timer applications. Pre: EET 143
Spring

EET 298 (1-4) Topics
Varied topics in Electronic and Computer Engineering Technology. May be repeated as topics change. Pre: to be determined by course topic

EET 310 (4) Programming Tools
Several programming tools and their use in creating electronic hardware systems are covered in this course. Creating special-purpose hardware using numerical analysis programs written in C. Creating hardware utilizing Virtual applications written in C. Use of scripting languages in hardware applications. Using Excel for input-output functions. Pre: EET 143, EET 222 and EET 254

EET 315 (3) Programmable Instrumentation
Instrumentation system design and integration with sensors, actuators and other electronic indicator components. Programming in a block diagram environment and with embedded C to interface different hardware components. Pre: MATH 113 or MATH 115 Variable

EET 340 (4) Programmable Hardware Technology
Create working programmable hardware using FPGA, GAL and other logic technology. Use industry standard tools such as Verilog, Xilinx, Orcad and Multisim along with development kits and extension boards to implement programmable systems. Interface LED displays, switches and I/O devices with programmable logic to create processing systems. Evolution of programmable logic and analog circuits. Pre: EET 143
Spring

EET 341 (2) Electronic Shop Practices
An introduction to tools, equipment, materials, and techniques used in fabrication of electronic projects and printed circuit boards. Pre: EET 142
Spring

EET 355 (3) Electrical Power Systems
Electrical power and magnetic circuit concepts, transformers, generators and motors (DC, synchronous, induction), special purpose motors, power-electronic motor drivers, prime movers/alternatives, generation, transmission/distribution, system stability/protection. Pre: PHYS 212
Fall

EET 393 (1-4) Practicum
Elective credit for approved experience in off-campus work related to EET major. Permission required. Fall, Spring

EET 398 (0) CPT: Co-Operative Experience
Curricular Practical Training: Co-Operative Experience is a zero-credit full-time practical training experience for one summer and on adjacent fall or spring term. Special rules apply to preserve full-time student status. Please contact an advisor in your program for complete information. Pre: EET 223. At least 60 credits earned; in good standing; instructor permission; co-op contract; other prerequisites may also apply. Fall, Spring, Summer

EET 430 (4) Computer Networking I
An introduction to the basic foundations of computer networking. The course will encompass telecommunications, local area networks, wide area networks and wireless communication. Topics covered include OSI model, the TCP/IP MODEL, different network topologies and associated hardware, error detection and correction, protocols, and security. Pre: EET 143, EET 223, EET 254
Fall
EET 431 (4) Computer Networking II
Pre: EET 430
Spring

EET 441 (4) Embedded Systems
Design and prototyping of embedded systems including both hardware and software components. A variety of hardware, software, sensors and displays will be used depending on the embedded system requirements. Issues related to hardware and software specifications will be studied as well as appropriate documentation standards.
Pre: EET 143
Spring

EET 452 (3) Operational Amplifier Applications
Operational amplifier circuits utilized in filters, sensors, comparators, voltage regulators, device testing, measurement systems, multipliers, phase-locked loops, and A/D converters. Differential amplifier basics. Linear integrated circuit processing.
Pre: EET 223 and MATH 121
Fall

EET 455 (3) Power Electronics
Use of solid-state switching devices in the conversion and control of electrical energy for low power and high power applications such as switched-mode regulated DC power supplies, motor speed control, lighting control, uninterruptible power supplies and HVDC transmission.
Pre: EET 143
Variable

EET 456 (4) Analog Communications
Communications principles and systems. Practical engineering aspects involved in modulation-demodulation, receivers, transmitters and filters. Also included are radiation and antennas, guided waves, microwaves, and microwave systems.
Pre: EET 222
Spring

EET 457 (1-4) Topics
Varied topics in Electronic and Computer Engineering Technology. May be repeated as topics change.
Pre: 40 hrs EET credits or written permission from program coordinator.
Fall, Spring

EET 458 (1) Advanced Instrumentation
Experiences with electronic equipment and instrumentation including maintenance, repair, calibration, safety and component identification.
Pre: 25 hours of EET courses, or consent
Spring

EET 461 (4) Industrial Automation I
Automation components and subsystems involving sensors, transistors, logic, amplifiers, software, microprocessors, PLCs, actuators, encoders, stages, motors, controllers, and drives. Students design, simulate, build, test and document automation systems for Capstone projects.
Pre: EET 223 and EET 254
Fall

EET 462 (4) Industrial Automation II
Continues building skills in automation components and subsystems involving sensors, transistors, logic, amplifiers, software, microprocessors, PLCs, actuators, encoders, stages, motors, controllers and drives. Students design, simulate, build, test and document automation systems for Capstone projects.
Pre: EET 461
Spring

EET 484 (4) Microprocessors II
A study of a high performance microprocessor architecture. Applications of a microprocessor for monitoring and controlling systems will be studied. Optimal utilization of a microprocessors resources will be stressed. PC programming in assembly and a high level language.
Pre: EET 143
Fall

EET 486 (3) Digital Communications
Pre: EET 142, EET 222
Variable

EET 487 (3) RF Systems Technology
Pre: EET 223
Variable

EET 491 (1-4) In-Service
EET 492 (4) Integrated Circuit Technology
Semiconductor industry and overview of integrated circuit manufacturing, integrated circuit types, crystal growth and wafer manufacturing, physics of semiconductor materials, detail of major IC fabrication steps, process yield, semiconductor devices and integrated circuit formation, packaging, and semiconductor measurements, introduction to layout tools.
Pre: EET 223
Spring

EET 494 (1) Global Experience in Engineering and Technology
This class provides students pursuing a minor in "Global Solutions in Engineering and Technology" with an opportunity to explore a set of topics related to achieving success in advance of and following an international experience (internship, study abroad, etc.). Speakers will include faculty, graduate students, visiting researchers and industry members as well as student participants. Returning students will be required to participate in mentoring of students preparing for their international experience and provide written and/or oral presentations of various topics during the semester. This course is required both before and after participation in the international experience (min. 2 cr.)
Variable

EET 497 (1-6) Internship
Should be taken at end of junior year. Permission required.
Pre: 40 hrs EET credits or written permission from program coordinator.
Fall, Spring

EET 498 (1-4) Topics
Varied topics in Electronic and Computer Engineering Technology. May be repeated as topics change.
Pre: to be determined by course topic

EET 499 (1-4) Individual Study
Fall, Spring