

# ELECTRONIC ENGINEERING TECHNOLOGY BS, CERTIFICATE AND MINOR

## Electronic Engineering Technology

College of Science, Engineering & Technology  
Department of Electrical & Computer Engineering and Technology  
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Website: [www.cset.mnsu.edu/ecet](http://www.cset.mnsu.edu/ecet)  
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Chair: Qun Zhang  
Program Coordinator: Qun Zhang

Faculty: Gale Allen, Nannan He, Tom Hendrickson, Han-Way Huang, 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, [www.abet.org](http://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 Bachelors 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 work force.
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.

### Academic Map/Degree Plan at [www.mnsu.edu/programs/#All](http://www.mnsu.edu/programs/#All)

#### POLICIES/INFORMATION

**Admission to Major** is granted by the department. Minimum program admission requirements are:

- 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 EET 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 credit hours to meet university general education and diverse cultures requirements.

|      |     |                     |
|------|-----|---------------------|
| CMST | 102 | Public Speaking (3) |
| ENG  | 101 | Composition (4)     |

#### Prerequisites to the Major

|      |     |   |
|------|-----|---|
| EET  | 113 | DC Circuits (3)   |
| EET  | 114 | AC Circuits (3)   |
| EET  | 141 | Integrated Computer Technology I (4)                    |
| EET  | 142 | Integrated Computer Technology II (4)                   |
| EET  | 143 | Integrated Computer Technology III (4)                  |
| EET  | 221 | Electronic CAD (3)                                      |
| EET  | 222 | Electronics I (4)                                       |
| EET  | 223 | Electronics II (4)                                      |
| EET  | 254 | Microprocessors I (4)                                   |
| MATH | 115 | Precalculus Mathematics (4)                             |
| MATH | 121 | Calculus I (4)  |
| MATH | 127 | Calculus II for Engineering Technology: Integration (2) |
| PHYS | 211 | Principles of Physics I (4)                             |
| PHYS | 212 | Principles of Physics II (4)                            |

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## ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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### Major Common Core

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

|      |     |  |
|------|-----|--|
| CHEM | 104 | Introduction to Chemistry (3)          |
| EET  | 340 | Programmable Hardware Technology (4)   |
| EET  | 341 | Electronic Shop Practices (2)          |
| EET  | 355 | Electrical Power Systems (3)           |
| EET  | 452 | Operational Amplifier Applications (3) |
| EET  | 456 | Analog Communications (4)              |
| EET  | 461 | Industrial Automation I (4)            |
| EET  | 462 | Industrial Automation II (4)           |
| EET  | 484 | Microprocessors II (4)                 |
| EET  | 497 | Internship (3)                         |
| MET  | 427 | Quality Management Systems (3)         |

### 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 (4) |

### 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.

### Common Core

|     |     |                                  |
|-----|-----|----------------------------------|
| AET | 334 | Fluid Power (3)                  |
| EET | 315 | Programmable Instrumentation (3) |
| EET | 355 | Electrical Power Systems (3)     |

### 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)

#### Digital Option

|     |     |                                      |
|-----|-----|--------------------------------------|
| EET | 254 | Microprocessors I (4)                |
| EET | 141 | Integrated Computer Technology I (4) |

#### Electronics Option

|     |     |                    |
|-----|-----|--------------------|
| EET | 223 | Electronics II (4) |
|-----|-----|--------------------|

(choose one of the following)

|     |     |  |
|-----|-----|--|
| EET | 452 | Operational Amplifier Applications (3) |
| EET | 455 | Power Electronics (3)                  |
| EET | 492 | Integrated Circuit Technology (4)      |

#### 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.  
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.  
Prerequisite: MATH 115, or concurrent  
Fall, Spring

#### EET 114 (3) AC Circuits

A study of AC circuits, power, phasors, series and parallel AC networks, and network analysis theorems. Ohm's Laws and Kirchhoff's Laws for AC circuits. Use of dependent sources in AC circuits.  
Prerequisite: EET 113  
Fall, Spring

#### 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

#### 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 exam 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

This course covers digital circuit and logic needed for electronic and computer engineering technology. Covers binary arithmetic, timing analysis, TTL, CMOS, logic gates, Boolean algebra, multiplexer, counter, adder, comparator, logic simulation, flip-flops, registers, and use of digital test equipment. Students design and build a complex architecture from small-scale logic components  
Co-requisite: EET 113  
Fall

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## ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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### EET 142 (4) Integrated Computer Technology II

The course introduces syntax and semantics of C programming language, and builds C programming skills needed for electronic and computer engineering technology. The course covers basic data types including arrays and strings, program flow control, pointers, functions and basic I/O utilities. Students will learn how to name the registers and bit fields in the registers and perform I/O programming that involves simple I/O devices such as LEDs, seven-segment displays, and DIP switches.

Prerequisite: 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.

Prerequisite: EET 142

Fall

### EET 221 (3) Electronic CAD

Drafting principles involving use of computer electronic CAD software in laying out block diagrams, schematic diagrams, production drawings, graphical presentation of data, and printed circuit board layout and construction.

Prerequisite: 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, BJT and FETs frequency response.

Prerequisite: 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, A/D conversion, four layered devices and their applications.

Prerequisite: EET 222

Co-requisite: 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, timer applications, and introduction to Internet of Things (IoT) and its impact to society.

Prerequisite: EET 143

Spring

### EET 298 (1-4) Topics

Varied topics in Electronic and Computer Engineering Technology. May be repeated as topics change.

Prerequisite: 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 Visual applications written in C. Use of scripting languages in hardware applications. Using Excel for input-output functions.

Prerequisite: 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.

Prerequisite: 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 Multism 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.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: EET 223, EET 254

Fall

### EET 431 (4) Computer Networking II

A continuation of EET 430. Router configurations, advanced LAN topologies, network configurations, protocols, and switching designs. Network troubleshooting and threaded case studies.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: EET 223 and MATH 121

Fall

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## ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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### 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.

Prerequisite: 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.

Prerequisite: EET 222

Spring

### EET 458 (1) Advanced Instrumentation

Experiences with electronic equipment and instrumentation including maintenance, repair, calibration, safety and component identification.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: EET 143

Fall

### EET 486 (3) Digital Communications

An overview of a communication system. Phase Shift Keying, Amplitude Shift Keying and Frequency Shift Keying. Coherent and non-coherent detection. Maximum likelihood receiver and Matched filter. Noise power, Noise figure, and Noise Temperature. Error performance in presence of noise. Linear block codes, cyclic codes and convolution codes. Spread Spectrum Techniques.

Prerequisite: EET 142, EET 222

Variable

### EET 487 (3) RF Systems Technology

Overview of wireless communication and control systems. Characterization and measurement of RF networks. Transmission lines. Antennas. Radio wave propagation. Fading. Smith Chart. RF transistor amplifiers, oscillators and mixer/modulator circuits. Klystrons, magnetrons and TWTs. Spread spectrum techniques. SAW matched filters.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: 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.

Prerequisite: to be determined by course topic

### EET 499 (1-4) Individual Study

Fall, Spring