

ELECTRONIC ENGINEERING TECHNOLOGY

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

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

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

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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 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.

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)

Pre-requisites to the Major

EET	113	DC Circuits (3)
EET	114	AC Circuits (3)
EET	141	Integrated Computer Technology I (4)

ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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)

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 (3)

Other Graduation Requirements

EE	450	Engineering Economics (3)
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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)
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(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.

Pre: 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.

Pre: 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

ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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 electronic CAD 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, BJT 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, A/D 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 Visual 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 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.

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

ELECTRONIC ENGINEERING TECHNOLOGY CONTINUED

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.

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 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

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.

Pre: 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.

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