

## ELECTRONIC ENGINEERING TECHNOLOGY

### Electronic Engineering Technology

College of Science, Engineering & Technology

Department of Electrical & Computer Engineering and Technology

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Web site: [www.cset.mnsu.edu/ecst](http://www.cset.mnsu.edu/ecst)

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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.

This program is accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET).

Accreditation. The Electronic Engineering Technology program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Telephone: 410-347-7700.

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.

### ELECTRONIC ENGINEERING TECHNOLOGY BS

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 (15 credits):

ENG 101	Composition (4)
SPEE 102	Public Speaking (3)
MATH 115	Precalculus Mathematics (4)
PHYS 211	Principles of Physics I (4)

#### Required Support Courses (7 credits):

MATH 121	Calculus I (4)
MET 427	Quality Management Systems (3)

#### Required for Major (Communication, Math and Science, 12 credits):

MATH 127	Calculus II for Engineering Technology: Integration (2)
PHYS 212	Principles of Physics II (4)
CHEM 104	Introduction to Chemistry (3)

Choose one of the following:

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

#### Required Core for Major (EET, 75 credits):

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 241	Electronic Shop Practices (2)
EET 254	Microprocessors I (4)
EET 340	Programmable Hardware Technology (4)
EET 355	Electrical Power Systems (3)
EET 452	Operational Amplifier Applications (3)
EET 456	Communications I (4)
EET 461	Industrial Automation I (4)
EET 462	Industrial Automation II (4)
EET 484	Microprocessors II (4)
EET 497*	Internship (3)

Choose a minimum of 6 credits from the following courses:

EET 425	EET 430	EET 455	EET 486	EET 487
EET 492				

\* You may substitute one EET advanced elective for internship.

**Required Minor: None.**

### ELECTRONIC ENGINEERING TECHNOLOGY MINOR

#### Required for Minor (Core, 13 credits):

EET 112	Elementary 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 Advanced Power Electronics (3)  
 EET 492 Integrated Circuit Technology (4)

#### NETWORKING OPTION

- EET 430 Computer Networking I (4)  
 EET 454 Microprocessors I (4)

#### COMMUNICATIONS OPTION

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

#### POWER OPTION

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

#### POLICIES/INFORMATION

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 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 speech courses equal less than 9 credits, either an advanced speech 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 bulletin for students transferring to Minnesota State Mankato from other schools, the electronic engineering 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.

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 Technology.

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.

#### COURSE DESCRIPTIONS

##### EET 112 (3) Elementary Electronics

Hands-on experiences in elementary electronics to easily and quickly develop basic knowledge of electronics related to simple analog and digital circuit and components. A self paced format with an open laboratory is used.

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 and MATH 115  
 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 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 on line format.

Fall  
 GE-6, GE-8 CD-Related

##### 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.

Co: 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

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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.

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 114 or concurrent

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

Spring

### **EET 241 (2) Electronic Shop Practices**

An introduction to tools, equipment, materials, and techniques used in fabrication of electronic projects and printed circuit boards.

Pre: EET 222 and EET 221

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.

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.

Pre: EET 143, EET 222 and EET 254

### **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 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: EET 114

Fall

### **EET 393 (1-4) Practicum**

Elective credit for approved experience in off-campus work related to EET major.

Permission required.

Fall, Spring

### **EET 425 (3) Advanced Digital Design**

A study of multiple-output switching functions optimization, flip-flops, registers and counters, programmable logic devices, synchronous sequential circuit design and synthesis, pulse mode and fundamental model sequential circuit design, test methods, and test vector generation.

Variable

### **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: IT 214 or consent of instructor.

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.

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 254

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) Advanced Power Electronics**

The half-wave rectifier with power loads, power semiconductor switches, thyristor states, controlled rectifiers, commutating circuits, AC voltage controllers (poly and single phase), motor controllers, DC-DC converters, and inverters.

Pre: EET 223 and EET355

Variable

### **EET 456 (4) Communications I**

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 or Consent

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 222 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 254 or consent of instructor

Fall

#### **EET 486 (3) Communications II**

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 456

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 456

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 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.

Prerequisite: to be determined by course topic