

## COMPUTER ENGINEERING TECHNOLOGY

### Computer Engineering Technology

College of Science, Engineering & Technology

Department of Electrical and Computer Engineering and Technology

137 Trafton Science Center S • 507-389-5747

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

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Computer Engineering Technology is a technological field requiring the application of scientific and engineering knowledge and methods, combined with technical skills, in support of computer activities. A computer engineering technologist is a person who is knowledgeable in computer hardware and software theory and design and who can apply them to a variety of industrial and consumer problems. Computers, controls/automation, robotics, instrumentation, and communications are just a few fields open to computer engineering technologists.

The program strives to prepare students for successful entry into the technical workforce. This means that the curriculum prepares students to:

1. Apply knowledge of mathematics, science, and computer engineering to problems.
2. Design and construct experiments and analyze and interpret the resulting data.
3. Design systems, components, or processes to meet specified needs.
4. Function effectively in teams.
5. Identify, formulate, and solve problems in computer engineering technology.
6. Understand their professional and ethical responsibilities.
7. Communicate effectively.

The Educational Objectives for our Bachelors Degree in Computer 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 computer 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.

**Accreditation.** The Computer Engineering Technology program is not yet accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

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.

Students who do not have the required background for MATH 115 may have to take additional preparatory coursework as well. Consult with your major adviser 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 mathematics and science courses.

### COMPUTER ENGINEERING TECHNOLOGY BS

#### Required for Major :

**(Communication, Mathematics and Science, 38 credits):**

|      |     |   |
|------|-----|---|
| CHEM | 104 | Introduction to Chemistry (3)                           |
| ENG  | 101 | Composition (4)   |
| MATH | 115 | Precalculus Mathematics (4)                             |
| MATH | 121 | Calculus I (4)  |
| MATH | 127 | Calculus II for Engineering Technology: Integration (2) |
| MATH | 180 | Math for Computer Science (4)                           |
| MET  | 427 | Quality Management Systems (3)                          |
| PHYS | 211 | Principles of Physics I (4)                             |
| PHYS | 212 | Principles of Physics II (4)                            |
| SPEE | 102 | Public Speaking (3)                                     |

Choose one of the following:

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

#### Required for Major (EET, 66 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 | 310  | Programming Tools (4)                  |
| 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 5 credits from the following courses:

|         |         |         |         |         |
|---------|---------|---------|---------|---------|
| EET 425 | EET 452 | EET 455 | EET 486 | EET 487 |
| EET 492 |         |         |         |         |

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

**Required Minor: None.**

### POLICIES/INFORMATION

**GPA Policy.** Students graduating with a degree in Computer Engineering Technology must have (1) completed a minimum of 20 semester credit hours of upper division EET at Minnesota State Mankato, (2) have a cumulative GPA of 2.0 or better on all upper division EET courses, and (3) have completed their senior design sequence at Minnesota State Mankato.

**P/N Grading Policy.** A student who majors in CET 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, 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.

Transfer of credit to the CET major is subject to policies described in this bulletin for all students transferring to Minnesota State Mankato and to the following department policies:

1. All transfer students must take EET 221 if not proficient with current Minnesota State Mankato software.
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. These credits may be used for EET 112, EET 113, and EET 114. The student may also attempt to test out of EET 114, EET 222, 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 A 20 credits may be accepted. Grades of transfer credits must be "C" or better to be acceptable for substitution for required courses.

**Accreditation.** The Computer Engineering Technology program is not accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

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 non-engineering 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.

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

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

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### **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.

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 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.

Pre: 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.

Pre: to be determined by course topic

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

Fall, Spring