

# Computer Engineering

*College of Science, Engineering & Technology*  
*Department of Electrical and Computer Engineering*  
*and Technology*

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Computer Engineering (CE) encompasses the research, development, design and operation of computers and computerized systems and their components. The primary objective of the Computer Engineering program is to educate engineering professionals who possess a sound design and analytical background coupled with a strong laboratory experience. This means that the department expects to prepare its graduates equally for:

1. Entry into the engineering work environment with well developed design and laboratory skills.
2. Further study toward advanced degrees in engineering and other related disciplines.
3. Advancement into managerial ranks and/or entrepreneurial endeavors.

In support of this objective, the program provides a curriculum including the following components that follow the guidelines set forth by ABET:

1. A strong background in the physical sciences, mathematics, and the engineering sciences including extensive hands-on laboratory instruction.
2. An integrated design component to the curriculum including instruction in basic practices and procedures, creativity, control, economics, and synthesis. The process begins with basic instruction during the freshman year and concludes with a capstone design project.
3. A choice of several subdisciplines in their senior level elective.
4. Opportunities for students to develop sensitivity to the social and humanistic implications of technology and motivate them to make worthwhile contributions to the profession and society, while upholding the highest standards of professional ethics.
5. Courses in economics to promote awareness of the economic aspects of engineering.
6. Preparation for continuing study and professional development.

The curriculum offers students the opportunity to emphasize a number of specialized areas including advanced digital systems, communications, digital signal processing, networking, and system design.

The recommended high school preparation is two years

of algebra, one year of geometry, one-half year of trigonometry, one-half year of college algebra, and a year each of physics and chemistry plus a programming language. Without this background it may take students longer than four years to earn a degree. During the first two years students take science and mathematics courses common to all branches of engineering (pre-engineering), as well as supporting work in English, humanities, and social sciences. Second-year computer engineering students complete physics, mathematics and 200-level engineering and computer science courses.

**Admission to Major.** Admission to the college is necessary before enrolling in non-engineering 300- and 400-level courses. Admission to the college is granted by the department. Minimum college requirements are:

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

Please contact the department for application procedures.

During spring semester of the sophomore year, students should submit an application form for admission to the junior-level computer engineering program. Admission to the program is selective and, following applications to the department, subject to approval from the faculty. The department makes a special effort to accommodate transfer students and has joint admissions agreements with many community colleges. Only students admitted to the program are permitted to enroll in upper-division engineering courses. No transfer credits are allowed for upper-division engineering courses except by faculty review followed by written permission.

Before being accepted into the program and admitted to 300-level engineering courses (typically in the fall semester), a student must complete a minimum of 48 semester credits as follows:

- General Physics (calculus-based) (10 credits)
- Calculus, Differential Equations, Probability & Statistics (15 credits)
- Electrical Engineering Circuit Analysis I and II (including laboratory) (7 credits)
- Chemistry (5 credits)
- English Composition (4 credits)
- Computer Sciences (Java and C++) (6 credits)

A cumulative GPA of 2.5 for all science and math courses must have been achieved for program admittance. Grades must be "C" or better for courses to be accepted.

**GPA Policy.** Students graduating with a degree in Computer Engineering must have:

- 1) completed a minimum of 20 semester credit hours of upper division EE and COMS courses at MSU.
- 2) have a cumulative GPA of 2.25 on all upper division EE and COMS courses, and
- 3) have completed their senior design sequence at MSU.

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

## COMPUTER ENGINEERING BSEC

### Required for Major (Prerequisites, 61 credits):

CHEM	201	General Chemistry I (5)
COMS	110	Foundations of Computer Sci. (4)
COMS	211	Fundamentals of Computer Sci. I (4)
COMS	212	Fundamentals of Computer Sci. II (4)
COMS	171	Intro. to C++ Programming (2)
EE	230	Circuit Analysis I (3)
EE	231	Circuit Analysis II (3)
EE	240	Evaluation of Circuits (1)
EE	244	Intro. to Digital Systems (2)
EE	254	Digital and Circuits Lab (1)
ENG	101	Composition I (4)
ENG	271	Technical Communication (4) <b>OR</b>
SPEE	233	Public Speaking for Technical Professionals (3) <b>OR</b>
SPEE	102	Public Speaking (3)
MATH	121	Calculus I (4)
MATH	122	Calculus II (4)
MATH	321	Ordinary Differential Equations (4)
MATH	354	Concepts of Probability and Statistics (3) <b>OR</b>
ME	291	Engineering Analysis (3)
PHYS	221	General Physics I (5)
PHYS	222	General Physics II (5)

### Required for Major (additional General Studies) Additional Supporting Studies (13 credits)

Choose a minimum of 13 credits from the following Humanities and Social Sciences courses:

#### Humanities (6-7 credits)

Courses acceptable by department or program include: ART 160, 260, 261, 413, 416, 419, 460, 462, 463, 466, 469; ENG 112, 113, 114, 320, 321, 325, 327, 328, 331, 332, 400, 401, 402, 403, 405, 406, 416, 478, 479, 481; FOREIGN LANGUAGE 200 level or above; HIST all except 490 and higher; HUM 150, 155, 250\*, 251, 280, 281, 282; MASS 110, 411, 412; MUS 120, 125, 126, 220, 221, 222, 422, 423, 424, 425, 426, 429, 432; PHIL all except 490 and higher; SPEE 100-203, 300, 315-403, 412, 413; THEA 100, 252, 283, 285, 481, 482.

\* Note: EET 125 may be substituted for HUM 250

#### Social Sciences (6-7 credits)

Courses accepted by department or program include: ANTH all courses except 480 and above; GEOG 100, 101, 103, 340, 341, 425, 430, 435, 437, 445, 446, 450, 454, 456; POL all except 420, 421, 422, 490 and above; PSYC all except 201, 202, 291, 303, 390, 391, 473 and above; SOC all except 201, 202, 466, 469, 470, 485 and above; URBS all except 301, 302, 481 and above; WOST all except 260, 277, 290, 320, 430, 460 and above.

In general, graduation credits toward the humanities requirement is not allowed for any course in subject areas such as speech communication, writing, art, music or theater that involve performance or practice of basic skills.

At least 3 credits of the courses selected to complete

the above requirements must be 300-level or above. At least one 300-level course must follow a lower level course in the same subject area.

In addition, you must select one course from the following:

ECON	201	Principles of Macroeconomics (3)
ECON	202	Principles of Microeconomics (3)

### Required for Major (Engineering Plus Computer Science, 52-53 credits):

COMS	310	Data Structures and Algorithms (4)
COMS	320	Machine Structures and Programming (4)
COMS	380	Systems Analysis and Design (4)
COMS	460	Operating Systems (4)
COMS	462	Communication Protocols (4)
EE	250	Engineering Economics (2)
EE	332	Electronic Circuits and Devices (4)
EE	333	Digital and Analog Electronic Systems (4)
EE	334	Microprocessor Engineering (3)
EE	337	Principles of Engineering Design (1)
EE	342	Electronics Design Laboratory (1)
EE	344	Design and Evaluation of Microprocessors (1)
EE	353	Communication Systems Engineering (2)
EE	363	Communication Systems Laboratory (1)
EE	380	Advanced Digital (2)
EE	462	Advanced Digital Systems (3)
EE	467	Principles of Engineering Design I (2)
EE	477	Principles of Engineering Design II (2)
EE	453	Advanced Communications Systems Engineering (3) <b>OR</b>
EE	484	VLSI Design (3)

### Required Minor: None.

**GPA:** A cumulative grade-point average of 2.5 for all science, math and engineering courses must have been maintained. Grades must be C or better for course to be accepted. MSU students should complete the pre-engineering courses listed under the major.

## COURSE DESCRIPTIONS

### Computer Science

#### **COMS 110 (4) Foundation of Computer Science**

This course provides a comprehensive introduction to the foundations of computer science. The topics covered include algorithms, pseudocode, computer theory, computer hardware, computer software, and the related social issues. Lab work develops familiarity with both hardware and software. The course is intended to provide knowledge and skills applicable to all disciplines while providing a broad introduction to the field of computer science.

Pre: MATH 112 (College Algebra)

GE-13

#### **COMS 171 (2) Introduction to C++ Programming**

This course provides an introduction to programming using C++. Emphasis on structured programming concepts, with a brief discussion of object-oriented programming. Control structures, expressions, input/ out-

put, arrays, and functions.  
F, S

#### **COMS 211 (4) Fundamentals of Computer Science I**

This is the first course in a two-course sequence for students who are planning to major or minor in computer science. The course emphasizes concepts needed for continuing study in computer science, the use of abstraction in program design, and advanced problem-solving skills. Programming in a high-level language is a focal point of the course. Prerequisite: A grade of A or B in COMS 110.

Coreq.: MATH 121 (Calculus I).

#### **COMS 212 (4) Fundamentals of Computer Science II**

This course is a continuation of 211. The course introduces students to object-oriented concepts and programming techniques. It also covers essential data structures such as linked lists, stacks, and queues, and trees. The student will be expected to produce larger applications, utilizing multiple compilation units.

Prerequisite: COMS 211

#### **COMS 310 (4) Data Structures & Algorithms**

Study of trees, hashing, and graph algorithms. Analysis of algorithms, memory management, and proof techniques.

Pre: COMS 112, MATH 180 or 121 F, S

#### **COMS 320 (4) Machine Structures and Programming**

Introduction to computer hardware and its design including Boolean logic, basic digital circuits, number representations and digital arithmetic, instruction set design, digital storage, performance metrics, processor datapath and control, pipelining, memory hierarchy, buses and I/O interfacing, parallel processors.

Pre: COMS 112, MATH 180 or 121 F, S

#### **COMS 380 (4) Systems Analysis & Design**

This course explores both structured as well as object oriented systems analysis and design. Use of upper and lower CASE tools are employed in the analysis, design and implementation of a team oriented term project.

Pre: COMS 111 F, S

#### **COMS 460 (4) Operating Systems**

This course covers basic operating systems concepts including processes, interprocess communication, interprocess synchronization, deadlock, memory allocation, segmentation, paging, resource allocation, scheduling, performance evaluation, file systems, storage, devices, protection, security, privacy and distributed systems.

Pre: COMS 320 F

#### **COMS 462 (4) Communication Protocols**

Advanced coverage of data communication and networking protocols with an emphasis on protocol design and implementation. Topics addressed will include data transmission methods, error detection and recovery, flow control, routing, data throughput, and performance analysis of existing and emerging Internet protocols.

### Electrical Engineering

#### **EE 230 (3) Circuit Analysis I**

This course is meant to develop Electrical Engineering Circuit Analysis skills in DC and AC circuits. It includes circuit laws and theorems, mesh and node analysis, sinusoidal steady state analysis, impedance/ admittance concepts, resonant circuits, frequency response, and first order circuit transients.

Pre: PHYS 222 or concurrent, MATH 321 or concurrent F

#### **EE 231 (3) Circuit Analysis II**

Continuation of Circuit Analysis I to include special topics in circuit analysis.

Pre: EE 230 and 240, MATH 321, PHYS 222 S

#### **EE 240 (1) Evaluation of Circuits**

Laboratory support for EE 230. Experimental evaluation of circuits including operational amplifier circuits. Verification of the theoretical concepts covered in EE 230 will be realized in the laboratory.

Pre: Must take concurrently with EE 230 F

#### **EE 244 (2) Introduction to Digital Systems**

A study of theoretical and practical aspects of digital systems including Boolean algebra, number systems, logic devices, Karnaugh maps, and sequential machines.

Pre: MATH 122 S

#### **EE 250 (2) Engineering Economics**

Overview of accounting and finance and their interactions with engineering, manufacturing, marketing, R&D and sales. Lectures include the development and analysis of financial statements, time value of money, decision making tools (stochastic and non-stochastic), ratio analysis, cost of capital, cash flow, rate of return and forecasting techniques.

F

#### **EE 254 (1) Digital and Circuits Lab**

Laboratory support for EE 231 and EE 244. Experimental evaluation of AC and transient circuits, digital logic devices including logic gates, flip flops, and sequential machines. Some simulation and testing of PAL devices and memory IC's.

Pre: EE 230, 240 and concurrently with EE 231 and 244 S

#### **EE 332 (4) Electronic Circuits and Devices**

Electronic amplifier concepts and real operational amplifier networks. Semiconductor device characteristics including Diodes, BJT's, JFET's, MOSFET's, and GaAsFET's. Also discuss DC bias circuits, along with small signal, large signal, and PSpice device modeling and analysis. Small-signal amplifiers (single and multistage), power amplifiers, differential amplifiers, and feedback amplifiers, concepts and design will all be discussed.

Pre: EE 231, admission to EE program F

#### **EE 333 (4) Digital and Analog Electronic Systems**

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EE electronics sequence with EE

332. Feedback systems/ stability; oscillator concepts and systems. Filters and tuned amplifiers. Design of IC operational amplifier. Hysteresis, bi-stability and nonlinear functional circuits; 555 timer. A/D and D/A converters. MOS and bipolar digital electronic circuits; memory. Electronic noise. Power switching devices.  
Pre: EE 332 S

### **EE 334 (3) Microprocessor Engineering**

Use of microprocessors and microcontrollers in engineering applications. Topics include assembly language programming, smart and programmable controllers, memory design including dynamic memory and direct memory access, bus standards and protocol, serial and parallel I/O, interfacing with other programmable systems, maskable and non-maskable interrupts.  
Pre: EE 244 F

### **EE 337 (1) Principles of Engineering Design**

Application of the design techniques in the engineering profession. Electrical engineering project and program management and evaluation including computer assisted tools for planning and reporting, design-to-specification techniques and economic constraints.  
Pre: Admission to EE program S

### **EE 342 (1) Electronics Design Laboratory**

Properties of materials; measurement of electronic device characteristics. Experimental evaluation of electronic amplifier designs. Experimental characteristics of feedback topologies; oscillator and op-amp circuit design and design verification. Power amplifier graphical design.  
Pre: EE 231 and 332 taken concurrently F

### **EE 344 (1) Design & Evaluation of Microprocessors**

Laboratory support for EE 334. Study of various single board computers through assembly language programming. Basic input/output, ports, memory, addressing, timers, A/D converters, serial and parallel communication protocol, and interrupt processing. One half design credit.  
Pre: Concurrent with EE 334 F

### **EE 353 (2) Communication Systems Engineering**

Signals and Systems, Fourier transforms, Parseval's theorem. Autocorrelation functions and spectral density functions. Information theory. Noise and noise figure, probability and statistics. Transformation of random variables, probability of error and bit error rate. Modulation and demodulation. Overview of analog, sampled analog and digital communication systems. Spread spectrum systems.  
Pre: EE 332 S

### **EE 363 (1) Communication Systems Laboratory**

Measurement techniques using the oscilloscope, spectrum analyzer and network analyzer. Signals and spectra. Frequency response. Noise and noise figure measurements. Intermodulation products. Amplitude and frequency modulation/demodulation. Sampling, aliasing, and intersymbol interference. Bit error measurement.  
Pre: Concurrent with EE 353 S

### **EE 380 (2) Advanced Digital**

Combinatorial circuit design with Karnaugh map and tabular method; using MSI chip as building blocks in a digital system; circuits of latches, flip-flops, and registers; design of counters; types of sequential circuits; design process of sequential circuits; minimization of sequential circuit design by performing state reduction and state encoding optimization; syntax and semantics of VHDL language; using VHDL in modeling and simulation digital circuits; implementation of digital system in complex programmable logic devices (CPLDs).  
F

### **EE 453 (3) Advanced Communications Systems Engineering**

Fundamentals of RF, microwave, and optical communication systems. Advanced information theory. Digital modulation techniques. Phase-lock loop receivers and frequency synthesizers. Characterization of digital data transmission systems. Equalization. Synchronization. Coding. Data compression. Nonlinear systems analysis. Amplitude and phase distortion. AM-PM conversion. Intermodulation and cross-modulation. Advanced spread spectrum systems.  
Pre: EE 353 and 363 F

### **EE 462 (3) Advanced Digital Systems**

A study of finite state machine design, hardware description language, principles of instruction execution, instruction pipe lining, superscalar processor design, multiprocessor systems and memory system design.  
Pre: EE 333 and 334 F

### **EE 467 (2) Principles of Engineering Design I**

Design and organization of engineering projects. Project proposals, reporting, feasibility studies, and interpretation. Specification preparation, interpretation, and control. Issues involving creativity, project planning and control, and intellectual property rights. Students enrolled in this course must initiate and complete a design project in a small team format.  
Pre: EE 337 and senior standing F

### **EE 477 (2) Principles of Engineering Design II**

Completion of design projects and reports. Lectures on ethics, issues in contracting and liability, concurrent engineering, ergonomics and environmental issues, economics and manufacturability, reliability and product lifetimes. Lectures by faculty and practicing engineers.  
Pre: EE 467 S

### **EE 484 (3) VLSI Design**

VLSI technology. MOS and Bipolar transistor theory, SPICE models. Transistor structure and IC fabrication processes; layout design rules. Custom CMOS/BICMOS logic design and layout topologies; cell layout/chip partitioning/ clocking. Bipolar/MOS analog circuit design and layout. Group design project. Library research study.  
Pre: EE 333 S