

Computer Engineering Technology

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PROGRAMS:

Electromechanical Engineering Technology/AAS
Computer Engineering Technology/BTech

FACULTY:

Professors: Razukas, Woytowich
Assoc Profs: Blank, Derman, Wotherspoon
Asst Profs: Carranza, Morton, Zia
Lecturer: Armstrong
CLTs: Carrington, Zaratan

Associate in Applied Science in ELECTROMECHANICAL ENGINEERING TECHNOLOGY

The Electromechanical Engineering Technology program, the only one of its kind within the CUNY system, was developed in response to the need to prepare competent technicians who had the special skills needed by the computer industry. It is multidisciplinary in nature, in that students are taught the basics of electrical and mechanical technology, computer hardware and software, and data communications. It prepares students to diagnose and analyze electromechanical problems associated with the development, performance and servicing of computers and computer-based office automation equipment, complex electromechanical industrial equipment and systems, biomedical instrumentation and robotics. Fifty percent of the curriculum is devoted to individualized laboratory instruction using state-of-the-art equipment. Students build their own devices for take-home experimentation and will assemble, program and test their own IBM-compatible computer system. Students can earn the associate degree and then continue on, at City Tech, for the baccalaureate (BTech) degree in computer engineering technology. Students will be expected to purchase an IBM-compatible computer by the third semester of the associate program. Specific information on the models currently used may be obtained from the department. Graduates qualify for the following occupational titles: field engineer, computer-repair technician, business machines technician, data processing equipment specialist, electromechanical technician, laboratory technician, production assembly technician, biomedical instruments service technician and robotics service technician.

Manufacturers and users of computers and electromechanical equipment are potential employers of graduates. Among the

employers of the graduates of this program are IBM, Verizon, Consolidated Edison, Canon, Eastman Kodak, the Metropolitan Transportation Authority, Xerox Corp. and the elevator industry.

The electromechanical engineering technology curriculum is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET).

REQUIRED COURSES IN THE MAJOR		Credits
EMT 1111/EM 111	Logic and Problem Solving	1
EMT 1120/EM 120.1	Technical Graphics	1
EMT 1130/EM 130	Tool Skills Laboratory	1
EMT 1150/EM 150	Electrical Circuits	5
EMT 1220/EM 220	Mechanisms	4
EMT 1250/EM 250	Digital Control	4
EMT 1255/EM 255	Electronics	4
EMT 2320/EM 320.1	Advanced Mechanisms	5
EMT 2370/EM 370	Computer Hardware Systems	2
EMT 2390L/EM 390L	Operating Systems Laboratory	1
EMT 2455/EM 455	Data Communications	2
EMT 2461/EM 461	Electromechanical Systems: Software Interface	2
EMT 2480L/EM 480L	Electromechanical Systems Laboratory	1
Subtotal		33
OTHER REQUIRED COURSES ¹		
CST 2403/CS 403	Introductory C++ Language Programming	3
ENG 1101/EG 101	English Composition I	3
MAT 1375/MA 375 ²	Mathematical Analysis	4
MAT 1475/MA 475	Calculus I	4
PHYS 1433/SC 433	Physics 1.2	4
PHYS 1434/SC 434	Physics 2.2	4
COMM ¹	ENG 1121/EG 121 or ENG 1133/EG 133	3
LAP ¹	Literature/Aesthetics/Philosophy	3
BS/SS ¹	Behavioral Science/Social Science	3
Subtotal		31
TOTAL CREDITS REQUIRED FOR THE DEGREE		64

¹ See page 34 for detailed explanation of core required courses and categories.

² Students without the requisite math background for MAT 1375/MA 375 will be required to take MAT 1175/MA 175 and/or MAT 1275/MA 275 in preparation. This will increase the number of credits required for the degree by up to eight (8).

Associate in Applied Science in ELECTROMECHANICAL ENGINEERING TECHNOLOGY

Curriculum by Semester

FIRST SEMESTER		Credits
EMT 1111/EM 111	Logic and Problem Solving	1
EMT 1120/EM 120.1	Technical Graphics	1
EMT 1130/EM 130	Tool Skills Laboratory	1
EMT 1150/EM 150	Electrical Circuits	5
MAT 1375/MA 375 ¹	Mathematical Analysis	4
ENG 1101/EG 101	English Composition 1	3
Subtotal		15
SECOND SEMESTER		
EMT 1220/EM 220	Mechanisms	4
EMT 1250/EM 250	Digital Control	4
EMT 1255/EM 255	Electronics	4
CST 2403/CS 403	Introductory C++ Language Programming	3
COMM ¹	ENG 1121/EG 121 or ENG 1133/EG 133	3
Subtotal		18
THIRD SEMESTER		
EMT 2320/EM 320.1	Advanced Mechanisms	5
EMT 2370/EM 370	Computer Hardware Systems	2
EMT 2390L/EM 390L	Operating Systems Lab	1
MAT 1475/MA 475	Calculus I	4
PHYS 1433/SC 433 ¹	Physics 1.2	4
Subtotal		16
FOURTH SEMESTER		
EMT 2455/EM 455	Data Communications	2
EMT 2461/EM 461	Electromechanical Systems Software Interface	2
EMT 2480L/EM 480L	Electromechanical Systems Lab	1
PHYS 1434/SC 434 ¹	Physics 2.2	4
LAP ¹	Literature/Aesthetics/Philosophy	3
BS/SS ¹	Behavioral Science/Social Science	3
Subtotal		15
TOTAL CREDITS REQUIRED FOR THE DEGREE		64

¹ See page 34 for detailed explanation of core required courses and categories.

Bachelor of Technology in COMPUTER ENGINEERING TECHNOLOGY

There are many ways a student can enter the bachelor of technology program in computer engineering technology. Students may enter the program as freshmen if they meet the general College criteria. These students will follow the electromechanical engineering technology AAS curriculum for the first 64 credits and may earn the AAS along the way. Students may transfer in from the City Tech AAS programs in electrical engineering technology or mechanical engineering technology areas before or after completing the AAS degree in these fields. Students may enter from other programs either here at City Tech or from other colleges if they meet College criteria for transfer admission. Students with questions are advised to consult the office of admissions. It is not necessary to have earned an associate degree in electromechanical engineering technology, or to have earned an associate degree at all. Transcripts of entering students will be evaluated to determine the courses they must complete for the bachelor of technology degree. The department chair may be called for further information.

The courses in the baccalaureate program build upon the knowledge gained at the AAS level, with an emphasis on computers, computer-controlled systems, and networking. More stress is placed upon independent thinking and analysis. In addition to advanced coverage of computers and electronics, the curriculum includes programming and advanced mathematics. A wide field of technical electives, including topics from computer engineering technology, electrical and telecommunications engineering technology, mechanical engineering technology, computer programming, and design give students considerable latitude to specialize in their own area of interest. This program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET).

REQUIRED COURSES IN THE MAJOR		Credits
CET 3510/EM 510	Microcomputer Systems Technology	4
CET 3525/EM 525 ³	Electrical Networks	4
CET 3550/EM 550 ²	Analog and Digital Electronics	4
CET 3615/EM 615	Instrumentation and Data Acquisition	4
CET 3625/EM 625	Applied Analysis Lab	1
CET 3640/EM 640	Software for Computer Control	3
CET 4705/EM 705	Component and Subsystem Design I	2
CET 4711/EM 711	Computer Controlled System Design I	2
CET 4762/EM 762 ⁴	Electromechanical Devices	4
CET 4773/EM 773	Microcomputer Interfacing	4
CET 4805/EM 805	Component and Subsystem Design II	2
CET 4811/EM 811	Computer Controlled Systems Design II	2
CET 4864/EM 864	Principles of Feedback Control Systems	4

CET/EM ¹⁸⁵	Technical Elective	4
CET/EM ⁵⁸¹⁰	Technical Elective or Internship	3

OTHER COURSES

CST 2403/CS 403 ¹¹	Introductory C++ Language Programming	3
MAT 1575/MA 575 ⁹	Calculus II	4
MAT 2580/MA 580	Introduction to Linear Algebra	3
MAT 2680/MA 680	Differential Equations	3

OTHER REQUIRED COURSES⁷

COMM ⁶	SPE 1330/TS 300 Series (Speech)	3
LAP ⁹	Literature/Aesthetics/Philosophy	3
BS/SS ^{8&9}	Behavioral Science/Social Science	6
LIT ⁹	Literature	3

TOTAL CREDITS REQUIRED FOR THE DEGREE 64

The college will grant a bachelor of technology degree (BTech) with a major in computer engineering technology upon satisfactory completion of an AAS degree in any of the following fields: Electromechanical Engineering Technology, Electrical Engineering Technology, Mechanical Engineering Technology OR AN ACCEPTABLE EQUIVALENT, and the required 64 credits listed above.

¹ Required for ET and EM AAS graduates.

² Required for MT AAS graduates

³ Required for MT and EM AAS graduates

⁴ Required for ET AAS graduates

⁵ Select from 900 level EM course or with department approval the following: 500 level (or higher) CS courses or 500 level (or higher) TC courses.

⁶ Students who have not successfully completed ENG 1121/EG 121 or higher must do so on a non-contributory basis.

⁷ See page 34 for detailed explanation of baccalaureate core courses and categories

⁸ Choose at least 3 credits from upper-division courses.

⁹ See page 34 for detailed explanation of core required courses and categories.

¹⁰ Required for EM AAS graduates.

¹¹ Required for ET and MT AAS graduates; EM AAS graduates who have not taken CST 2403/CS 403 must do so on a non-contributory basis.

Bachelor of Technology in COMPUTER ENGINEERING TECHNOLOGY

Curriculum by Semester

Upper-division bachelor of technology in computer engineering technology for students with an AAS in electrical engineering technology

FIFTH SEMESTER		Credits
CST 2403/CS 403	Introductory C Language Programming	3
MAT 1575/MA 575	Calculus II	4
CET 3510/EM 510	Microcomputer Systems Technology	4
COMM ¹	Elective	3
BS/SS ¹	Behavioral Science/Social Science	3
Subtotal		17
SIXTH SEMESTER		
MAT 2580/MA 580	Intro to Linear Algebra	3
MAT 2680/MA 680	Differential Equations	3
CET 3615/EM 615	Instrumentation and Data Acquisition	4
CET 3625/EM 625	Applied Analysis Laboratory	1
CET 3640/EM 640	Software for Computer Control	3
LAP ¹	Literature/Aesthetics/Philosophy	3
Subtotal		17
SEVENTH SEMESTER		
CET 4705/EM 705	Component and Subsystem Design I	2
CET 4711/EM 711	Computer-Controlled Systems Design I	2
CET 4762/EM 762	Electromechanical Devices	4
CET 4773/EM 773	Microcomputer Interfacing	4
CET/EM	Technical Elective	4
Subtotal		16
EIGHTH SEMESTER		
CET 4805/EM 805	Component and Subsystem Design II	2
CET 4811/EM 811	Computer-Controlled Systems Design II	2
CET 4864/EM 864	Feedback-Controlled Systems	4
BS/SS ¹	Behavioral Science/Social Science (Advanced)	3
LIT ¹	Elective	3
Subtotal		14
TOTAL CREDITS		64

¹ See page 34 for detailed explanation of core required courses and categories.

Bachelor of Technology in COMPUTER ENGINEERING TECHNOLOGY

Curriculum by Semester

Upper-division bachelor of technology in computer engineering technology for students with an AAS in mechanical engineering technology

FIFTH SEMESTER		Credits
CST 2403/CS 403	Introductory C++ Language Programming	3
MAT 1575/MA 575	Calculus II	4
CET 3525/EM 525	Electrical Networks	4
CET 3550/EM 550	Analog and Digital Electronics	4
Subtotal		15
SIXTH SEMESTER		Credits
MAT 2680/MA 680	Differential Equations	3
CET 3510/EM 510	Microcomputer Systems Tech	4
CET 3615/EM 615	Instrumentation and Data Acquisition	4
CET 3625/EM 625	Applied Analysis Laboratory	1
COMM ¹	Communications Elective	3
BS/SS ¹	Behavioral Science/Social Science	3
Subtotal		18
SEVENTH SEMESTER		Credits
MAT 2580/MA 580	Intro to Linear Algebra	3
CET 3640/EM 640	Software for Computer Control	3
CET 4705/EM 705	Component and Subsystem Design I	2
CET 4711/EM 711	Computer-Controlled Systems Design I	2
CET 4773/EM 773	Microcomputer Interfacing	4
LAP ¹	Literature/Aesthetics/Philosophy	3
Subtotal		17
EIGHTH SEMESTER		Credits
CET 4805/EM 805	Component and Subsystem Design II	2
CET 4811/EM 811	Computer Controlled Systems Design II	2
CET 4864/EM 864	Feedback Control Systems	4
BS/SS ¹	Behavioral Science/Social Science (Advanced)	3
LIT ¹	Literature Elective	3
Subtotal		14
TOTAL CREDITS		64

¹ See page 34 for detailed explanation of core required courses and categories.

Bachelor of Technology in COMPUTER ENGINEERING TECHNOLOGY

Curriculum by Semester

Upper-division bachelor of technology in computer engineering technology for students with an AAS in electromechanical engineering technology

FIFTH SEMESTER		Credits
MAT 1575/MA 575	Calculus II	4
CET 3510/EM 510	Microcomputer Systems Tech	4
CET 3525/EM 525	Electrical Networks	4
COMM ¹	Communications Elective	3
Subtotal		15
SIXTH SEMESTER		Credits
MAT 2580/MA 580	Intro to Linear Algebra	3
MAT 2680/MA 680	Differential Equations	3
CET 3615/EM 615	Instrumentation and Data Acquisition	4
CET 3625/EM 625	Applied Analysis Laboratory	1
CET 3640/EM 640	Software for Computer Control	3
BS/SS ¹	Behavioral Science/Social Science	3
Subtotal		17
SEVENTH SEMESTER		Credits
CET 4705/EM 705	Component and Subsystem Design I	2
CET 4711/EM 711	Computer-Controlled Systems Design I	2
CET 4773/EM 773	Microcomputer Interfacing	4
CET/EM	Technical Elective	4
BS/SS ¹	Behavioral Science/Social Science (Advanced)	3
LAP ¹	Literature/Aesthetics/Philosophy	3
Subtotal		18
EIGHTH SEMESTER		Credits
CET 4805/EM 805	Component and Subsystem Design II	2
CET 4811/EM 811	Computer-Controlled Systems Design II	2
CET 4864/EM 864	Feedback Control Systems	4
CET/EM	Technical Elective or Internship	3
LIT ¹	Literature Elective	3
Subtotal		14
TOTAL CREDITS		64

Note: This schedule assumes that CST 2403/CS 403 was completed as part of the AAS program.

¹ See page 34 for detailed explanation of core required courses and categories.

COURSES:**EMT 1111/EM 111
Logic and Problem Solving***2 lab hrs, 1 cr*

This course introduces the foundations of problem solving and computer programming as it is applied to electromechanical engineering technology. It provides a basic understanding of number systems and programming techniques with practical examples implemented in a modern programming language. Concepts are developed through hands-on laboratory exercises.

Prerequisite: CUNY certification in mathematics

**EMT 1120/EM 120.1
Technical Graphics***3 lab hrs, 1 cr*

Training in basic orthographic projection and isometric drawing using sketching as a tool. Included are standard symbols and representations used in the electromechanical field, assembly drawings, charts, graphs, electrical and electronic schematics and timing charts. Extensive use of electrical, electronic, mechanical and electromechanical visual aids.

Prerequisite: None

**EMT 1130/EM 130
Tool Skills Laboratory***3 lab hrs, 1 cr*

Once working in the field, the student may find it necessary to be proficient in the selection and use of various hand and machine tools. The students acquire these skills by constructing their own digital trainer which is used in EMT 1250/EM 250L to study digital electronics.

Prerequisite: None

**EMT 1150/EM 150
Electrical Circuits***4 cl hrs, 3 lab hrs 5 cr*

Introduction to the basic principles of direct and alternating current circuits. Topics include linear and nonlinear passive components, transient response and phase relationships. Laboratory work is performed both in school and at home (using student purchased kits). The use of the multi-meter, oscilloscope and frequency generator is introduced; computers are used for problem solving.

Pre- or corequisites: MAT 1175/MA 175 or equivalent, EMT 1120/EM 120, EMT 1130/EM 130

**EMT 1220/EM 220
Mechanisms***3 cl hrs, 3 lab hrs, 4 cr*

Levers, gears, cams, belts, chains and sprockets, intermittent motions, brakes and clutches. The application of these mechanisms as motion converters and electromechanical energy conversion systems and their displacement, velocity and acceleration. Laboratory study of physical and operational characteristics of mechanical and electromechanical components through the technique of breadboarding. Standard industrial components are used for this purpose.

Prerequisites: EMT 1120/EM 120.1, EMT 1130/EM 130; pre- or corequisites: MAT 1275/IMA 275 or equivalent, PHYS 1433/SC 433

**EMT 1250/EM 250
Digital Control***3 cl hrs, 3 lab hrs, 4 cr*

Students learn how to implement and analyze control functions and arithmetic operations using digital IC's. Computer techniques are used to simulate systems and for troubleshooting. Laboratory problem solving through the synthesis, breadboarding and testing of such systems. State-of-the-art integrated circuits are used with students working with their individual digital trainers.

Prerequisites: EMT 1111/EM 111, EMT 1130/EM 130, EMT 1150/EM 150

**EMT 1255/EM 255
Electronics***3 cl hrs, 3 lab hrs, 4 cr*

Non-linear behavior using semiconductor devices from diodes to CMOS IC's. A black box analysis of amplifiers and other circuits is introduced, as well as basic optical devices. Typical circuits are breadboarded, analyzed and tested in the laboratory.

Computer simulations are used for the additional reinforcement of course material.

Pre- or corequisites: EMT 1250/EM 250, MAT 1375/IMA 375

**EMT 2320/EM 320.1
Advanced Mechanisms***4 cl hrs, 3 lab hrs 5 cr*

Representative components are studied in terms of how basic concepts previously covered are utilized to provide specialized devices that convert signal data to desired movements, motions and forces to perform specific actions. Typical items studied include

pneumatics, solenoids, relays, stepping motors and computer peripherals. Applications in writing and reading data and power control are discussed in detail. The student evaluates the performance characteristics and limitations of these devices by constructing and testing breadboard subsystems. The computer disk drive is studied in detail as a representative system.

Prerequisites: EMT 1120/EM 120.1, EMT 1220/EM 220; pre- or corequisite: EMT 1255/EM 255

**EMT 2370/EM 370
Computer Hardware Systems***1 cl hr, 2 lab hrs, 3 cr*

Computer hardware systems, along with several software concepts, are studied to understand the function and relationship of the CPU, memory, and peripheral equipment. Course material is chosen for relevance to industry certification exams, such as A+. The peripheral equipment includes monitors, disk drives, scanners, and printers. During laboratory exercises, computer systems, with monitor and operating system, are provided for analysis by students working in teams. However, as an option, each student can build, configure, analyze, and troubleshoot his or her own IBM PC (or compatible) computer.

Prerequisite: EMT 11250/EM 250

**EMT 2390L/EM 390L
Operating Systems Laboratory***3 lab hrs, 1 cr*

Students study the characteristics of operating systems used in IBM systems. They learn how to install the operating system, and set it up to control the computer hardware. They also learn to use features of the operating system to manage the computer system.

Pre- or corequisite: EMT 2370/EM 370

**EMT 2455/EM 455
Data Communications***1 cl hr, 2 lab hrs, 3 cr*

This course introduces the foundations of data communications with applications in engineering technology. It provides a basic understanding of data communication systems and practical examples of communications networks. Topics include core network concepts, standards, physical layer propagation, a small Ethernet PC network, other LAN technologies,

Wide Area Networks (WANs), TCP/IP internetworking, security, network management and systems administration, and network applications for computer-based control of devices.

Prerequisites: EMT 1250/EM 250, EMT 2370/EM 370

**EMT 2461/EM 461
Electromechanical Systems:
Software Interface***1 cl hr, 2 lab hrs, 2 cr*

How computer hardware and electromechanical systems control external devices, both electrically and mechanically. Students build a project to learn the interface of software and hardware for use as a control element.

Prerequisites: EMT 2320/EM 320.1, EMT 2370/EM 370, CS 403; pre- or corequisite: EMT 2455/EM 455, MAT 1475/IMA 475

**EMT 2480L/EM 480L
Electromechanical Systems
Laboratory***3 cl hrs, 1 cr*

Actual electromechanical systems used in the field of computers, biomedical and robotics are analyzed. Considerable emphasis is placed on student presentation on how the various complex subsystems are interrelated.

Pre- or corequisite: EMT 2461/EM 461

**CET 3510/EM 510
Microcomputer Systems
Technology***3 cl hrs, 3 lab hrs, 4 cr*

An introduction to microcomputer architecture and the basic concepts used in the Personal Computer (PC). Key features of the PC are explored by writing programs in a high-level language (such as C) to access them. Assembly language programs are utilized to gain insight into machine level operations.

Laboratory exercises support the lecture and are carried out in the context of currently available operating systems.

Pre- or corequisites: CST 2403/CS 403, MAT 1575/IMA 575; prerequisite: Previous course in digital electronics

**CET 3525/EM 525
Electrical Networks***3 cl hrs, 3 lab hrs, 4 cr*

Applications of principles of electrical circuit analysis to the solution of practical network problems, with emphasis on steady-state AC Circuits. Applications of Kirchoffs Laws, superposition and Thevenin's theorems.

Pre- or corequisite: MAT 1575/IMA 575 with grade of "C" or better

**CET 3550/EM 550
Analog and Digital Electronics***3 cl hrs, 3 lab hrs, 4 cr*

Concepts of active circuit elements and non-linear behavior. Study of the properties of solid-state components, whether discrete (diodes and transistors) or combined into an integrated circuit (analog or digital). Topics from analog electronics include an overview of common devices, with detailed study of selected amplifier configurations. Topics from digital electronics include Boolean algebra, binary arithmetic, and use of logic gates (AND, OR, etc.) to form more complex circuits. Laboratory experiments include practical amplifier applications and frequency-dependent behavior of analog circuits, as well as the use of digital components to construct common devices such as flip-flops, counters and adders.

Pre- or corequisites: MAT 1575/IMA 575, CET 3525/EM 525

**CET 3615/EM 615
Instrumentation and Data Acquisition***3 cl hrs, 3 lab hrs, 4 cr*

An introduction to the concepts and techniques of instrumentation. Analog and digital techniques are used taking into account standards, precision, accuracy and sensitivity in the data acquisition process. Interfacing with mechanical and electronic sensors. The lab emphasizes practical components and system analysis with evaluation of results, and utilizes computer-based data-acquisition systems as well as stand-alone instruments. *Prerequisites: MAT 1575/IMA 575 with grade of "C" or better, CET 3525/EM 525, PHYS 1434/SC 434, previous course(s) in analog and digital electronics*

**CET 3625/EM 625
Applied Analysis Lab***3 lab hrs, 1 cr*

Students are introduced to the application of calculus and ordinary differential equations to the modeling and solution of advanced problems in engineering technology. This course is coordinated with MA 680 Differential Equations.

Prerequisite: MAT 1575/IMA 575 with grade of "C" or better; corequisite: MAT 2680/IMA 680

**CET 3640/EM 640
Software for Computer Control***2 cl hrs, 2 lab hrs, 3 cr*

Programming concepts and software development techniques for computer-controlled systems. Laboratory exercises apply these concepts to a variety of systems and devices.

Prerequisites: CST 2403/CS 403, CET 3510/EM 510

**CET 4705/EM 705
Component and Subsystem Design I***1 cl hr, 2 rec hrs, 2 cr*

Develops the foundations for performing electrical design in computer engineering technology applications. Typical systems are analyzed mathematically and graphically. Subsystems are designed to meet specific performance criteria.

Prerequisites: MAT 2680/IMA 680 and CET 3625/EM 625 with grades of "C" or better, CET 3615/EM 615, previous course(s) in analog and digital electronics

**CET 4711/EM 711
Computer-Controlled Systems Design I***1 cl hr, 2 rec hrs, 2 cr*

Modem design principles and methodologies. Software tools for systems design, including computer-aided design and computer-aided engineering. Students carry out the conceptual design of a complete device or system.

Prerequisites: MAT 2680/IMA 680 and CET 3625/EM 625 with grades of "C" or better, CET 3510/EM 510; pre- or corequisite: CET 4705/EM 705

**CET 4762/EM 762
Electromechanical Devices***3 cl hrs, 3 lab hrs, 4 cr*

Elements of spur gears, helical gears, worm gear sets and bevel gears. Design of simple, compound and reverted gear trains. Design of electrical control systems for machines using programmable logic controllers. Analysis of four-bar linkages, fundamentals of synchros and stepping motors. Laboratory experiments coordinate with lecture material.

Prerequisites: CET 3615/EM 615, MA 680 and CET 3625/EM 625 with grades of "C" or better

**CET 4773/EM 773
Microcomputer Interfacing***3 cl hrs, 3 lab hrs, 4 cr*

Electronic interfacing technologies and techniques required to connect computers to internal and external systems and other computers and components. Topics include Local Area Networks (LAN) and Wide Area Networks (WAN), timing and control signals, I/O requirements, bus standards and protocols.

Prerequisite: CET 3510/EM 510

**CET 4805/EM 805
Component and Subsystem Design II***1 cl hr, 2 rec hrs, 2 cr*

Continuation of CET 4705/EM 705. Further design of subsystems requiring solution by differential equations. Worst-case designs and component tolerances, development of control systems. A term project may be assigned.

Prerequisite: CET 4705/EM 705

**CET 4811/EM 811
Computer-Controlled Systems Design II***1 cl hr, 2 rec hrs, 2 cr*

A capstone course dealing with design and programming concepts of particular importance for computer-controlled systems. In the lab, students may choose to utilize their concept designs from EM 711, or to design a new device from scratch. Students apply their knowledge of component design, systems design, control theory, and computer programming to carry out detailed design of their device or system, build a working model, and program a computer to perform the desired measurement and/or control functions.

Prerequisite: CET 3640/EM 640, CET 4711/EM 711; pre- or corequisites: CET 4773/EM 773, CET 4805/EM 805, CET 4864/EM 864

**CET 4864/EM 864
Principles of Feedback Control Systems***3 cl hrs, 3 lab hrs, 4 cr*

Introduction to feedback concepts (positive and negative). Transient and steady-state analysis using Laplace transforms. Bode plots and stability criteria. Lab work includes the use of mathematical analysis and simulation.

Prerequisites: MAT 2680/IMA 680, CET 4762/EM 762; corequisites: CET 3625/EM 625, CET 4805/EM 805

**CET 4900/EM 900
Internship in Computer Engineering Technology***2 cl hrs bi-wkly, 120 field hrs, 3 cr*

Assignment to field work/study situations of approximately eight hours per week at one of the following: small, medium, or large companies or governmental institutions. Students may work in design, manufacturing, installation, programming, troubleshooting, or other appropriate activities related to computer-controlled electromechanical devices or systems, computer hardware, or computer-based instrumentation and control systems. Students keep a log or journal to be shared in the group seminar. Supervision provided by faculty and by the job supervisor. *Prerequisites: CET 3510/EM 510, CET 4705/EM 705, CET 4711/EM 711, CST 2403/CS 403*

TECHNICAL ELECTIVES

These courses are offered as the needs and preferences of the students require. Since some time may elapse between offerings, the content changes to reflect advances in the relevant technology.

**CET 4930/EM 930
Applied Mechanics***3 cl hrs, 3 lab hrs, 4 cr*

The practical application of the principles of statics and dynamics. Topics include force systems, resultant forces, beams and trusses. Also work, power energy and motion (rectilinear and curvilinear). *Prerequisites: PHYS 1433/SC 433, MAT 1575/IMA 575 with grade of "C" or better*

**CET 4942/EM 942
Economics of Engineering
and Management**

3 cl hrs, 3 cr

The concepts of the interrelationship between time and money. Factors that go into cost analysis: material, labor, overhead, depreciation, present and future worth.

Prerequisite: MAT 1575/MA 575 with grade of "C" or better

**CET 4950/EM 950
Heating, Ventilation and Air
Conditioning**

3 cl hrs, 3 cr

Applicable concepts in heat transfer, fluid mechanics and thermodynamics. Heating and cooling load characteristics. Energy conservation parameters for contemporary design.

Prerequisites: MAT 2680/MA 680 and CET 3625/EM 625 with grades of "C" or better

**CET 4952/EM 952
Robotics Technology**

3 cl hrs, 3 lab hrs, 4 cr

Geometric configurations and classifications of robots, work envelope, drive components (electric, hydraulic, pneumatic), computer controls and interfacing, sensors and data acquisition/handling and conversion. Lab projects using a robot/computer system.

Prerequisites: CET 3510/EM 510; *pre- or corequisite:* MAT 2580/MA 580

**CET 4960/EM 960
Applied Digital Technology**

3 cl hrs, 3 lab hrs, 4 cr

An introduction to the use of the digital computer for measurements of real-world signals and control of real-world devices. Students program data acquisition and control hardware in a high-level language such as C.

Prerequisites: CST 1403/CS 403, MAT 1575/MA 575 with grade of "C" or better

**CET 4962/EM 962
Applied Software
Technology**

3 cl hrs, 3 lab hrs, 4 cr

Development of hardware-oriented programming skills. Students write programs to access external devices via the serial port or other interfaces.

Prerequisites: CST 1403/CS 403, MAT 1575/MA 575 with grade of "C" or better

**CET 4963/EM 963
Modern Communications
Electronics**

3 cl hrs, 3 cr

Introduction to digital communication via RF and microwave as well as optical communication over fiber optic links. Noise theory, s/n ratio, AM and FM.

Prerequisites: MAT 2680/MA 680 and CET 3625/EM 625 with grades of "C" or better

**CET 4964/EM 964
Electro-Optical Technology
and Applications**

3 cl hrs, 3 lab hrs, 4 cr

Combines the principles of optics and electronics. Theory and applications of modern devices including lasers, LEDs, and fiber optics. Background material in classical optics (refraction, total internal reflection, interference, wave/particle duality).

Prerequisites: CET 1255/EM 255, PHYS 1434/SC 434

**CET 4970/EM 970
Design of Electrical
Equipment Installations**

3 cl hrs, 3 cr

Introduction to generation and distribution systems. Distribution systems used in buildings for power and light, including code requirements. Load factors for typical mechanical and electrical equipment. Analysis of a complete design and specification of a selected project. Elements of estimating and contracts, including pricing.

Prerequisites: CET 3525/EM 525, MAT 1575/MA 575 with grade of "C" or better

**CET 4971/EM 971
Linear Integrated Circuit
Applications**

3 cl hrs, 3 lab hrs, 4 cr

The use of linear ICs for the control of mechanical and electronic systems. Topics include op. amps, power amplifiers, D/A converters, regulators and opto-isolators.

Prerequisites: MAT 2680/MA 680 and CET 3625/EM 625 with grades of "C" or better, CET 4960/EM 960 or equivalent

**CET 4972/EM 972
Digital Integrated Circuits**

3 cl hrs, 3 lab hrs, 4 cr

Design and analysis of ICs in digital applications. Functional differences and design considerations.

Prerequisite: CET 3510/EM 510

**CET 4974/EM 974
Introduction to Computer-
Aided Design**

3 cl hrs, 3 lab hrs, 4 cr

Theory and concepts of CAD and CAM using industry standard graphics work stations. Coordinate systems, drafting practices, computational methods, database management and manufacturing considerations.

Prerequisites: CET 3510/EM 510, MAT 2680/MA 680 and CET 3625/EM 625 with grades of "C" or better

**CET 4980/EM980
Special Projects in
Technology**

or

**CET 4981/EM 981
Special Projects in
Technology**

or

**CET 4982/EM 982
Special Projects In
Technology**

1 to 3 cr (credits vary by scope and depth of project)

Projects chosen for their particular or current interest to students. Students work on their own and must select a project topic and work with a faculty mentor.

Prerequisite: Approval of department chair

**CET 4983/EM 983
Engineering Technology III**

2 cl hrs 3 lab hrs 3 cr

Solution of complex real-world problems including complete engineering documentation. Topics change to reflect current technology and industrial need.

Prerequisites: CET 4705/EM 705, CET 4710/EM 710 or CET 4711/EM 711; *pre- or corequisites:* CET 4805/EM 805, CET 4810/EM 810 or CET 4811/EM 811