

ENGINEERING TECHNOLOGY DIVISION

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Chairperson: Ece Yaprak

<http://www.engineering.wayne.edu/et/>

The Division of Engineering Technology was founded in 1973 and offers both undergraduate (upper-division: junior and senior level) and graduate programs. It stresses the application of current technology to typical industrial problems. Entering students in the upper division program are assumed to have a background equivalent to an associate degree in engineering technology or in a related discipline. The program complements a community college education by providing more application-oriented analytical techniques. In the curriculum a close relationship is maintained between the theoretical principles taught in the classroom and their applications in corresponding laboratories.

Engineering technology is a profession closely related to engineering and deals with the application of knowledge and skill to industrial processes, production, and management. Technologists are organizers of people, materials, and equipment for the effective planning, construction and maintenance of technical facilities and operations. They are responsible for work requiring technical and practical knowledge. They can apply their abilities in using technical equipment, selling technical products, serving as manufacturers' technical representatives, or supervising varied construction projects and manufacturing processes. They work with engineers in many aspects of project development, production planning, and final testing of industrial, military, or consumer products. Their talents are used in virtually every activity where technical expertise is required. They may be involved with electronic and mechanical instruments, experimental equipment, computing devices, tool design, manufacturing, or drafting.

Technical skills in the use of electronic equipment, machinery, tools, and drafting instruments are characteristic of this type of work. Thus, engineering technology students can find challenging employment in business and industry. Graduates of Wayne State's Engineering Technology program have been employed in areas such as manufacturing engineering, engineering production, marketing, maintenance, quality control, product testing, field engineering, consulting engineering, design, and technical supervision. Baccalaureate engineering technology graduates are often called technologists to distinguish them from baccalaureate graduates of engineering programs. However, the National Bureau of Labor Statistics does not have a category called 'technologist', and consequently, many industrial job titles show little distinction between technologists and engineers. Graduates of Engineering Technology and Engineering programs complement each other in their skills and interests, and together with technicians and scientists, they form a technological team which has been able to produce an ever-increasing rate of technological advancement.

Academic Regulations: Division of Engineering Technology

For complete information regarding academic rules and regulations of the University, students should consult the Academic Regulations (<http://bulletins.wayne.edu/undergraduate/general-information/academic-regulations>) section of this bulletin. The following additions and amendments pertain to the Division of Engineering Technology.

'AGRADE' Program (Accelerated Graduate Enrollment)

The College of Engineering allows academically superior undergraduate seniors to enroll simultaneously in undergraduate and graduate programs

and apply a maximum of sixteen credits toward both an undergraduate and graduate degree in the student's major field. Students who elect the 'AGRADE' Program may expect to complete the bachelor's and master's degrees in one additional year of full-time study.

To be eligible, applicants must have completed a minimum of ninety credits of course work applied towards the engineering technology degree and be accepted in the professional program of their major. The minimum grade point averages for acceptance into the program are a 3.4 g.p.a. in engineering and not less than a 3.6 g.p.a. in their department of specialization, as computed by the rules of the Division of Engineering Technology. See the departmental advisor for further details.

Student Conduct

Each student is subject to official regulations governing student activities and student behavior. Furthermore, it is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge.

If there are reasonable grounds to believe that a student has disregarded the regulations or student responsibilities, he or she may be disciplined. Such discipline may include failure in the course, suspension or dismissal, but no dismissal will be directed without reasonable opportunity for an appropriate hearing.

Probation Policy

A student is considered to be on probation whenever his/her cumulative grade point average (g.p.a.) falls below 2.0. A student may also be placed on probation whenever his/her academic performance is deemed unsatisfactory. When placed on probation, the student is required to meet with the Division Head or the Academic Standards Committee of the Division of Engineering Technology, to remove an academic hold on his/her registration. While on probation, a student may not represent the Division of Engineering Technology in student activities. The Academic Standards Committee of the Division formulates the regulations for probationary students and hears requests for exceptions.

A student on probation is expected to bring up his/her grade point average promptly. If, at the end of the first semester on probation, the student's cumulative grade point average has not increased to at least 2.0, he/she will be excluded from the Division of Engineering Technology for at least one calendar year. Course work taken at any institution during the period of exclusion may not be considered for transfer toward an engineering technology degree.

For part-time students, a semester will be considered to consist of twelve consecutive credits. If a student's cumulative g.p.a. reaches at least 2.0 by the end of the first semester after being placed on probation, he/she will be returned to regular status. Multiple occurrence of probation will result in the student's exclusion from the Division of Engineering Technology.

A student may be refused the privilege of registering in the Division if, at any time, his/her grade point average falls below 2.0. A student may also be refused the privilege of registering in the Division for irresponsible attendance and performance in class, regardless of any probationary status.

A student who has been refused registration may request that the Division Head or Academic Standards Committee reconsider his/her

status. Such request should only be made when evidence of extenuating circumstances can be provided

Division of Engineering Technology Rules for Calculating Grade Point Average

The Division of Engineering Technology computes Division and College grade point averages using rules that differ from those used to compute the cumulative grade point average on the official University transcript: the College g.p.a. is calculated based on all engineering and technical courses, as well as required English courses. The Division g.p.a. includes all courses taken within the Division including courses bearing the subject codes of: CMT, ET, EET, MCT, MIT, ETT.

For students admitted to the College of Engineering for the Winter 2004 semester or later, repeated courses will not be included in the grade point average calculations (following standard University regulations). The new grade will replace the old grade in the g.p.a. calculation, but only a maximum of five repeated courses will be allowed.

For students admitted to the College of Engineering prior to Winter 2004, the inclusion of repeated courses in the grade point calculation follows different rules. When a course is repeated, the new grade will replace the previous grade unless the student exceeds the maximum number of repeats: one repeat for each thirty-four credits completed at Wayne State University. After the maximum number of repeats is exceeded, both grades are used in computing the student's grade point average.

Dean's List of Honor Students

A student who achieves a semester grade point average of 3.5 or more, based on a program of at least twelve credits, is notified by the Dean of citation for distinguished scholarship and his/her name is included on the Dean's List of Honor Students.

Substandard Performance

A minimum grade of C- is required for all courses. A course in which a grade below C- has been earned can not be subsequently passed by special examination. When repeating a course, failure for the third time to pass it with a grade satisfactory to the Division constitutes grounds for denying a student further registration in the Division of Engineering Technology.

Technology Transfer Credit

University policy allows a maximum of sixty-four semester credits to be transferred from community colleges to Wayne State. In some cases, students following University-approved articulation agreements with community colleges are able to exceed the maximum of sixty-four credits; however, a minimum of thirty semester credits must be earned from Wayne State, and at least twenty-four of those credits must be earned in Division of Engineering Technology courses. Each Engineering Technology degree program specifies lower division technical courses that may be part of the sixty-four credits transferred to Wayne State. These are listed in *Requirements* tab of each degree program under the heading, *Lower Division Technical Transfer Credits*. For evaluation of courses submitted to satisfy this requirement, students should consult an Engineering Technology advisor.

Changes of Election and Withdrawal

In addition to the University policies regarding changes of program and withdrawal from courses (<http://bulletins.wayne.edu/undergraduate/general-information/records-registration>), the following additions and amendments apply to the Division of Engineering Technology:

Registration and Adding Courses

A student may register for courses through the last day of the second week of classes for fifteen-week courses. A registered student may add a

course through the last day of the second week of classes by submitting a completed Drop/Add form. Students are not permitted to add courses after the first week of the term without instructor and departmental permission.

A student may not change from one section of a course to another section of the same course after the fourth week of classes. Drop/Add forms will be valid for ten calendar days from the date of the earliest signature of approval. Once a student is admitted to Wayne State University, he/she does not have to go through the admissions procedure again. If a student does not register for two or more terms, he/she must first have his/her status upgraded at the University Records Office.

Withdrawals

Courses from which a student withdraws, such that a mark of WP, WF, or WN appears on the transcript, are counted as an attempt at the course and are taken into account when assessing the allowed number of repeats. If a student feels that circumstances beyond their control (e.g., family emergency, change of work schedule) justify the withdrawal, a written petition may be submitted to the Associate Dean for Academic Affairs before the end of the semester in which the course was taken. If the petition is approved, it will be noted in the student's advising record that the course will not be counted towards Engineering repeat allowances.

Graduation

Students must apply for graduation at the beginning of the semester in which they plan on completing their degree requirements. At graduation, the University requires a minimum 2.0 grade point average in the total residence credit. Additionally, Engineering Technology programs require a minimum 2.0 grade point average in the Division. The student's total g.p.a., as well as division grade point average, is calculated using the Division of Engineering Technology rules as described above.

Graduates with a minimum of thirty credits in residence at Wayne State University and a grade point average of at least 3.0 may qualify for a special diploma under the following conditions:

Summa Cum Laude: Student must have a grade point average in the 95th percentile of the College of Engineering graduating class.

Magna Cum Laude: Student must have a grade point average in the 90th percentile of the graduating class.

Cum Laude: Student must have a grade point average in the 80th percentile of the graduating class.

Commencement

Each year, commencement exercises are held in both May and December. College Order of the Engineer and Professional Order of Engineering Technology ceremonies will be held in May to induct graduates into these organizations. Students who are graduating in December are eligible to participate in the induction ceremony for the following May.

AYOObI, MOHSEN: Ph.D., Louisiana State; M.Sc. and B.Sc., Isfahan University; Assistant Professor

CHEN, JIMMY CHING-MING: Ph.D., Texas A&M University; M.S., B.S., National Taiwan University; Assistant Professor

CHEN, WEN: Ph.D., Simon Fraser University; M.S., Nanyang Technological University; Diploma, Northeastern University; Associate Professor

DJURIC, ANA: Ph.D., M.S., University of Windsor; M.E., B.S., Belgrade University; Assistant Professor

LIAO, GENE Y.: D.Eng., University of Michigan; Mechanical Engineer, Columbia University; M.S., University of Texas at Arlington; B.S., National Central University; Professor

SSEMAKULA, MUKASA E.: Ph.D., M.S., B.S., University of Manchester Institute of Science and Technology; Professor

YAPRAK, ECE: Ph.D., M.S., Wayne State University; B.S., University of Michigan, Dearborn; Professor and Chair

YEH, CHIH-PING: Ph.D., M.S., Texas A & M University; B.S.E.E., Tamkang University; Associate Professor

- Computer Technology (B.S.C.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/computer-technology-bsct>)
- Construction Management (B.S.C.M.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/construction-management-bscm>)
- Electrical/Electronic Engineering Technology (B.S.E.E.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/electrical-electronic-engineering-technology-bseet>)
- Electromechanical Engineering Technology (B.S.E.M.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/electromechanical-engineering-technology-bsemt>)
- Electric Transportation Technology (B.S.E.T.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/electric-transportation-technology-bset>)
- Mechanical Engineering Technology (B.S.M.C.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/mechanical-engineering-technology-bsmct>)
- Manufacturing Engineering Technology (B.S.M.F.T.) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/manufacturing-engineering-technology-bsmft>)
- Energy Storage Systems, Advanced (Certificate) (<http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/energy-storage-systems-advanced-certificate>)
- Construction Management (p. 3)
- Electrical/Electronic Engineering Technology (p. 4)
- Electric Transportation Technology (p. 5)
- Engineering Technology (p. 5)
- Manufacturing/Industrial Engineering Technology (p. 6)
- Mechanical Engineering Technology (p. 7)

Construction Management

CMT 3000 Construction Estimating and Bidding Cr. 3

Fundamental cost estimating principles, processes and methods used in residential and commercial construction. Offered Fall.

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3010 Introduction to Construction Management Cr. 3

Overview of construction industry; processes involved in construction projects from conception to final delivery. Offered Fall.

Prerequisites: CMT 21X0 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3020 Residential and Commercial Land Development and Design Cr. 3

Role and responsibilities of a developer; financing strategies and new trends in lending; forming an effective partnership. Technical processes: from undeveloped land to surveying, conceptual drawing, site planning process, engineering and design, permits, and construction. Offered Winter.

Prerequisites: CMT 2X20 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3030 Construction Safety Management Cr. 3

Construction safety and health management as applicable to contractors, owners, and designers. Construction injury and fatality statistics; humanitarian, legal and economic justification for safety; accident causation and control theories; OSHA standards and safe construction procedures. Safety policy, project safety rules, communications network, accident investigation and record keeping, worker orientation and training, and safety program evaluation and audits. Offered Fall.

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3040 Building Codes Cr. 3

Requirements by regulatory agencies pertaining to the construction industry; current International Building Code and other regulations; emphasis on Michigan applications. Offered Winter.

Prerequisites: CMT 21X0 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3050 Construction Accounting and Financial Management Cr. 3

Successful management of finances of the construction project and companies. Accounting systems, financial statements, overhead and profits, cash flows for construction projects and companies, project financing, and financial decision making. Offered Fall.

Prerequisites: ECO 2020 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3060 Planning and Scheduling Cr. 3

Principles and use of Primavera Project Planner scheduling software: project planning, scheduling, control, and analysis. Project scheduling methods and construction activity analysis, including Critical Path Method (CPM) and networking techniques. Offered Winter.

Prerequisites: ET 5870 with a minimum grade of C

CMT 3070 Introduction to Green Construction Cr. 3

Sustainable or green-building design and construction: efficient use of resources to create healthier and more energy-efficient buildings. Motivations for green construction projects, technical aspects of their design, obstacles, future directions. Knowledge and capabilities to project-manage a green building. Offered Fall.

Prerequisites: BIO 1030 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 3080 Advanced Computers in Construction Cr. 3

Advanced applications of MS Excel software in estimating and financial management of construction projects; making effective project presentations using MS PowerPoint. Field applications of computers; use of PDAs and handheld devices in data acquisition and management. Use of REVIT software in Building Information Modeling (BIM). Offered Winter.

Prerequisites: CE 3010 with a minimum grade of C or ET 2140 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 4030 Facilities Management Principles Cr. 3

Aspects of facilities management: buildings and grounds, custodial services, design and construction, operations and maintenance management. Offered Fall.

Prerequisites: CMT 21X0 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 4050 Construction Methods Cr. 3

Overview of construction practices in industry; processes and equipment involved in construction projects from conception to final delivery. Offered Fall.

Prerequisites: CMT 21X0 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 4070 Mechanical and Electrical Systems in Buildings Cr. 3

Principles and applications of basic mechanical and electrical systems; design examples; emerging technology and environmental issues; essential engineering calculations and data. Offered Fall.

Prerequisites: PHY 2130 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 4140 Project Administration Cr. 3

Overview of construction project and contract administration and management. Use of Excel, Expedition, and Prolog software. Offered Winter.

Prerequisites: CMT 2X00 with a minimum grade of C

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 4200 Senior Project Cr. 3

Satisfies General Education Requirement: Writing Intensive Competency Capstone project; senior students work in teams; application of skills, knowledge, techniques and concepts. Satisfies the University General Education Writing Intensive Course in the Major requirement. Offered Winter.

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students with a class of Senior; enrollment limited to students in the College of Engineering.

Electrical/Electronic Engineering Technology

EET 2000 Electrical Principles Cr. 3

Kirchhoff's laws, D.C. and A.C. circuit analysis, impedance, phasors, power and power factor correction, mutual coupling. Power transformers, D.C. and A.C. generators and motors, motor controls. Offered Yearly.

Prerequisites: MAT 1800 with a minimum grade of C-

EET 2100 Principles of Digital Design Cr. 3

Applied Boolean algebra and number systems. Logic families, K-mapping; combinational logic, multiplexers and demultiplexers, readouts and displays, flip flops. Offered Yearly.

EET 2720 Microprocessor Fundamentals Cr. 3

Use of microprocessors as interface devices, including software, interfaces, memory, registers, and microcomputer system architecture, computer programming design projects. Offered Yearly.

Prerequisites: CSC 1050 with a minimum grade of C-

Course Material Fees: \$25

EET 3100 Advanced Digital Design Cr. 3

System level design of digital logic circuits using hardwired and programmable logic devices. ROMs, PROMs, and PLAs. Synchronous and asynchronous circuit design and analysis. Offered Fall, Winter.

Prerequisites: EET 2100 with a minimum grade of C-

EET 3150 Network Analysis Cr. 4

Analysis of circuits with dependent sources, RL, RC, and RLC circuit transient and sinusoidal response, network functions, frequency response, and power analysis. Offered Fall, Winter.

Prerequisites: EET 2000 with a minimum grade of C- and May be taken concurrently: ET 3450 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

EET 3180 Analog Electronics Cr. 4

Operational amplifiers, circuit and applications; summing and subtracting amplifiers; integrating and differentiating amplifiers; comparators. Design of active filters, oscillators and waveform generating circuits, and audio integrated circuits. Offered Fall, Winter.

Prerequisites: CHM 1020 with a minimum grade of C- and EET 2000 with a minimum grade of C-

Course Material Fees: \$20

EET 3300 Applied Signal Processing Cr. 3

Continuous-time and discrete-time signals, frequency response and impulse response; transfer function of linear systems, data acquisition and sampling, continuous and discrete Fourier transform; spectrum analysis and filtering; digital filter design. Offered Fall, Winter.

Prerequisites: May be taken concurrently: EET 3150 with a minimum grade of C-

EET 3500 Electrical Machines and Power Systems Cr. 3

Energy fundamentals. Physical and operating characteristics of D.C. and A.C. generators and motors, transformers. Electric power network. Transmission line stability. Power factor correction. Load sharing by transformers and generators. Per unit notation. Environmental impact of electric power generation. Offered Intermittently.

Prerequisites: EET 2000 with a minimum grade of C- and ET 3430 with a minimum grade of C-

EET 3720 Micro and Programmable Controllers Cr. 3

Microprocessors and Programmable logic controllers; on-chip I/O resources, interfacing; controls, instrumentation, and communication; data manipulation and sequencer instruction set; development and debugging tools. Offered Fall, Winter.

Prerequisites: CSC 1050 with a minimum grade of C- and EET 2720 with a minimum grade of C-

Course Material Fees: \$20

EET 4100 Computer Hardware Design Cr. 3

Structural organization and hardware design of digital computers. Register transfer, micro-operations, and microprogram control. Processing and control units, arithmetic algorithms, input-output systems, and memory systems. Offered Yearly.

Prerequisites: EET 2720 with a minimum grade of C- and EET 3100 with a minimum grade of C-

EET 4200 Control Systems Cr. 4

Feedback control systems with topics in time response, stability criteria, system representation, frequency response, compensation. PID controller; simulation of electrical and mechanical systems. Offered Fall, Winter.

Prerequisites: ET 3450 with a minimum grade of C- and EET 3150 with a minimum grade of C- or MCT 3010 with a minimum grade of C-

Course Material Fees: \$10

EET 4600 Power Electronics Cr. 3

Understanding different types of power semiconductor devices; analysis of typologies of uncontrolled and controlled converters, dc-dc converters. Simulation of power converters and application of power converter technologies in industrial and utility applications. Offered Yearly.

Prerequisites: EET 3150 with a minimum grade of C- and ET 3450 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

EET 4990 Guided Study Cr. 1-6

Supervised study and instruction in field selected by student. Offered Intermittently.

Repeatable for 6 Credits

EET 5720 Computer Networking Applications Cr. 4

Networking protocols, components, architecture, and standards. Data communication, data packet structure, data transmission methods and techniques, network topologies, and media access control methods. Offered Yearly.

Prerequisites: EET 3100 with a minimum grade of C- and EET 3720 with a minimum grade of C-

Course Material Fees: \$25

EET 5730 Embedded Systems Networking Cr. 3

Principles of data communications and real-time wired and wireless embedded systems networking. State of the art embedded networks including Controller Area Networks (CAN), internet connectivity and other embedded standards will be utilized in this project based class. Offered Fall.

Electric Transportation Technology

ETT 3190 Fundamentals of Automotive Electrical and Electronic Systems Cr. 3

Foundations in contemporary automotive electronic systems. Topics include: review of automotive electronics, basic circuit building blocks, vehicle controllers, networking, diagnostics, sensors, actuators, and power electronics. Offered Fall.

Prerequisites: EET 2000 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ETT 4150 Fundamentals of Hybrid and Electric Vehicles Cr. 3

Hybrid and electric vehicle technologies: concepts and design, energy analysis, unified model approach, hybridization, hybrid powertrain architectures, IC engines for HEVs, transmissions used in HEVs, on-board energy storages. Offered Winter.

Prerequisites: ET 3430 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ETT 4310 Energy Storage Systems for Hybrid and Electric Vehicles Cr. 3

Overview of advanced battery technologies and applications in EV/HEV, hybrid powertrain configuration and requirements, in-vehicle energy storage systems, battery development, thermal management, control systems, cell monitoring, balancing, and on-board diagnostics. Offered Winter.

Prerequisites: ET 3430 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ETT 4410 Introduction to Advanced Energy Storage Cr. 3

Comprehensive coverage of energy storage for automotive and renewable energy; battery technology; hydrogen electrochemical cells and regenerative fuel cells; mechanical energy storage; thermal and chemical storage; superconductor. Offered Fall.

Prerequisites: ET 3430 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ETT 4510 Power Management and Applications of Energy Storage Systems Cr. 3

Principles of electric machines, power electronics, control, and power management strategy for energy systems, and the applications of energy storage systems in alternative energy systems and electric drive vehicles. Offered Fall.

Prerequisites: ET 3430 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

ETT 4650 Power Electronics and Charging Infrastructure for Hybrid and Electric Drive Vehicles Cr. 3

Principles of power systems, distribution systems, and ac/dc charging systems; applications of power electronic technologies in traction control, battery management, and regenerative braking for electric drive vehicles. Offered Winter.

Prerequisites: EET 3150 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ETT 4740 In-Vehicle Networking and Embedded Systems Cr. 3

Principles of data communications and real time embedded systems networking, with emphasis on in-vehicle networking. Controller Area Networks and FlexRay are covered. Project-oriented course utilizing various hardware/software. Offered Yearly.

Prerequisites: EET 3100 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

Engineering Technology

ET 1500 Engineering Technology Trades Internship Cr. 1-6

Industrial practice dealing with specific skill trades in engineering technology, under supervision in cooperative internship program. Offered Intermittently.

ET 2140 Computer Graphics Cr. 3

Solution of drafting problems and development of graphic presentations using computer-assisted drafting techniques. Use of programming techniques for direct solution of drafting/graphic problems and available software routines. Introduction to the use of computer plotters, CRTs, digitizers. Offered Fall, Winter.

Prerequisites: CSC 1050 with a minimum grade of D-

Course Material Fees: \$15

ET 2160 Computer Applications for Engineering Technology Cr. 2

Various software programming environments and programming skills for engineering technology applications, including programming logic, file IO, data acquisition and processing, computer simulation, and communication protocols. Offered Fall, Winter.

Prerequisites: EET 2000 with a minimum grade of C- or ET 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

ET 2200 Engineering Materials Cr. 3

Application and characteristics, both physical and chemical, of metallic and nonmetallic materials, polymers, and composites used in industry. The primary process involved in producing these materials. Offered Yearly.

Prerequisites: CHM 1020 with a minimum grade of C-

ET 2500 Co-op Experience Cr. 1-4

Industrial practice under supervision in cooperative education. Work-study program. Report required. Offered Every Term.

Repeatable for 4 Credits

ET 3030 Statics Cr. 3

The objective of this course is to provide the student with a basic understanding of the analytical and graphical techniques that are used to determine the forces acting upon and within a body or structural component under static load. This course provides the necessary foundation for later studies in the analysis and design of structures as well as mechanical and electrical equipment. Offered Fall, Winter.

Prerequisite: ET 2140 with a minimum grade of C- and PHY 2130 with a minimum grade of C- and ET 3430 (may be taken concurrently) with a minimum grade of C-

ET 3050 Dynamics Cr. 3

Kinematics; kinetics of particles; kinetics of translation and rotation of a rigid body; relative motion; use of equations of plane motion. Application of impulse and momentum principles; work and efficiency. Offered Yearly.
Prerequisites: ET 3030 with a minimum grade of C- and MAT 3430 with a minimum grade of C-

ET 3430 Applied Differential and Integral Calculus Cr. 4

Limits, derivatives, applications of derivatives, definite integrals and their applications, and trigonometric functions. No degree credit in College of Liberal Arts and Sciences. Offered Every Term.
Prerequisites: MAT 1800 with a minimum grade of C-
Equivalent: MAT 3430

ET 3450 Applied Calculus and Differential Equations Cr. 4

Continuation of MAT/ET 3430, including logarithmic and exponential functions, first and second order ordinary differential equations, vectors, polar coordinates, Laplace transforms, Taylor series, and Fourier series. No degree credit in College of Liberal Arts and Sciences. Offered Every Term.
Prerequisites: ET 3430 with a minimum grade of C- or MAT 3430 with a minimum grade of C-
Equivalent: MAT 3450

ET 3850 Reliability and Engineering Statistics Cr. 3

Probability, hypergeometric, binomial, Poisson, and normal probability distribution; confidence intervals; inferences concerning means; linear regression; introduction to statistical quality control and reliability; use of computers. Offered Fall, Winter.
Prerequisites: MAT 1800 with a minimum grade of C-

ET 3870 Engineering Economic Analysis Cr. 3

Techniques to economically evaluate major technical projects, rate of return and present worth, interest formulae, federal taxes, risk, inflation, and non-economic constraints. Offered Every Term.
Prerequisites: MAT 1800 with a minimum grade of C-

ET 4990 Guided Study Cr. 1-6

Supervised study and instruction in field selected by student. Offered Intermittently.
Repeatable for 6 Credits

ET 4999 Senior Project Cr. 3

Satisfies General Education Requirement: Writing Intensive Competency Student designs, builds, and tests product; philosophy of design. Project proposal to be submitted by second week, final outcome to be completed by thirteenth week; progress reports, and oral presentation required. Offered Fall, Winter.
Prerequisites: ENG 3050 with a minimum grade of C

ET 5100 Fundamentals of Mechatronics and Industrial Applications Cr. 3

Fundamentals of mechatronics and their applications in industry; building blocks of mechatronic products including sensors, proximity, displacement and rotational measurement sensors, force and torque measurement sensors, pressure sensors, accelerometers, and actuators; introduction of closed-loop control, electrohydraulic motion control, PLC mechatronics design by embedding sensors, actuators and controllers into mechanical components. Offered Winter.
Prerequisites: EET 3180 with a minimum grade of C- or MCT 3010 with a minimum grade of C-

ET 5110 Advanced Programmable Controllers and Industrial Applications Cr. 3

Introduces basic concepts and architecture of industrial control systems, sensors, measurement devices, PID controllers, and operating principles of PLCs. Students will learn how to operate the PLC programming software. Ladder logic programs are the main language, and functions and function blocks will also be taught for students to grasp high-level PLC-programming skills. Offered Fall, Winter.
Prerequisite: EET 3720 with a minimum grade of C-

ET 5500 Graduate Industrial Internship Cr. 1-4

Industrial practice under supervision in cooperative education. Oral presentation and written report describing professional experience required. Offered for graduate credit only. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 4 Credits

ET 5800 Industrial Robots Programming Cr. 3

Provides an understanding of basic robotic theory (direct kinematics, inverse kinematics, links, joints, coordinates systems, and robotic vision theory) and applications. Students will program and maintain an R-J or higher robot controller with a standard application software package; identify the components of a vision system; install vision hardware; develop an application; perform error recovery procedures; and follow recommended safety practices. Labs, assignments and projects will be done using industrial robots: FANUC S 430 iw, FANUC LR Mate 200 iC, FANUC LR Mate 200 iD, and FANUC CR 4iA collaborative robot. Simulation and off-line programming will be done using Visual Components and ROBOGUIDE simulation software packages. Students will have the opportunity to receive an industrial certificate if they successfully complete the required test. Offered Fall.

ET 5870 Engineering Project Management Cr. 3

Provides the student with insights into human and organizational behavior affecting projects, in addition to the quantitative tools for the successful management of engineering projects. The course addresses a variety of project types and deals with how to select, initiate, operate and control as well as terminate a project. The role of project managers and their interaction with the rest of the organization is highlighted. Offered Fall, Winter.
Prerequisites: MAT 1800 with a minimum grade of C-

ET 5995 Special Topics in Engineering Technology I Cr. 1-4

Topics to be announced in Schedule of Classes. Offered Intermittently.
Repeatable for 8 Credits

Manufacturing/Industrial Engineering Technology

MIT 3350 Applied Human Factors Cr. 3

Introduction to human physiological and psychological functions and capabilities from an engineering viewpoint; sensory information processing and motor abilities, human-machine design aspects. Offered Yearly.

MIT 3500 Machine Tool Laboratory Cr. 1

Laboratory experiences in manufacturing processes, machine tools, and mechanization. Calibration and part-setup. Offered Fall, Winter.
Prerequisites: ET 2140 with a minimum grade of C-

MIT 3520 Manufacturing Processes Theory Cr. 2

Nature and deformation behavior of materials commonly used in manufacturing; basic processes used in transforming them into useful products; scientific theory underlying those processes; criteria for selecting particular processes. Offered Fall, Winter.
Prerequisites: CHM 1020 with a minimum grade of C- and May be taken concurrently: MIT 3500 with a minimum grade of C-

MIT 3600 Process Engineering Cr. 3

Processing functions. Methods of manufacturing analysis. Manufacturing sequence, mechanization. Selection of tooling and equipment. Planning the process of manufacture. Offered Yearly.
Prerequisites: MIT 3520 with a minimum grade of C-

MIT 4700 Computer-Aided Design and Manufacturing Cr. 3

Fundamentals of computer-aided manufacturing using computer software. Two- and three-dimensional applications programming, numerical control and programming. Offered Yearly.

Prerequisites: ET 2140 with a minimum grade of C- and MIT 3520 with a minimum grade of C- or MIT 3510 with a minimum grade of C-
Course Material Fees: \$25

MIT 4800 Quality Control Cr. 4

Introduction to total quality systems design and to basic analytical techniques for quality control. Offered Intermittently.

Prerequisites: ET 3850 with a minimum grade of C-

MIT 4990 Guided Study Cr. 1-6

Supervised study and instruction in the field selected by the student. Offered Intermittently.

Repeatable for 6 Credits

MIT 5500 Machine Tool Laboratory Cr. 1

Laboratory experiences in manufacturing processes, machine tools, and mechanization. Calibration and part-setup. Offered Fall, Winter.

Prerequisites: ET 2140 with a minimum grade of C-

MIT 5700 Industrial Robots Modeling and Simulation Cr. 4

Topics include: the direct kinematic problem (homogeneous transformation matrices, composite homogeneous transformation matrix, links, joints and their parameters, the Denavit-Hartenberg representation, kinematic equations for manipulators); the inverse kinematic problem (geometric approach applied for 2DOF, 3DOF, 4DOF, 5DOF, and 6DOF manipulators; modeling, simulation and off-line programming of industrial robots and cobots (collaborative robots); and current trends and research in industrial robotics and cobotics. Offered Winter.

Restriction(s): Enrollment is limited to Graduate or Undergraduate level students; enrollment limited to students with a class of Unranked Grad or Senior.

Mechanical Engineering Technology

MCT 3010 Instrumentation Cr. 3

Theory and use of measurement instruments and techniques; standards and dimensional units; experimental procedures and data analysis; sensors and transducers for parameters such as displacement, stress, strain, force, torque, temperature, motion, sound. Offered Fall, Winter.

Prerequisites: EET 2000 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students.

Course Material Fees: \$25

MCT 3100 Mechanics of Materials Cr. 3

The elastic behavior of load bearing materials. Tension, compression, shear, combined stress, bending, torsion and columns. Failure analysis. Offered Fall, Winter.

Prerequisites: ET 3030 with a minimum grade of C- and May be taken concurrently: ET 3430 with a minimum grade of C-

Course Material Fees: \$10

MCT 3410 Kinematics and Dynamics of Machines Cr. 3

Velocity and acceleration of moving parts in machine elements and mechanisms; cam, gear, and gear train design; static and inertial forces, balancing, gyroscopic effects, and critical speeds. Offered Fall, Winter.

Prerequisite: ET 3050 with a minimum grade of C-

MCT 4150 Applied Thermodynamics Cr. 3

First and second laws of thermodynamics; power and refrigeration cycles; gas and vapor mixtures, nozzle and blade passage flow and combustion. Introduction to compressible flow. Direct energy conversion. Offered Yearly.

Prerequisites: ET 3430 with a minimum grade of C-

Course Material Fees: \$10

MCT 4180 Fluid Mechanics Cr. 3

Properties of fluids, fundamentals of fluid flow, dimensional analysis and similitude, and flow measurement techniques. Analysis of hydrostatic equipment, hydrokinetic equipment and systems. Introduction to network analysis and calculation. Offered Yearly.

Prerequisites: ET 3030 with a minimum grade of C- and May be taken concurrently: ET 3450 with a minimum grade of C-

MCT 4210 Heat Transfer Cr. 3

Basic modes of heat transfer and their applications. Steady state conduction in one and two dimensions and transient conduction. Numerical and graphical methods. Heat exchanges. Condensation and boiling heat transfer. Introduction to mass transfer. Offered Yearly.

Prerequisites: May be taken concurrently: MAT 3450 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

MCT 4400 Design of Machine Elements Cr. 3

Fundamental concepts in the design of the separate elements which compose the machine; application of properties and mechanics of materials modified by practical considerations. Offered Yearly.

Prerequisites: MCT 3100 with a minimum grade of C- and MCT 3410 with a minimum grade of C-

MCT 4990 Guided Study Cr. 1-6

Supervised study and instruction in the field selected by the student. Offered Intermittently.

Repeatable for 6 Credits

MCT 5210 Energy Sources and Conversion Cr. 3

Various energy sources and how they are utilized. Wind, solar, geothermal, fuel cells, storage devices, energy economics and transportation techniques, related to harnessing energy to a usable form such as electricity and heat. Offered Fall.

Prerequisites: ET 3430 with a minimum grade of C- and PHY 2140 with a minimum grade of C-

MCT 6150 Hybrid Vehicle Technology Cr. 4

Technical concepts and design, energy analysis, unified modeling approach, optimization, control; power generation, engine overview, concepts of hybridization, on-board energy storage; overview of motors, transmissions, fuel cells, future applications. Offered Yearly.

Prerequisites: ET 3450 with a minimum grade of C- and PHY 2140 with a minimum grade of C-