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.

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.

Undergraduate Registration

Engineering Technology students are required to meet with their academic advisor a minimum of once per academic year in order to discuss their academic progress and curriculum. It is strongly recommended that these meetings take place before each semester's registration. Special attention should be paid to course pre- and co-requisites requirements in prerequisites. It is the student's responsibility to ensure that all pre-requisite and co-requisite requirements are satisfied. Students will be removed from courses entered without satisfying these requirements. The Division will adhere strictly to this established policy, and waivers may be considered for truly exceptional cases only.

Some courses may be offered only once a year; others may have multiple sections running every semester. The University Schedule of Classes (http://www.classschedule.wayne.edu/?_gl=1*1ajwq5r*_ga*MTgyNTYxMzc4NS4xNjkzNDAyOTAy*_ga_ZYEBRZJFL1*MTY5N published prior to each semester, shows when and where the classes will meet and outlines registration procedures and times.

Attendance Policy

Regular attendance in classes is necessary for success in college work. Excessive unexcused absences may result in a student failing a course. The student should arrange with the course instructor in advance for all predictable absences. Absences due to illness or conditions beyond the student's control should be reported in writing to the instructor as soon as possible, and substantiating documentation provided upon the student's return to class.

Dean's List of Honor Students

A student who achieves a term grade point average of 3.5 or more, based on a load of twelve credits or more, is cited by the Dean for distinguished scholarship and is included on the Dean's List of Honor Students.

AGRADE Program (Accelerated Graduate Enrollment)

The Engineering Technology Division 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 3.3 g.p.a. overall and not less than a 3.45 g.p.a. in their program of specialization, as computed by the rules of the Division of Engineering Technology. See the academic 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. Thus, a student should not falsely claim the work of another as their own or misrepresent themselves so that the measures of their academic performance do not reflect their own work or personal knowledge.

If there are reasonable grounds to believe that a student has violated the regulations or student responsibilities, they may be disciplined. Such discipline may include failure in the course, suspension or dismissal from the program. A description of the University's Student Due Process Policy and a discussion of academic integrity can be found at the Dean of Students Office (http://www.doso.wayne.edu/assets/codeofconduct.pdf).

Division of Engineering Technology Rules for Calculating Grade Point Average

Engineering Technology computes grade point averages of major requirement courses using rules that differ from those used to compute the cumulative grade point average on the official University transcript: Engineering Technology g.p.a. is calculated based on all upper division courses (3000 level or higher) required for the program of study. For students admitted to the James and Patricia Anderson 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 James and Patricia Anderson 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.

Substandard Performance

A minimum grade of C- is required for all courses. If a grade below C- is received in any course to be applied towards the degree, the student will be required to repeat that course in the next semester in which it is available. The course must be repeated, and a satisfactory grade earned before the next course in the sequence is taken. **Students will be administratively withdrawn from courses for which they have not satisfied course prerequisites.** A course in which a grade below C- has been earned cannot 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.

For part-time students, a semester will be considered to consist of twelve consecutive credits.

A student may be refused the privilege of registering in the Division if, at any time, their 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 their status. Such request should only be made when evidence of extenuating circumstances can be provided.

Auditing Courses

Undergraduate students may elect to formally audit a course that interests them. In order to audit a course, a student must register for the class and pay the appropriate tuition. However, this course will not apply towards any degree requirements. Any course that has been completed for audit may not be subsequently enrolled in for credit, nor may credit be obtained by special examination.

Courses used to satisfy program requirements may not be taken on a Pass-Fail basis, except for industry sponsored project courses taken for elective credit (maximum of 3 credit hours). Capstone design course, even if they include an industry sponsored project, may not be taken on a Pass-Fail basis.

Repeating Courses

If a student receives a substandard grade in a course at Wayne State University, they will be required to repeat that course at Wayne State University. Exceptions to this policy require prior written approval from the Associate Dean for Academic Affairs in order to take the course at another designated institution.

Students are directed to Repeating Courses — The mark of R (https://bulletins.wayne.edu/undergraduate/general-information/academic-regulations/#repeats) for University policies related to repeating courses and credit by special examination. See also 'Division of Engineering Rules for Calculating Grade Point Average,' above.

General education and technical elective courses, which are not specifically required for the degree, may be repeated or a different course may be chosen to satisfy that requirement. If a different course is selected, the first grade will not be replaced in the calculation of the g.p.a.

Exclusion from the James and Patricia Anderson College of Engineering

Students may repeat up to five courses in which they obtained a grade below C-. Should a student need to retake a sixth course to fulfill degree requirements, they will face exclusion from the James and Patricia Anderson College of Engineering. Moreover, failing to achieve a grade of at least 'C-minus' after three attempts in a course will serve as grounds for exclusion from the James and Patricia Anderson College of Engineering. Prerequisite math courses, although not credited towards the degree, become part of the exclusion count if students didn't place into MAT 1800. It's important to note that repeating a course for a better understanding, even if a satisfactory grade ('C-minus' or higher) was initially earned, will not contribute to the tally of permitted repeats.

Following exclusion from James and Patricia Anderson College of Engineering, the privilege of registering in the College will be withheld for at least one calendar year.

A student who has been denied the opportunity to enroll in the James and Patricia Anderson College of Engineering may seek a review of their status by the Academic Standards Committee (ASC) following a one-year exclusionary period. However, such a request should only be made if there is supporting evidence of academic preparation or circumstantial changes that significantly enhance the chances of academic success. To initiate the reconsideration process, a formal written request must be submitted to the Associate Dean for Academic Affairs. Students planning to petition for readmission are advised to consult with their academic advisor early in the exclusion period to explore potential changes that could facilitate readmission. It is important to note that readmission to the James and Patricia Anderson College of Engineering is not guaranteed in any circumstance.

Probation Policy

A student enters probationary status when their cumulative grade point average (g.p.a.) falls below 2.0 or when their academic performance is considered unsatisfactory. During this period, the student must meet with their academic advisor to address academic deficiencies and devise an academic recovery plan for the next two semesters. While on probation, participation in student activities representing the Division of Engineering Technology is not allowed. The Academic Standards Committee of the Division establishes probationary regulations and reviews exception requests.

A student is granted two consecutive terms on probation. If, after these terms, the cumulative g.p.a. remains below 2.00, the student faces exclusion from their program. At the end of the initial semester on

probation, if the cumulative grade point average has not improved to at least 2.0, the student is prohibited from applying to the Division of Engineering Technology for readmission or reinstatement for a minimum of one calendar year.

Changes of Election and Withdrawal

In addition to the University policies regarding changes of program and withdrawal from courses (https://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 W 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.

Transfer Credit Policy

There is no limit to the number of credits a student can transfer in. However, the applicability of transfer credits to specific programs in the Division will vary with the **articulation agreements/transfer pathways** with the individual institutions. For more information on transferring credits, see the following link:

Transferring credit - Transfer to Wayne State University - Wayne State University

Students must take a minimum of 34 credit hours from WSU, including 24 hours, which must be delivered by the Division of Engineering Technology. In order for a transfer course to be utilized in a student's plan of study, it cannot be lower than a C. (In other words, C-, D+, D, D-, and F are considered unsuitable for transfer).

Course Prerequisite Policy

The Division of Engineering Technology has instituted a system of prerequisites and co-requisites for technical courses. These requirements are designed to ensure that students have the necessary background knowledge for the subsequent courses. Thus, the Division will adhere strictly to this established policy, and waivers may be considered for truly exceptional cases only.

Request to petition any established Division or College rules must be submitted to the academic advisor in writing.

Although we rely primarily on the Banner system for prerequisite checks, students will be administratively withdrawn at any time during the term if through any other means we find them lacking the necessary requirements.

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.

Students must take a minimum of 34 credit hours from WSU, including 24 hours, which must be delivered by the Division of Engineering Technology. 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 James and Patricia Anderson 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.

Guest Students

A student attending another engineering college who wishes to take course work at Wayne State for the purpose of credit transfer to the home institution may be admitted as a guest student for one term. This is done by applying through the University Office of Admissions using either the Application for Undergraduate Admission or the Graduate Guest Application. These applications require certification by an official of the home institution. For information on graduate guest admission and visiting doctoral guests, see the Wayne State University Graduate Bulletin. Guest students are expected to have met the listed prerequisite requirements for courses in which they wish to enroll. Students wishing to register for 3000- or 4000-level engineering classes must first receive permission from the department that teaches the course.

Second and Concurrent Degree

In accordance with the University requirements, students may earn a Bachelor of Science in one of the Division programs concurrently with or subsequent to another bachelor's degree at Wayne State University. Such students must satisfy applicable departmental and college requirements; consult an academic advisor to review these requirements.

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

BOILEAU, JAMES: Ph.D., Wayne State University; Associate Professor

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

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

JAGER, MARK: M.S., B.S., Wayne State University; Assistant Professor of Teaching

KIM, SOOIN: Ph.D., University of Texas-Arlington; Assistant Professor

MAO, YANBING: Ph.D.; State University of New York at Binghamton; Assistant Professor

PLATEAU, TAZDIK PATWARY: Ph.D., Missouri University of Science and Technology; Assistant Professor

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

VAGLICA, JOSEPH: Ph.D., Wayne State University; Associate Professor - Teaching

WHITE, TOMMY: Ph.D., Oakland University; Assistant Professor - Teaching

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

- Computer Technology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/computer-technology-bsct/)
- Construction Management (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/construction-management-bscm/)
- Electrical/Electronic Engineering Technology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/electrical-electronic-engineering-technology-bseet/)
- Electromechanical Engineering Technology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/electromechanical-engineering-technology-bsemt/)
- Mechanical Engineering Technology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/mechanical-engineering-technology-bsmct/)
- Welding and Metallurgical Engineering Technology (B.S.) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/welding-metallurgical-engineering-technology-bswmet/)
- Advanced Energy Storage Systems (Undergraduate Certificate) (http://bulletins.wayne.edu/undergraduate/college-engineering/engineering-technology-division/energy-storage-systems-advanced-certificate/)

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- Engineering Technology (p. 6)
- Manufacturing/Industrial Engineering Technology (p. 7)
- Mechanical Engineering Technology (p. 8)
- Welding and Metallurgical Engineering Technology (p. 8)

Construction Management

CMT 2200 Soils and Foundations Cr. 3
It is essential for construction manager to understand basic soil engineering properties, classification system, phase diagram, relationship between density and moisture content, and how it determines foundation design, and real-world application in the construction industry. Application of International Building Code in foundation design. Offered Fall, Winter.
Restriction(s): Enrollment is limited to students with a major in 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 Spring/Summer.
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 Fall.
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 3010 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 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.
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: 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 4050 Construction Methods Cr. 3
Overview of construction practices in industry; processes and equipment involved in construction projects from conception to final delivery. Offered Winter.
Prerequisites: MAT 1800 with a minimum grade of C- or CMT 2200 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 limited to students with a class of Senior; enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CMT 5030 Facilities and Management Principles Cr. 3
An introduction to Facilities Management (FM) with an overview of the many facets of FM including the Facility lifecycle, strategic, master, and annual planning cycles. Including how these cycles are used in the management of finances, spaces, real property, sustainability, projects, security, emergencies, operations, and maintenance. Offered Fall.
Prerequisites: CMT 3010 with a minimum grade of C
Restriction(s): Enrollment limited to students in the College of Engineering.

CMT 5060 Planning and Scheduling Cr. 3
Provides an overview of the principles needed to successfully manage the time schedule of construction projects using Primavera P5. There principles are attributed to many processes and techniques, including, Critical path Method (CPM) Technique, Time Scheduling and updating, Resource Management (Allocation, Leveling and Control), Cost Management, and Reporting. Offered Fall.
Prerequisites: CMT 3010 with a minimum grade of C-

CMT 5070 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 Winter.
Prerequisites: MAT 1800 with a minimum grade of C-
Restriction(s): Enrollment limited to students in the College of Engineering.

CMT 5080 Construction Management Law Cr. 3
The objectives of this course are to introduce students to the legal responsibilities, risks, and rights inherent in the professional practice of construction management. Offered Winter.

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- or ET 2160 with a minimum grade of C-
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-, 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-
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: EET 3150 with a minimum grade of C- (may be taken concurrently)

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 Winter.
Prerequisites: EET 2000 with a minimum grade of C- and ET 3450 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: EET 2720 with a minimum grade of C-
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 3500 with a minimum grade of C-
Fees: $10

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 2720 with a minimum grade of C- and EET 3100 with a minimum grade of C-
Fees: $25

Electric Transportation Technology 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.
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.
Prerequisites: EET 2000 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.
Prerequisites: ET 2140 with a minimum grade of C-, PHY 2130 with a minimum grade of C-, and (ET 3430 with a minimum grade of C- (may be taken concurrently) or MAT 2010 with a minimum grade of C- (may be taken concurrently))

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 (ET 3430 with a minimum grade of C- or MAT 2010 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 2010 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-, MAT 2010 with a minimum grade of C-, or ET 3430 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-, MAT 2010 with a minimum grade of C-, or ET 3430 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 Design 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. Students must be in one of their last two semesters before graduation in order to enroll in this course. Offered Fall, Winter.
Prerequisites: ENG 3050 with a minimum grade of C
Restriction(s): Enrollment limited to students with a class of Senior.

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 Fall.
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 Winter.
Prerequisites: EET 3720 with a minimum grade of C- or MCT 3010 with a minimum grade of C-

ET 5200 Charging Infrastructures for Electric Vehicles Cr. 3
This course provides the student with technical knowledge into concept development, product design, and manufacturing of Charging Infrastructures for Electric Vehicles. Explore concept development, design, etc. to manage Michigan, USA, and global increased sales volumes. Student will research and document evolving battery technology which includes battery chemistry, precious materials, mineral mining, and supply chain technical challenges. Offered Spring/Summer.

ET 5300 Machine Vision - Industrial Applications Cr. 3
To build a basic understanding of fundamental vision and imaging concepts through both lecture and hands-on projects. In this course, students will understand basic optic and lighting strategies as well as understanding the fundamentals of image sensor technology, basic processing tools and software. The goal of this course is to provide students and engineers the basic tools and knowledge required to implement an engineered vision solution for robotics, automation and other industries. Offered Spring/Summer.
Restriction(s): Enrollment limited to students with a class of Applicant Masters, Candidate Masters, Unranked Grad, Graduate Certificate, Doctorate, Senior or Post Bachelor; enrollment limited to students in the College of Engineering.

ET 5400 Micro-Nanomanufacturing Cr. 3
Introduce micro-nanomanufacturing, classification of micromanufacturing and nanomanufacturing, modern fabrication techniques, micro-nanomanufacturing applications in energy storage, solar, robotics, biomedical and industrial engineering, various types of nanostructured materials - nanofibers, nanorods, nanoparticles. Offered Yearly.
Restriction(s): Enrollment limited to students with a class of Applicant Masters, Candidate Masters, Unranked Grad, Graduate Certificate, Doctorate, Senior or Post Bachelor; enrollment limited to students in the College of Engineering.

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 6 Credits

ET 5600 Python: Industrial Applications Cr. 3
Provides a combination of lectures and hands-on projects on how computer programming is applied in various industrial applications including robotics, automation and visualization applications. After an introduction to the basics of Python programming, students will then be provided with the opportunity to perform industrial projects using Python. Offered Yearly.
Restriction(s): Enrollment limited to students with a class of Applicant Masters, Candidate Masters, Unranked Grad, Graduate Certificate, Doctorate, Senior or Post Bachelor; enrollment is limited to Graduate or Undergraduate level students.

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. 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-, MAT 2010 with a minimum grade of C-, or ET 3430 with a minimum grade of C-
Restriction(s): Enrollment limited to students with a class of Applicant Masters, Candidate Masters, Unranked Grad, Graduate Certificate, Doctorate, Senior or Post Bachelor.

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 2500 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. 3
Fundamentals of material manufacturing processes in the context of their applications in industry. Emphasis on the nature and deformation behavior of materials commonly used in manufacturing, basic processes used in transforming them into useful products, the scientific theories underlying those processes, and criteria for selecting particular processes for industrial manufacturing operations. Offered Fall, Winter.
Prerequisites: CHM 1020 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 Fall.
Prerequisites: MIT 3600 with a minimum grade of C-
Fees: $25

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.
Prerequisites: ET 3430 with a minimum grade of C-

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.
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 (ET 3430 with a minimum grade of C- (may be taken concurrently) or MAT 2010 with a minimum grade of C- (may be taken concurrently))
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
Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and the first and second law analysis of systems and control volumes. Integration of these concepts into the analysis of different power and refrigeration cycles. Offered Yearly.
Prerequisites: (ET 3430 with a minimum grade of C- or MAT 2010 with a minimum grade of C-), CHM 1020 with a minimum grade of C-, and (PHY 2130 with a minimum grade of C- and PHY 2131 with a minimum grade of C-)
Fees: $10

MCT 4180 Fluid Mechanics Cr. 3
Properties of fluids, fundamentals of fluid flow, dimensional analysis and similitude, and flow measurement techniques. Introduction to internal and external flows and how to analyze them. 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 ET 3450 with a minimum grade of C- (may be taken concurrently)

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: MAT 3450 with a minimum grade of C- (may be taken concurrently) 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- (may be taken concurrently)

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 5150 Hybrid Vehicle Technology Cr. 3
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 Fall.
Prerequisites: ET 3450 with a minimum grade of B+ and PHY 2140 with a minimum grade of B+

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- or MAT 2010 with a minimum grade of C-) and PHY 2140 with a minimum grade of C-

Welding and Metallurgical Engineering Technology

WMT 3000 Welding Quality and Safety Cr. 3
Provides the basic knowledge of welding engineering as related to the inspection of welds. Includes an in-depth review of how various national, international structural and automotive welding standards relate to the quality of automatic, semi-automatic and manual welding processes. Understanding weld quality to determine if weldment(s) are fit for purpose is critical in developing a quality program that optimizes design and production requirements for automotive, military and aerospace weldments. Emphasis will be on process selection that minimizes rework, scrap or premature fracturing of production weldments. Examines the interrelationship between weld process, quality standards, material properties, and their effect on the performance of the weldment. Offered Yearly.

WMT 3100 Engineering Alloys Cr. 3
A firm and thorough knowledge of engineering alloys is critical in developing an optimal design for a given application while minimizing the risk of material failure. This course examines the interrelationships between processing, structure, properties, and performance of various engineering metals such as ferrous and non-ferrous metals with an emphasis on welding. The intent is to develop the ability both to select appropriate materials to meet engineering design criteria and to understand the effects of thermal treatments, hot and cold work, imperfections, forming, welding and chemical environments upon material properties and performance. Offered Yearly.
Prerequisites: ET 2200 with a minimum grade of C-

WMT 3200 Thermodynamics of Welding and Metallurgy Cr. 3
The principles and application of the fundamental laws of thermodynamics to metallurgical systems and welding engineering processes. The fundamentals will be used to obtain a thorough understanding of the basic relationships of thermodynamic driving force for phase transformations in metal and alloy systems. These fundamentals will be applied to understand the solid-solid, solid-liquid, and liquid-solid phase transformations occurring during heat-treatment and during welding processes. Offered Yearly.
Prerequisites: (ET 2200 with a minimum grade of C- or BE 1300 with a minimum grade of C-) and CHM 1020 with a minimum grade of C-

WMT 3451 Mechanical Metallurgy Cr. 3
The course will examine the strength, deformation, and failure of engineering materials from a first-principles materials science principles point of view. Established relationships between the mechanical behavior of materials and their microstructure as well as the control of mechanical behavior through materials processing and microstructural change will be studied. Emphasis will be placed on the behavior of structural defects associated with the welding of metallic alloys and how these defects affect the mechanisms of yielding, plastic deformation, strengthening, fatigue, fracture, and creep. Offered Yearly.
Prerequisites: WMT 3100 with a minimum grade of C- (may be taken concurrently)

WMT 3452 Physical Metallurgy Cr. 3
This course provides foundational knowledge of microstructural evolution during solidification, thermodynamics and phase transformation kinetics, alloy design, heat treatment, and the relationship between processing-microstructure-properties of metals and alloys. This course aims to teach students the crystallography principles of metallic systems, experimental tools, and techniques, solidification of metals and alloys, crystal defects in metals, diffusion kinetics, binary and ternary phase diagrams, cold working, and heat treatment. Students will also gain hands-on experience in heat treatment, metallography, and microscopy through the laboratory component. Offered Yearly.
Prerequisites: WMT 3100 with a minimum grade of C-

WMT 4500 Failure Fracture Analysis Cr. 3
The scope of this course is to understand various types of failure modes in metals and alloys, contributing factors to failures and analytical and detection methods employed to identify and resolve failure issues. The discussion of the failures of structural members will include design considerations, material selection and mechanical and chemical loading. Offered Yearly.
Prerequisites: WMT 3451 with a minimum grade of C-
Restriction(s): Enrollment limited to students in a BS in Weld & Metal Engg Tech degree.

WMT 4600 Metallurgy of Welding Processes Cr. 3
This course teaches the principles and applications of welding processes in addition to the standard fusion processes of shielded metal arc, gas metal arc, gas tungsten arc and flux-cored arc welding. The welding and metallurgical principles of resistance welding, gas welding, solid state welding, plasma arc, submerged arc, laser beam and electron beam welding will be addressed. There will be strong focus on the relationships between weld parameters and metallurgical fundamentals. Offered Yearly.
Prerequisites: WMT 3452 with a minimum grade of C-

WMT 4700 Welding Design Cr. 3
Offers a practical understanding and application of the design process for projects in welding engineering. The engineering aspects of the production of welded structures from the perspective of program development, concept, design and metallurgy will be taught. Students will gain further understanding of welding theory as it applies to design. Offered Yearly.

WMT 4800 Advanced Welding Metallurgy Cr. 3
This course provides students with the knowledge and skills they need to become a welding professional. Both theoretical foundation on advanced welding metallurgy and hands-on practical training will be the focus of the course. Offered Yearly.
Prerequisite: WMT 4600 with a minimum grade of C-

WMT 5350 Resistance Welding Processes Cr. 3
This course teaches the principles and applications of resistance welding processes including Resistance Spot, Seam, Projection Welding as well as Resistance Mash, Flash-Butt, High Frequency and Stud Welding processes. The course will include the basic electrical and physical changes that occur during welding. The principles of both basic fusion and solid-state welding mechanisms will be discussed and related to metallurgical principles and process specific equipment requirements. Overall, there will be strong focus on the relationships between weld parameters, metallurgical implications, and how these affect the equipment requirements. Weld quality control, corporate and industry specifications, and spot weld analysis techniques will be taught through laboratory and homework assignments. Offered Yearly.
Restriction(s): Enrollment is limited to students with a major in Weld & Metal Engg Tech; enrollment limited to students in the BS in Weld and Metal Engg Tech program.

WMT 5800 Welding Automation and Robotics Cr. 3
The scope of this course is to understand the concepts and technology associated with the operation of automatic and robotic welding systems. This course will incorporate automation and robotic technology with welding metallurgy. Students will learn to develop and edit programs to complete simple and complex welds and learn the effects of welding variables and options on weldment structural integrity as they are applied to automated and robotic weld systems. Offered Yearly.
Restriction(s): Enrollment is limited to students with a major in Weld & Metal Engg Tech.