ENGINEERING TECHNOLOGY

Civil & Construction, Electrical, and Mechanical Engineering Technology

Associate of Applied Science Degree

Students can earn an associate degrees in:

- Civil and Construction Engineering Technology
- Electrical Engineering Technology
- Mechanical Engineering Technology

Graduates of these programs are awarded the Associate of Applied Science degree and may serve as engineering technicians.

Graduates of the associate degree programs having enough technical knowledge to support scientists and engineers and therefore can obtain an internship or full-time employment. Their work is in the design, drafting (CAD), development, testing, and production phases of engineering projects. Their tasks include laboratory testing, data gathering, evaluation, and instrument calibration. They may perform quality-control tests, inspectors, serve as technical sales representatives, or serve as technical writers in the formulation of specifications or trade manuals.

Degrees in these programs may be earned in four semesters if students average 17-18 hours per semester.

Bachelor of Science in Applied Science Degree

The Civil and Construction Engineering Technology (CCET), Electrical Engineering Technology (EET), and Mechanical Engineering Technology (MET) programs are based on the "two-plus-two" educational system which provides the student with the flexibility of earning an associate degree and a bachelor's degree according to his or her needs. After completing the requirements of the associate degree, the student may elect to: a) continue their education in pursuit of a bachelor degree which is two years of full-time study (averaging 17 hours per semester) or equivalent part-time study, earn the Bachelor of Science in Applied Science (BSAS); b) pursue professional employment; or c) enter industry and continue their education in pursuit of a bachelor degree.

Graduates of a BSAS degree program obtain employment as engineers or engineering designers for government agencies, consulting engineers, architects, industry and manufacturing, and contractors. Because their education is more extensive, they are prepared for more responsibility and more-rapid advancement. BSAS engineering technology graduates work as engineers doing design work, inspectors, project managers, production and maintenance managers/supervisors.

Based on an evaluation of their work, transfer students who have a related associate degree from a regionally accredited institution may be admitted to the bachelor's degree program at the junior level.

Accreditation and Registration

The Civil and Construction, Electrical, and Mechanical Engineering Technology associate and bachelor programs are accredited by the ETAC Accreditation Commission of ABET, http://www.abet.org. In most states, including Ohio, West Virginia and Pennsylvania, bachelor's degree graduates are qualified to take the Fundamentals of Engineering (FE) exam, and, with sufficient work experience, the Professional Engineers (PE) exam. Graduates are also qualified to apply to the National Institute for Certification in Engineering Technologies (NICET) for certification procedures in various specialty areas, depending on academic major and employment area.

Admission Requirements

Admission to all of engineering technology programs requires at least one year of high school algebra and one year of high school geometry with grades of "C" or better. Transfer students must be in good standing at their previous institution. All freshmen must take the Mathematics Placement Test prior to admission into an engineering technology program.

Students not meeting the admission requirements are enrolled as pre-majors in the College of Science, Technology, Engineering, and Mathematics. While advising is provided by professional advisors within the college, these students are also encouraged to see the coordinator of the program in which they are interested for further orientation.

Qualified engineering technology students must enroll in the ENTC 1505 Engineering Technology Concepts course. It is designed to acquaint students with the nature of the engineering career area, and therefore assist prospective students in determining the level of their interest. ENTC 1505 Engineering Technology Concepts is required of all engineering technology majors.

Civil and Construction Engineering Technology

Students in the Civil and Construction Engineering Technology (CCET) program may choose to complete two years of study and earn an Associate of Applied Science (AAS) degree. The AAS degree provides early access to employment in engineering support positions. Upon completion of the AAS degree, the student may continue on for the Bachelor of Science in Applied Science (BSAS) degree. This program provides additional coursework, continuing the student's growth to that of an engineer or engineering designer. Exceptional students may be eligible for enrollment in a Master of Engineering, Engineering Management, or Master of Business Administration program.

Program Educational Objectives

Educational objectives for the civil and construction engineering technology program have been developed by faculty and the program industrial advisory committee to support the university, college, program mission. Graduates of the CCET associate degree program are prepared to:

- Secure employment and achieve recognition in a technical career related to their civil and construction engineering technology degree
- Continue to gain professional knowledge through lifelong learning and communicate effectively in a professional environment
- Advance in pursuit of the BSAS degree

Bachelor's degree graduates are prepared to assist with planning, design, inspection, and direction of the construction of projects involving buildings, roads, dams, bridges, airports, and wastewater treatment facilities.

During their first few years after earning the CCET bachelor degree at YSU, graduates will have demonstrated the ability to:

- Secure employment and achieve recognition in a technical career related to their civil and construction engineering technology degree.
- Continue to gain professional knowledge through lifelong learning and communicate effectively in a professional environment

Program Outcomes

Graduates with a civil and construction engineering technology degree will achieve the following learning outcomes by the time they graduate:

Associate of Applied Science Degree Program

Graduates of the associate degree in civil and construction engineering technology will possess the following competencies upon graduation:

- **Learning Outcome 1**: use graphic techniques to produce engineering documents and use modern instruments, methods, and techniques to implement construction contracts, documents, and codes

- **Learning Outcome 2**: conduct standardized field/laboratory testing on civil engineering materials and evaluate materials/methods for construction projects
- **Learning Outcome 3**: utilize modern surveying methods for land measurement and/or construction layout
- **Learning Outcome 4**: determine forces and stresses in elementary structural systems
- **Learning Outcome 5**: estimate material quantities and costs for technical projects
- **Learning Outcome 6**: employ productivity software to solve technical problems

Bachelor of Science in Applied Science Degree Program

Graduates of the bachelor degree in civil and construction engineering technology will possess the following competencies upon graduation.

- **Learning Outcome 1**: ability to plan, prepare, and utilize design, construction, and operations documents, such as specifications, contacts, change orders, engineering drawings, and construction schedules
- **Learning Outcome 2**: perform economic analyses and cost estimates related to design, construction, operations, and maintenance of systems related to civil and construction engineering
- **Learning Outcome 3**: ability to select appropriate construction and engineering materials/practices
- **Learning Outcome 4**: (Construction Engineering Technology) ability to apply principles of construction law and ethics
- **Learning Outcome 5**: apply basic technical concepts related to the civil and construction engineering technology field; such as hydraulics, hydrology, geotechnics, structures, material behavior, transportation systems, and water and wastewater systems
- **Learning Outcome 6**: perform standard analysis/design in at least one technical specialty within civil and construction engineering technology

Electrical Engineering Technology

Students in the Electrical Engineering Technology (EET) program may choose to complete two years of study and earn an Associate of Applied Science (AAS) degree. The AAS provides early access to employment in engineering support positions. Upon completion of the AAS degree, the student may continue on for the Bachelor of Science in Applied Science (BSAS) degree. This program provides additional coursework, continuing the student's growth to that of an engineer or engineering designer. Exceptional students may be eligible for enrollment in a Master of Engineering, Engineering Management, or Master of Business Administration program.

program Educational Objectives

Educational objectives for the electrical engineering technology program have been developed by faculty and the program industrial advisory committee to support the university, college, and program mission. Graduates of the EET associate degree program are prepared to:

- Secure employment and achieve recognition in a technical career related to their Electrical Engineering Technology degree.
- Continue to gain professional knowledge through lifelong learning and communicate effectively in a professional environment
- Advance in pursuit of the BSAS degree

Bachelor's degree graduates are prepared to assist with planning, design, inspection, and direction of the electrical engineering projects involving electrical systems, industrial automation, smart grid and power distribution, and computer networking systems.

During their first few years after earning the EET bachelor degree at YSU, graduates will have demonstrated the ability to:

- Secure employment and achieve recognition in a technical career related to their civil and construction engineering technology degree.
- Continue to gain professional knowledge through lifelong learning and communicate effectively in a professional environment

Program Outcomes

Graduates in electrical engineering technology will achieve the following learning outcomes by the time they graduate:

Associate of Applied Science

Graduates of the Associate Degree EET program will possess the following competencies upon graduation.

- **Learning Outcome 1**: be able to apply principles of mathematics and applied science, to perform technical calculations and solve technical problems of the types commonly encountered in electrical engineering technology careers
- **Learning Outcome 2**: demonstrate the ability to identify, formulate, and present creative solutions to technical problems in a variety of specialty areas within the broad fields of electrical engineering technology
- **Learning Outcome 3**: be able to function competently in a laboratory setting, making measurements, operating technical equipment, critically examining experimental results, and properly reporting on experimental results, including their potential for improvement.
- **Learning Outcome 4**: be able to use modern computational tools for technical problem solving, including scientific calculators, computers, and appropriate software.
- **Learning Outcome 5**: demonstrate a broad education and knowledge of contemporary issues in a global and societal context, as necessary to develop professional and ethical responsibility, including responsibility to employers and to society at large
- **Learning Outcome 6**: recognize the need for life-long learning and possess the skills to maintain and improve technical and non-technical abilities
- **Learning Outcome 7**: demonstrate an ability to communicate and function effectively with members of multi-disciplinary teams from a variety of backgrounds.
- **Learning Outcome 8**: demonstrate an ability to utilize computer software applications used in electrical engineering technology such as CAD, spreadsheets, word processing, and basic programming

Bachelor of Science in Applied Science

Graduates of the bachelor's degree EET program will possess the following competencies upon graduation.

- **Learning Outcome 1**: be able to apply principles of mathematics and applied science, to perform technical calculations and solve technical problems of the types commonly encountered in electrical engineering technology careers
- **Learning Outcome 2**: demonstrate the ability to identify, formulate, and present creative solutions to technical problems in a variety of specialty areas within the broad fields of electrical engineering technology.
- **Learning Outcome 3**: be able to function competently in a laboratory setting, making measurements, operating technical equipment, critically examining experimental results, and properly reporting on experimental results, including their potential for improvement
- **Learning Outcome 4**: be able to use modern computational tools for technical problem solving, including scientific calculators, computers, and appropriate software.
- **Learning Outcome 5**: demonstrate a broad education and knowledge of contemporary issues in a global and societal context, as necessary to develop professional and ethical responsibility, including responsibility to employers and to society at large.
- **Learning Outcome 6**: recognize the need for life-long learning and possess the skills to maintain and improve technical and non-technical abilities
- **Learning Outcome 7**: demonstrate an ability to communicate and function effectively with members of multi-disciplinary teams from a variety of backgrounds

- **Learning Outcome 8**: the ability to identify, formulate, and solve engineering problems in the following major electrical engineering technology disciplines: analog and digital electronics, communication systems, power, aerospace and computer systems.
- **Learning Outcome 9**: the knowledge of professional practice issues, with an understanding of social responsibilities and a respect for diversity

Associate Degree Program

Graduates of the two-year electrical engineering technology program generally function as assistants to electrical engineers in the design, analysis, and laboratory testing of electrical and electronic systems and of rotating machinery. Most graduates are employed by electrical and electronic equipment manufacturers, utility companies, the aerospace industry, and manufacturing companies in general.

Bachelor's Degree Program

The bachelor's degree program in electrical engineering technology prepares students for employment as engineers or engineering designers. The students focus on analog and digital electronics communication systems, smart grid and power distribution, and computer networking systems. Co-op programs with various local companies enable EET students to gain experience and income during their junior and senior years. Many students work full or part-time while completing the BSAS degree taking evening classes. Students are encouraged to take the Fundamentals of Engineering (FE) exam as the first step toward professional registration.

Mechanical Engineering Technology

The Mechanical Engineering Technology (MET) program is designed as a "two-plus-two" program. Students may earn an Associate of Applied Science degree after two years of full-time study. With this degree, they may begin a career in industry. The associate degree graduate can continue for two more years of full-time study to earn the bachelor's degree.

program Educational Objectives

Educational objectives for the MET program have been developed by faculty and the program industrial advisory committee to support the university, the college, and the program mission. Graduates of the MET associate degree program function as assistants in the design, drafting and testing of mechanical products, equipment and processes. Bachelor's degree graduates assume greater responsibility in the design and testing of mechanical products, manufacturing processes, equipment.

During their first few years after completion of the mechanical engineering technology program at YSU, graduates will have demonstrated the ability to:

- Work competently in technical and professional careers related to the field of mechanical engineering technology.
- Communicate effectively in a professional environment.
- Continue growth in professional knowledge and skills.
- Achieve recognition and/or compensation consistent with their educational achievements.

Program Outcomes

Associate of Applied Science

Graduates of the associate degree MET program will possess the following competencies upon graduation:

- mastery of knowledge, skills, and tools of the discipline
- ability to apply knowledge to solve engineering problems
- ability to conduct, analyze, and interpret experiments
- ability to work effectively in teams
- ability to identify, analyze, and solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical, social, and diversity responsibilities and diversity
- commitment to quality, timeliness, and continuous improvement

Bachelor of Science in Applied Science

Graduates of the bachelor's degree MET program will possess the following competencies upon graduation:

- mastery of knowledge, skills, and tools of the discipline
- ability to apply knowledge to solve engineering problems
- ability to conduct, analyze, and interpret experiments
- ability to be creative in design
- ability to work effectively in teams
- ability to identify, analyze, and solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical, and social responsibilities
- respect for diversity, professional, societal, and global issues
- commitment to quality, timeliness, and continuous improvement

Professor

Theodore R. Bosela, Ph.D., Professor

Michael D. Costarell, M.S.M.E., Professor

Robert J. Korenic, M.S.E., Associate Professor

Carol M. Lamb, Ph.D., Professor

John D. Martin, M.S., Associate Professor

Daniel J. Opalewski, Ph.D., Assistant Professor

Joseph S. Sanson, M.S., Associate Professor

Brian D. Vuksanovich, M.S.M.E., Professor

Jason Zapka, M.S., Assistant Professor

Lecturer

Brian M. Ennis, Ph.D., Lecturer

Majors

- Civil and Construction Engineering Technology Associate Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/asas-civil-construction-engineering-technology/)
- Civil and Construction Engineering Technology Bachelor's Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/bs-civil-construction-engineering-technology/)
- Electrical Engineering Technology Associate Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/electrical-engineering-technology-associate/)
- Electrical Engineering Technology Bachelor's Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/electrical-engineering-technology-bachelors/)
- Mechanical Engineering Technology Associate Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/mechanical-engineering-technology-associate/)

- Mechanical Engineering Technology Bachelor's Degree Program (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/mechanical-engineering-technology-bachelors/)

Minors

- Minor in Electrical Engineering Technology (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-engineering-technology/minor-electrical-engineering-technology/)

Civil and Construction Engineering Technology

CCET 1503 CAD Technology 2 s.h.
Basic instruction in the use of AutoCAD computer-aided drafting system. Includes primary 2D skills including dimensioning, blocks, external reference and plotting. Customization methods and an introduction to application programming. One and one-half hours lecture, one and one-half hours lab per week. Grading is A, B, C, NC. Prereq. or.
Prereq.: C or better in MATH 1510 or MATH 1510C.
Coreq.: MATH 1513 or MATH 1511 or 1511C or at least Level 45 on the Mathematics Placement test.

CCET 1504 Drafting and Plan Reading 2 s.h.
Drafting basics including plan, section, and elevation views; orthographic projections; line types and weights; drafting scales; dimensioning; tolerances; grading and contours, and construction layout for the civil, mechanical, and electrical technology disciplines. Development of skills in the interpretation and preparation of plans used for civil, mechanical, and electrical construction and fabrication. One and one-half hours lecture, one and one-half hours laboratory per week. Grading is A, B, C, NC.
Prereq.: C or better in MATH 1510 or MATH 1510C.
Coreq.: MATH 1513 or MATH 1511 or MATH 1511C or at least level 45 on Mathematics Placement Test.

CCET 2604 Properties and Strength of Materials 3 s.h.
Introduction to the physical and chemical properties of materials and their behavior under various loads and environments. Concepts of stress and strain developed and evaluated for the application of axial, shear, torsional, and bending loads. Four (4) hours lecture per week. Prereq. or.
Prereq.: Grade of "C" or better in ENTC 1505 and MATH 1513 or MATH 1510 or MATH 1510C and MATH 1511 or MATH 1511C.
Coreq.: MET 1515.

CCET 2607 Civil 3D 3 s.h.
Civil 3D is a course intended to prepare students for entry-level production use of AutoCAD Civil 3D 2015. The primary goal of this class is to teach students how to use the software, but it is also an opportunity to show them how projects are executed and what types of roles they will play in completing them. One (1) hour lecture and three (3) hours lab per week.
Prereq.: "C" or better in CCET 1503 and CCET 1504.

CCET 2614L Materials Laboratory 1 2 s.h.
Use and care of testing equipment, data retrieval, data reduction and report preparation. Physical testing of metals, concrete, aggregates, asphalts, soils and woods. Three hours per week.
Prereq or concurrent: CCET 2604.

CCET 2617 Construction Methods and Materials 3 s.h.
Basic properties of construction materials. Processing and placement methods. Purchase, use and replacement of construction equipment. Application of engineering economics to construction. Use of building codes.
Prereq.: CCET 2604, MET 1515 both with a grade of "C" or better.

CCET 2620 Transportation Technology 3 s.h.
Transportation planning and highway system design. Familiarization with AASHTO design manuals; geometric design and signalization of highway segments; capacity analysis and route selection. Cost-benefit analysis for transportation projects. Four (4) hours lecture per week. Prereq. 'C' or better in CCET 2604.

CCET 3705 Computing for Technologists 3 s.h.
Development of computer techniques used in solutions to problems in all fields of engineering technology. Students write computer programs to solve problems with which they are familiar. Use of database management, spreadsheets. May be taken by non-CCET majors. Two hours lecture, three hours lab per week.
Prereq.: MATH 1570 or MATH 1571 grade of "C" or better and junior standing or consent of instructor.

CCET 3706 Structural Design 4 s.h.
Structural design using AISC, ACI and similar codes. Selection of members and connections in accordance with manuals and code specifications. Design and AutoCAD projects required. Three hours lecture and three hours computational lab per week.
Prereq.:"C" or better in CCET 1503, CCET 1504, MET 1515, MATH 1513, MATH 1510 or MATH 1510C and MATH 1511 or MATH 1511C, CCET 2604.

CCET 3708 Building Information Modeling 3 s.h.
Introduction and applications of Autodesk Revit 3D CAD program. Use of Revit software to assemble a complete building information model of a building and use the model to coordinate systems between disciplines, to create material take-offs, construction documents, and presentation drawings. Two hours lecture, three hours lab per week.
Prereq.: "C" or better in CCET 3706.

CCET 3709 Structural Analysis 1 3 s.h.
Fundamental determination of member forces in trusses, beams, arches, frames and cables. Calculation of member stresses and defections. Two hours lecture, three hours computational lab per week.
Prereq.: ENTC 1505, MATH 1513 or MATH 1510 or MATH 1510C and MATH 1511 or MATH 1511C and CCET 2604, all with a grade of "C" or better.

CCET 3711 Specifications and Estimating 3 s.h.
Fundamentals of writing and interpreting specifications for materials and construction methods. Estimating materials and labor costs for construction projects. Use of computer estimating packages. Two hours lecture and three hours computational laboratory.
Prereq.: ENTC 1505, MATH 1513 or MATH 1510 or MATH 1510C and MATH 1511 or MATH 1511C, CCET 2604, MET 1515 all with grade of "C" or better.

CCET 3714 Soil Mechanics 2 s.h.
A study of soil properties, classifications, strength and behavior. Theory of consolidation, shear strength and stability analysis. Two hours lecture per week.
Prereq.: "C" or better in the following courses CCET 2614L, CCET 3706, CCET 3709.

CCET 3714L Soil Mechanics Laboratory 1 s.h.
Practice in soil identification and determination of soil properties. Use and care of basic soil testing equipment and standard test procedures. Three laboratory hours per week.
Concurrent with: CCET 3714.

CCET 3719 Environmental Impact of Abandoned Mines 3 s.h.
Mining methods, types of mines, information retrieval, mine stabilization, and the effects of abandoned mines on environmental and human activities, especially deep coal mines in the Mahoning Valley and adjacent areas. Two hours lecture and three hours of lab per week. Prereq. GEOL 1505 or equivalent or permission of instructor.

CCET 3724 Hydraulics and Land Development 3 s.h.
Study of hydraulics and hydrologic principles and their applications to drainage requirements, storm-water management, detention/retention basin design, erosion and sedimentation control plans and land-use planning. Use of computer software for analysis and design. Two hours lecture, three hours of computational lab per week.
Prereq.: CCET 1503, CCET 1504, ENTC 1505, MATH 1513 or MATH 1510 or MATH 1510C and MATH 1511 or MATH 1511C, CCET 2604, MET 1515 all with a grade of "C" or better.

CCET 3735 Heavy Highway Technology 3 s.h.
Study of principles of heavy highway construction as it relates to the current highway system. The reading and comprehension of highway construction plans and specifications. Three (3) hours lecture per week.
Prereq.: "C" or better in CCET 2620.

CCET 3740 Construction Management 3 s.h.
Design and construction office planning and scheduling techniques. Construction reports, contracts, specifications and general conditions. Relationships among owner, architect/engineer, and constructor. Introduction to computer methods for program planning and updating. Financial, labor, and material resource allocation and tracking. Three (3) hours lecture per week.
Prereq.: "C" or better in CCET 3711.

CCET 4807 Project Planning & Scheduling 3 s.h.
Application of planning, scheduling, and control system techniques for an integrated project including theory, options, legal implications, and practices. Students plan and schedule projects using CPM computer software and set up control systems for the project. Two hours lecture, one hour laboratory per week.
Prereq.: "C" or better in CCET 3711.

CCET 4809 Structural Analysis 2 3 s.h.
Continuation of CCET 3709. Analysis techniques for common structures. Introduction to classical approaches to statically indeterminate structures and calculation of deflections. Use of standard computer programs such as StruCalc, SAP and SABLE. Three hours lecture, one hour computational lab per week.
Prereq.: "C" or better in both CCET 3709 and MATH 1570 or MATH 1571.

CCET 4810 Construction Surveying 3 s.h.
Theory and applications of advanced land surveying techniques for: route surveying and geometric design; topographic site surveys and mapping; civil engineering, utilities, and construction surveys; global positioning systems; and quantities and final surveys. Two hours lecture and three hours field surveying laboratory.
Prereq.: "C" or better in CEEN 2610, CEEN 2610L.

CCET 4812 Concrete Design 3 s.h.
Behavior and design of concrete elements subject to flexure, shear, axial and combined effects. Emphasis on reinforced concrete design in accordance with the ACI Code including beams, T-beams, slabs, walls, and columns. An introduction to prestressed and precast concrete design. Two hours lecture, one hour design lab per week.
Prereq.: "C" or better in both CCET 3706 and CCET 3709.

CCET 4813 Steel Design 3 s.h.
Loading and behavior of steel structures and design of standard rolled shapes in accordance with current LRFD and ASD specifications. Design of welded and bolted connections and an introduction to design of cold-formed steel members. Two hours lecture, one hour lab per week.
Prereq.: "C" or better in both CCET 3706 and CCET 3709.

CCET 4814 Foundation Design 3 s.h.
Application of soil mechanics to the design of foundations. Topics include spread footings, drilled piers, piles, retaining walls, sheet piles walls and underground structures. Three hours lecture per week.
Prereq.: "C" or better in CCET 3714 and CCET 3714L.

CCET 4815 Masonry Design 3 s.h.
Design of beams, columns, shear walls and bearing walls using clay and concrete masonry units. Application of allowable stress design (ASD) and strength design (SD) in accordance with the MSJC Building Code Requirements for Masonry Structures. Additional topics include prestressed and autoclaved aerated concrete (AAC) masonry. Two hours lecture, one hour lab per week.
Prereq.: "C" or better in both CCET 3706 and CCET 3709.

CCET 4816 Timber Design 3 s.h.
Design of beams, poles, piles, diaphragms, shear walls and fasteners using timber elements. Application of the National Design Specification for Wood Construction that incorporates a dual format using both allowable stress design (ASD) and load and resistance factor design (LRFD). Additional topics include glued-laminated members and design of mechanical connectors. Design, analysis, construction, and testing of scale models is required. Two hours lecture, one hour lab per week.
Prereq.: "C" or better in both CCET 3706 and CCET 3709.

CCET 4824 Environmental Technology 3 s.h.
Application of environmental principles to land planning and development. Wastewater treatment processes and system design. Application of water and wastewater management to specific sites. Permitting and endangerment assessment. Two hours lecture, one hour lab per week.
Prereq.: "C" or better in CCET 3724 and junior standing.

CCET 4884 Civil/Structural Facilities Design 3 s.h.
Interdisciplinary capstone course. An overview of the requirements and design procedures for civil and structural systems. Includes the analysis and design for site development, utilities, foundation, wall systems, framing systems, floor system and the preparation of the plans, specifications and estimate package. Includes a major interdisciplinary group project. Four (4) hours lecture per week. Prereq. or.
Prereq.: Senior standing in CCET or EET permission of instructor.
Coreq.: EET 4810.

CCET 4890 Special Topics in Civil and Construction Engineering Technology 1-4 s.h.
New developments in CCET. Subject matter, special prerequisites, and credit hours to be announced in advance of each offering. May be repeated with different subject matter to a maximum of 8 s.h.
Prereq.: Senior standing in CCET or consent of the instructor.

Electrical Engineering and Technology

EET 1501 Circuit Theory 1 3 s.h.
Theoretical analysis of DC electrical circuits including units conversions, current voltage, power, Ohms Law, Kirchhoffs Laws, network theorems, capacitance, magnetic circuits, inductance and transient analysis of RL and RC circuits.
Prereq.: C or better in either MATH 1513, or in either MATH 1510 or MATH 1510C and in either MATH 1511 or MATH 1511C.
Coreq.: EET 1501L.

EET 1501L Circuit Theory 1 Lab 1 s.h.
Use of electrical components to construct circuits and use of electrical instrumentation including meters and oscilloscopes to analyze DC resistive series/parallel networks and basic RC & RL transient circuits. Computer circuit analysis with PSPICE. Three hours per week.
Concurrent with: EET 1501.

EET 1502 Circuit Theory 2 3 s.h.
Study of AC sinusoidal waveforms, phasor representations, phasor algebra and phasor diagrams. Solution of steady state single phase series/parallel networks including network theorems, power and power factor, resonant circuits, filters, mutual inductance, transformers and balanced three-phase systems.
Prereq.: "C" or better in EET 1501 and EET 1501L; "C" or better in either MATH 1513, or in either MATH 1510 or MATH 1510C and in either MATH 1511 or MATH 1511C.
Coreq.: EET 1502L.

EET 1502L Circuit Theory 2 Lab 1 s.h.
Measure effective values of AC currents and voltages, observe waveforms with oscilloscopes, verify impedance concepts and phasor diagrams for AC series/parallel networks and resonant circuits. Computer circuit analysis with PSPICE. Three hours per week.
Concurrent with: EET 1502.

EET 2605 Electronics 1 3 s.h.
Physical basis of semiconductor materials, diodes, rectifier circuits, Zener diode regulators, clippers, clampers, special purpose diodes. Bipolar junction transistors (BJT) characteristics, bias circuits, equivalent circuit models, amplifiers and field effect transistor (FET) characteristics. Coreq: EET 2605L.
Prereq.: EET 1502 and EET 1502L; C or better in either MATH 1513, or in either MATH 1510 or MATH 1510C and in either MATH 1511 or MATH 1511C.

EET 2605L Electronics 1 Laboratory 1 s.h.
Use of meters, oscilloscope, transistor curve tracer for experiments on diode characteristics, rectifier circuits, clippers, clampers, Zener regulators, BJT and FET characteristics, BJT bias circuits and amplifiers. Computer circuit analysis with PSPICE. Three hours per week.
Concurrent with: EET 2605.

EET 2620 Digital Electronics 2 s.h.
An introductory study of number systems and conversions, codes, Boolean algebra, and logic gates. Includes Boolean function simplification, truth tables, Karnaugh maps, and combination circuits.
Prereq.: "C" or better in EET 1501 and EET 1501L, and ENTC 1505; "C" or better in either MATH 1513, or in either MATH 1510 or MATH 1510C and in either MATH 1511 or MATH 1511C.
Coreq.: EET 2620L.

EET 2620L Digital Electronics Lab 1 s.h.
Experiments utilizing digital integrated circuits to implement various logic functions discussed in EET 2620. Three hours per week.
Concurrent with: EET 2620.

EET 3700 Methods in Circuit Analysis 3 s.h.
Review of circuit analysis techniques using phasor algebra; mesh and nodal analysis; Thevenin and Norton equivalents; superposition theorem; three phase circuits; circuit solutions using matrix methods; and Fourier analysis of periodic waveforms with applications to circuit analysis. Two hours lecture and three hours computational lab per week. Prereq. or.
Prereq.: Grade of C or better in EET 2605 and EET 2605L and EET 3710 and EET 3710L and EET 3735 and EET 3735L and (MATH 1570 or MATH 1571).
Coreq.: MATH 2670.

EET 3701 Transform Circuit Analysis 3 s.h.
Introduction to LaPlace transforms and the use of LaPlace transforms in circuit analysis, transfer functions, frequency response of networks, poles and zeroes, stability, Bode plots. Two hours lecture and three hours of computational lab per week.
Prereq.: MATH 2670 and EET 3700 with a grade of "C" or better.

EET 3706 Electronics 2 3 s.h.
Field effect transistor (FET) bias circuits and amplifiers, thyristor circuits, frequency effects (Bode plots), differential amplifiers, linear and non-linear op amp circuits, active filters, oscillators and regulated power supplies.
Prereq.: "C" or better in EET 1502 and EET 1502L and EET 2605 and EET 2605L and MATH 1570.
Concurrent with: EET 3706L.

EET 3706L Electronics 2 Laboratory 1 s.h.
Experiments involving field effect transistors (FETs), integrated circuits (ICs), operational amplifiers, frequency effects on gain, oscillator circuits and regulated power supplies. Computer circuit analysis with PSPICE. Three hours per week.
Concurrent with: EET 3706.

EET 3710 Electrical Machines 3 s.h.
Construction, operating principles and characteristics, efficiency and control of DC motors, generators, and specialized machines. AC single and 3-phase transformers, alternators, induction and synchronous motor principles, characteristics, efficiency and control.
Prereq.: "C" or better in EET 1502 and EET 1502L and ENTC 1505 and MATH 1570.
Concurrent with: EET 3710L.

EET 3710L Electrical Machines Lab 1 s.h.
Experiments with DC motors and generators and AC transformers, alternators, induction and synchronous motors to observe operation, efficiency, control and machine characteristics. Three hours per week.
Concurrent with: EET 3710.

EET 3712 Programmable Logic Controllers 3 s.h.
Development of ladder logic programming and application to programmable logic controllers (PLCs). Examination of input/output (I/O) device characteristics and interfacing including both digital and analog I/O. Installation, maintenance and safety practices for PLCs.
Prereq.: "C" or better in EET 1502 and EET 1502L and EET 2620 and EET 2620L and EET 3710 and EET 3710L and MATH 1570.

EET 3712L PLC Laboratory 1 s.h.
Exercises in ladder logic programming for programmable logic controllers (PLCs) using concepts developed in EET 3712. Input/Output (I/O) concepts related to PLCs. Three hours per week.
Concurrent with: EET 3712.

EET 3715 Industrial Instrumentation and Control 3 s.h.
Introduction to industrial instrumentation and process control. Application of calculus, thermodynamics, and fluid flow to instrumentation and control systems. Characteristics of sensing devices including temperature, pressure, flow, level, position, analytical, vibration, etc. Analog electronic instrumentation and instrument calibration. Concepts of closed loop control, process dynamics and loop tuning, feedforward, feedback, and cascade control in industrial process systems. 2 hours lecture, 3 hours lab per week.
Prereq.: EET 3710 and EET 3710L and EET 2605 and EET 2605L and EET 2620 and EET 2620L and CHEM 1515 and CHEM 1515L and PHYS 1501 and (MATH 1570 or MATH 1571) with letter grade of C or better.

EET 3725 Electromechanical Systems 3 s.h.
AC/DC circuit analysis techniques including network theorems, MultiSim computer circuit analysis with applications to AC/DC machinery, electronics, digital circuits and control systems. Three hours lecture per week.
Prereq.: C or better in MATH 1570 and ENTC 1505.
Concurrent with: EET 3725L.

EET 3725L Electromechanical Systems Lab 1 s.h.
Lab experiences to accompany EET 3725 Electromechanical Systems. Topics include lab safety, resistor color code, DC and AC circuits, oscilloscope and function generator, diode rectifiers, transistor switching circuits and amplifiers, three phase power measurements, transformer testing, DC and AC motor characteristics.
Prereq.: C or better in the following: MATH 1570, ENTC 1505.
Concurrent with: EET 3725.

EET 3730 Logic Systems Design 2 s.h.
The characteristics and applications of integrated circuit logic families and various memory devices. Emphasis on the design of digital systems with SSI, MSI, and LSI as system components.
Prereq.: "C" or better in EET 2620 and EET 2620L and EET 2605 and EET 2605L and EET 1502 and EET 1502L and MATH 1570.
Concurrent with: EET 3730L.

EET 3730L Logic Systems Design Lab 1 s.h.
Laboratory exercises dealing with applications of concepts developed in EET 3730. Three hours per week.
Coreq.: EET 3730.

EET 3735 Microprocessor Architecture and Programming 2 s.h.
An introduction to microprocessor architecture, memory organization, and input/output addressing. Emphasis on machine/assembly language programming to teach concepts of buses, machine cycles, and internal data flow. Two hours lecture per week.
Prereq.: "C" or better in CSIS 1590, or in EET 1501 and EET 1501L and EET 2620 and EET 2620L; "C" or better in either MATH 1513, or in either MATH 1510 or MATH 1510C and in either MATH 1511 or MATH 1511C.
Coreq.: EET 3735L.

EET 3735L Microprocessor Architecture and Programming Laboratory 1 s.h.
Laboratory exercises dealing with applications of concepts developed in EET 3735. Three hours per week.
Coreq.: EET 3735.

EET 3745 Microprocessor Systems 2 2 s.h.
Continuation of EET 3735 with emphasis on advanced programming techniques, memory mapping, I/O ports, and basic I/O interfacing. Two hours lecture per week.
Prereq.: "C" or better in EET 3735 and EET 3735L and EET 1502 and EET 1502L and MATH 1570.
Coreq.: EET 3745L.

EET 3745L Microprocessor Systems 2 Lab 1 s.h.
Laboratory exercises utilizing a microcomputer to provide practical applications of concepts developed in EET 3745. Three hours per week.
Prereq.: Concurrent with: EET 3745.
Concurrent with EET 3745.

EET 3760 Variable Speed Drives 2 s.h.
Variable Speed Drive. Introduction to electronic speed control of direct and alternating current motors. Power conversion and waveform modulation techniques, drive sizing, harmonics, and motor performance.
Prereq.: "C" or better in EET 3710 and EET 3710L and EET 2605 and EET 2605L, EET 3700, and MATH 2670.
Concurrent with: EET 3760L.

EET 3760L Variable Speed Drives Lab 1 s.h.
Exercises in variable speed drive applications, demonstrating the concepts developed in EET 3760. Three hours per week.
Coreq.: EET 3760.

EET 3780 Communication Systems 2 s.h.
Communication System. Audio signals, noise, untuned and RF amplifiers, amplitude, frequency, pulse modulation, transmission lines, antennas, and multiplexing of communication channels.
Prereq.: "C" or better in the following: EET 1502, EET 1502L, EET 2605, EET 2605L, EET 3700, and MATH 2670.
Concurrent with: EET 3780L.

EET 3780L Communication Systems Lab 1 s.h.
Laboratory exercises dealing with application of concepts developed in EET 3780. Three hours per week.
Coreq.: EET 3780.
Concurrent with: EET 3780.

EET 4810 Electrical System Design 3 s.h.
The design and layout of electrical systems for power, light, heat, signals, and communications in commercial, industrial, and residential buildings. Two hours lecture, three hours of lab per week.
Prereq.: EET 3710 and EET 3710L or EET 3725 and EET 3725L, with grade of C or better.

EET 4812 Automation Systems Integration 3 s.h.
Network technologies that support system integration of process/manufacturing automation, building automation (smart buildings), environment management, as well as energy management and electricity systems automation (smart grid systems). Hardware and software, including NetDDE, OPC, and SCADA Systems comprising the infrastructure of Industrial Internet of Things (IIoT) ad Industry 4.0. IIoT infrastructure components such as Artificial Intelligence based control systems, wireless technology in automation systems, safety systems, and organizational approach to automation. Two hours lecture and three hours lab per week.
Prereq.: EET 3701 and EET 3760 and EET 3760L and EET 3745 and EET 3745L and CSIS 2610 and MATH 2670 and completion of one upper division technical elective with letter grade C or better.

EET 4815 Power System Studies 3 s.h.
Introduction to electrical power system studies including system modelling, load flow and voltage drop, short circuit, protective device coordination, motor transient starting, power quality, and arc flash calculations. Two hours lecture and three hours computational lab per week.
Prereq.: EET 3710 and EET 3710L and EET 3700 and MATH 2670 all with grades of "C" or better.

EET 4820 Power System Protection and Control 2 s.h.
Power System Protection Control. An introduction to electrical power system protection and control utilizing intelligent smart grid technologies. Topics include power system analysis, real time data acquisition and control, synchrophasor measurements, communications, and application of microprocessor-based protective relaying. Two hours lecture per week.
Prereq.: "C" or better in EET 3710 and EET 3710L and EET 3712 and EET 3712L, EET 3700 and MATH 2670.
Concurrent with: EET 4820L.

EET 4820L Power System Protection and Control Lab 1 s.h.
Establishing communications, programming, and testing of various microprocessor based power system protective relays, including time-overcurrent, bus, differential, motor, distributed generation, and transformer relays. Three hours lab per week.
Prereq.: "C" or better in EET 3710 and EET 3710L and EET 3712 and EET 3712L.
Coreq.: EET 4820.

EET 4845 Microprocessor Systems 3 2 s.h.
Continuation of EET 3745 with emphasis on real data acquisition, A/D and D/A conversions, and industrial applications.
Prereq.: "C" or better in EET 3730 and EET 3730L and EET 3745 and EET 3745L and MATH 2670.
Coreq.: EET 4845L.

EET 4845L Microprocessor Systems 3 Lab 1 s.h.
Laboratory exercises utilizing a microcomputer to provide practical applications of concepts developed in EET 4845. Three hours per week.
Coreq.: EET 4845.

EET 4850 Integrated Circuit Applications 2 s.h.
Introduction to integrated circuits technology and typical application.
Prereq.: "C" or better in EET 2605 and EET 2605L and EET 1502 and EET 1502L and MATH 2670.
Concurrent with: EET 4850L.

EET 4850L Integrated Circuit Applications Lab 1 s.h.
Laboratory exercises dealing with the application of concepts developed in EET 4850. Three hours per week.
Coreq.: EET 4850.

EET 4870 Process Control Technology 4 s.h.
Interdisciplinary capstone course. Analysis and design of control systems for industrial processes, utility automation, and electromechanical systems. Includes preparation of schematic, control, and wiring diagrams; specifications, estimates, project schedule, and presentation of results. Three hours lecture, three hours lab per week.
Prereq.: Grades of C or better in EET 3712 and EET 3712L and EET 3760 and EET 3760L and EET 3701 and MATH 2670 and EET 4810 and two EET electives and Senior standing in EET and permission of EET program coordinator.

EET 4890 Special Topics in EET 1-4 s.h.
Special topics/new developments in electrical engineering technology. Subject matter, special prerequisites, and credit hours to be announced in advance of each offering. May be repeated with different subject matter to a maximum of 8 s.h.
Prereq.: Senior standing in EET or consent of the instructor.

Engineering Technology

ENTC 1500 Technical Skills Development 4 s.h.
A course designed to develop the technical, analytical and problem solving skills of students planning to enter an engineering or technical course of study. Three (3) hours of lecture and three (3) hours lab per week. Grading is A, B, C, NC.
Prereq. or concurrent: MATH 1501.

ENTC 1505 Engineering Technology Concepts 4 s.h.
The role of the technician, technologist, engineer and scientist in the technology team; a study of basic mathematical, scientific, and communicative techniques as applied to the work of engineering technologists; ethical, global, and societal issues facing the engineering technology professional. Three hours lecture, three hours lab per week. Grading is A, B, C, NC. Corequistite MATH 1513 or MATH 1511.
Prereq.: grade of "C" or better in MATH 1510.

ENTC 3799 Professional Practice in Engineering Technology 1 s.h.
This course provides students with cooperative education experiences in various engineering technology disciplines. To receive credit for the course, the student is expected to work at the assignment a minimum of 400 hours, submit a report of activities, and obtain approval of the department Professional Practice Committee. Course may be repeated up to a maximum of 3 s.h. toward the BSAS. Students are considered full-time even though only 1 s.h. is given for each course. Grading: PR, CR, NC.
Prereq.: Consent of department chairperson.

ENTC 4895 Independent Engineering Technology Project 1-4 s.h.
Individual study under direction of a faculty member. Written and oral report required. May be repeated for a maximum of 4 s.h.
Prereq.: Junior standing, consent of instructor, and prior approval of the project by the IETP committee of engineering technology faculty.

Electrical Utility Technology

EUT 1504 Maintenance Fundamentals 1 4 s.h.
Introduction to blueprint reading and technical diagrams, use of hand tools and power tools, safety and health, development of troubleshooting skills, chemical hazards, and material safety data sheets. Three hours lecture, and three hours lab per week.
Prereq. or concurrent: ENTC 1500.

EUT 1505 Maintenance Fundamentals 2 4 s.h.
Introduction to piping systems, basic hydraulics and pneumatics, hydraulic and pneumatic troubleshooting, rigging and equipment installation, welding principals, oxyacetylene cutting and welding. Three hours lecture, three hours lab per week.
Prereq.: EUT 1502 and EUT 1504, concurrent or prerequisite EUT 1503.

EUT 2600 Electric Utility Distribution Systems 4 s.h.
Applications of transformers, switchgear, regulators, overhead conductors and underground cable. Power factor correction, voltage regulation, coordination and overcurrent protection of distribution circuits.
Prereq.: EUT 1500.

EUT 2601 Electrical Codes and Standards 4 s.h.
National Electrical Code and National Electrical Safety Code as applied to overhead and underground electric utility distribution systems. Pole guying, overhead conductor sag and tension, cable pulling, and clearances. Four hours lecture per week.
Prereq.: EUT 2600.

EUT 2604 Power Plant Electrical Equipment 3 s.h.
Study of three-phase power systems including motors, generators, transformers, and switchgear. NEC and NESC Code requirements, automatic and manual motor controls, variable speed drives, circuit protection. Three hours lecture per week.
Prereq.: EUT 1500 and EUT 1500L.
Concurrent with: EUT 2604L.

EUT 2604L Power Plant Electrical Equipment Lab 1 s.h.
Lab component to accompany EUT 2604. Provides hands-on activities related to three-phase power systems, motors, generators, transformers, and switchgear. Three hours lab per week.
Prereq.: EUT 1500 and EUT 1500L.
Concurrent with: EUT 2604.

EUT 2605 Intermediate Power Plant Systems 3 s.h.
Continuation of EUT 1502. Study of power plant cycles, thermodynamic properties of water and steam, and use of steam tables. Includes thermodynamic analysis of boiler system, feedwater, superheat, and reheat systems, heat transfer in pre-heaters, turbine, condensers, and pumps. Three hours lecture per week.
Prereq.: EUT 1503, and EUT 1503L.
Concurrent with: EUT 2605L.

EUT 2605L Intermediate Power Plant Systems Lab 1 s.h.
Lab component to accompany EUT 2605. Provides hands-on and computational methods to dynamic analysis of boiler system, feedwater, superheat, and reheat systems, heat transfer in pre-heaters, turbine, condenser, and pumps. Three hours per week.
Prereq.: EUT 1503, and EUT 1503L.
Concurrent with: EUT 2605.

EUT 2606 Power Plant Operator Practice 3 s.h.
Discusses the operation of large utility power plants including start-up and shut-down of all major systems, disturbance response, and safe operation of plant systems. Three hours lecture per week.
Prereq.: EUT 1503 and EUT 1503, EUT 1503L.
Concurrent and EUT 2605/EUT 2605L.

EUT 2607 Power Plant Instrumentation and Control 3 s.h.
Introduces basic principles of process instrumentation and control systems. Measurement parameters such as flow, pressure, level, temperature, and pH. Includes coverage of programmable logic controllers, and distributed control systems. Three hours lecture per week.
Prereq.: EUT 2604, EUT 2604L and EUT 2605, EUT 2605L.
Concurrent with: EUT 2607L.

EUT 2607L Power Plant Instrumentation & Control Lab 1 s.h.
Lab component to accompany EUT 2607. Provides hands-on activities related to process instrumentation and control systems. Three hours per week.
Prereq.: EUT 2604L, and EUT 2605L.
Concurrent with: EUT 2607.

EUT 2608 Advanced Power Plant Systems 3 s.h.
Continuation of EUT 2605. Examines on-line boiler control concepts, including combustion, feedwater, header pressure, oxygen content, power demand, and other processes as applied to utility boilers and process heat supply boilers. Also examines pollution control systems, gas turbines and diesel generators. Three hours lecture per week.
Prereq.: EUT 2605, EUT 2605L.
Concurrent with: EUT 2607, EUT 2607L and EUT 2608L.

EUT 2608L Advanced Power Plant Systems Lab 1 s.h.
Lab component to accompany EUT 2608. Provides hands-on activities related to on-line boiler control concepts, pollution control systems, gas turbines and diesel generators. Three hours per week.
Prereq.: EUT 2605, EUT 2605L.
Concurrent with: EUT 2607, EUT 2607L and EUT 2608.

Mechanical Engineering Technology

MET 1515 Mechanics 1 3 s.h.
Study of forces as vector quantities; resultants of force systems; principles of mechanical equilibrium; application of principles to problems, devices and structures commonly encountered in industry. Three hours lecture per week.
Prereq.: "C" or better in ENTC 1505 and MATH 1513 or MATH 1510 and MATH 1511 or MATH 1510C and MATH 1511C.

MET 2606 Solid Modeling 4 s.h.
Study of parametric solid modeling and other 3D techniques using Solid Works and Inventor software, including work with geometric dimensioning and tolerancing. Four hours lecture per week.

MET 2616 Mechanics 2 3 s.h.
Introduction to dynamics of solids, study of various types of motion, Newton's second law, work and energy, impulse and momentum. Three hours lecture per week.
Prereq.: MET 1515 "C" or better.

MET 2630 Manufacturing Techniques 3 s.h.
The study of materials and processes used in manufacturing, including casting, heat treatment, hot and cold working, plastics processing and machining, Geometric Dimensioning and Tolerancing.
Prereq.: "C" or better in ENTC 1505 and CCET 2604.

MET 2630L Manufacturing Techniques Laboratory 1 s.h.
Practice and procedures of machine tool operation including lathes, drill presses, shapers, and milling machines. Two hours lab per week. "C" or better in MET 2630 or concurrent with MET 2630.

MET 3705 Thermodynamics 4 s.h.
Properties of ideal and real gases, first and second laws of thermodynamics, application to thermodynamic cycles involving power plants and cyclic machinery.
Prereq.: "C" or better in CHEM 1515 or CHEM 1505, "C" or better in EET 3725.

MET 3706 Machine Design 1 4 s.h.
Principles of stresses and deflections, shear and moment diagrams, combined stresses, fatigue, measurement of strain, and theories of failure. Application of these principles to design of machine components. Includes a capstone experience for MET AAS degrees. 4 s.h.
Prereq.: "C" or better in CCET 2604, "C" or better in CCET 1503.

MET 3707 Machine Design 2 3 s.h.
Continuation of MET 3706, progressing to the design of machine elements such as gears, belts, clutches, chains, bearings, welded and bolted joints.
Prereq.: "C" or better in MET 3706.

MET 3710 Tool Design 3 s.h.
Design and selection of cutting tools, fixtures, bending and forming dies, inspection and gauging instruments, and material feed mechanisms.
Prereq.: "C" or better in MET 3706.

MET 3711 Heat and Power Cycles 4 s.h.
A continuation of MET 3705, including the study of heat transfer, the Rankine cycle, the Otto cycle, the Diesel cycle, and the performance of pumps and heat exchangers.
Prereq.: 'C" or better in MET 3714, "C" or better in MET 3705.

MET 3714 Fluid Mechanics 4 s.h.
Principles of fluid statics and fluid dynamics and their application to incompressible flow in pipes and channels; Bernoulli's equation, laminar and turbulent flow; energy and momentum in fluid flow.
Prereq.: "C" or better in MET 1515.

MET 3714L Fluid Mechanics Laboratory 1 s.h.
Fluid Mechanics Lab. Experiments and applications of concepts covered in MET 3714. One hour lab per week.
Prereq.: C or better in MET 3714 or concurrent with MET 3714.

MET 3720 Mechanisms 3 s.h.
Graphical and analytical solution of problems involving displacement, velocity, and acceleration in machine mechanisms. Design of linkages with drafting software to provide required motions of machine members. Two hours lecture, two hours lab per week.
Prereq.: C or better in MET 2616, "C" or better in MATH 1570 or "C" or better in MATH 1571.

MET 4810 Manufacturing Systems Analysis 3 s.h.
Study of manufacturing systems including manufacturing process design, analysis, selection and sequencing; value analysis, machine tool cost and functions; computer and statistical simulation of production systems. Three hours lecture per week.
Prereq.: "C" or better in MET 3706.

MET 4812 Numerical Control 3 s.h.
A study of the programming of numerically-controlled machine tools. Students program NC machines using manual and computer-assisted techniques.
Prereq.: C or better in MET 2606, and C or better in MET 2630 and MET 2630L.
Concurrent: MET 4812L.

MET 4812L Numerical Control Lab 1 s.h.
A study of the programming of numerically-controlled machine tools. Students program NC machines using manual and computer-assisted techniques. One hours lab per week.
Coreq.: MET 4812.

MET 4820 Machine Systems 3 s.h.
Interdisciplinary capstone course. Analysis and design of complex machine systems incorporating hydraulic and pneumatic subsystems and electrical controls, including PLCs. Comprehensive design projects. Three hours lecture per week.
Prereq.: Senior standing in MET and permission of instructor.

MET 4830 Intro to Additive Manufacturing 3 s.h.
Covered topics include learning about the seven different additive manufacturing (AM) technologies and the AM process chain. Other topics covered include software issues, post-processing, rapid tooling, and other applications. Upon completion of this course, students will be able to determine if and when it is appropriate to implement AM technology for a particular application or process line and understand both the positive and negative implications of doing so. Three hours lecture per week.
Prereq.: "C" or better in MET 2630.

MET 4860 Robotics Technology 2 s.h.
An application-oriented course on the technology and use of industrial robots, including classification, tooling, sensors, workcell design, safety, and programming.
Prereq.: "C" or better in MET 3714, Concurrent with: MET 4860L.

MET 4860L Robotics Technology Laboratory 1 s.h.
Practice in the programming and application of industrial robots and associated equipment. Construction of simulated robotic workcells using actual industrial robots, programmable controllers, sensors, and grippers. Two hours lab per week.
Prereq.: MET 3714 "C" or better.
Concurrent with: MET 4860.

MET 4870 Applied Finite Element Method 3 s.h.
Introduction of the finite element method with an emphasis on modeling and interpretation of results. Linear static problems are solved using commercial finite element analysis (FEA) software, where the results are verified using theoretical calculations. Topics include trusses, frames, plane stress/strain, and 3-D structures. Three hours lecture.
Prereq.: "C" or better in MET 3707 or CCET 3709.

MET 4890 Special Topics in Mechanical Engineering Technology 1-4 s.h.
New developments in Mechanical Engineering Technology. Subject matter, special prerequisites, and credit hours to be announced in advance of each offering. May be repeated with different subject matter to a maximum of 8 s.h.
Prereq.: Senior standing in MET or consent of the instructor.