ELECTRICAL ENGINEERING (152–153 CREDITS)

This degree combines studies in selected areas of engineering, physics, mathematics, and science to prepare students to solve real-world problems in electrical engineering. The Bachelor of Science in Electrical Engineering Degree is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

The first two years of the curriculum allow students to establish a solid foundation in mathematics and sciences. The third year curriculum introduces students to a broad spectrum of electrical engineering coursework with specialization and capstone introduced into the fourth year. The senior year capstone course allows the students to consolidate their education experience with the solution of practical engineering problems provided by industry.

The primary objective of the electrical engineering program is to prepare students to enter and progress in electrical engineering positions in business, industry and government. Graduates are generally expected to work in the research and development of ideas, products and processes by applying engineering principles to the solution of practical problems in the electrical engineering field.

Required Courses (78–79 credits)
- EENG 160 Digital Circuits (4)
- EENG 209 Circuit Theory I (5)
- EENG 210 Circuit Theory II (5)
- EENG 250 Digital Hardware (2)
- EENG 260 Microcontroller Systems (4)
- EENG 320 Signals and Systems I (5)
- EENG 321 Signals and Systems II (5)
- EENG 330 Microelectronics I (5)
- EENG 331 Microelectronics II (5)
- EENG 350 Energy Systems (5)
- EENG 360 Hardware Description Languages (5)
- EENG 401 Engineering Applied Electromagnetics (5)
- or PHYS 401 Electromagnetism I (4)
- EENG 420 Digital Signal Processing (5)
- EENG 430 CMOS Integrated Circuits Design (5)
- EENG 440 Digital Communication Systems (5)
- EENG 490A Senior Capstone: Design Laboratory (2)
- and EENG 490B Senior Capstone: Design Laboratory (3)
- TECH 395 Technology in Work Civilization (4)

Supporting Courses (64 credits)
- CHEM 151 General Chemistry (5)
- CSCD 255 C Programming for Engineers (5)
- EENG 383 Applied Stochastic Processes (4)
- or MATH 385 Probability and an Introduction to Stochastic Processes (4)
- EENG 388 Applied Stochastic Processes Lab (1)
- or MATH 307 Mathematical Computing Laboratory (1)
- ENGL 295 Introduction to Technical Writing (5)
- or MENG 381 Laboratory Analysis and Report (5)
- MATH 161 Calculus I (5)
- MATH 162 Calculus II (5)
- MATH 163 Calculus III (5)
- MATH 231 Linear Algebra (5)
- MATH 241 Calculus IV (5)
- MATH 547 Introductory Differential Equations (4)
- PHYS 151 General Physics I (4)
- PHYS 152 General Physics II (4)
- PHYS 153 General Physics III (4)
- PHYS 161 Mechanics Lab (1)
- PHYS 162 Heat and Optics Lab (1)
- PHYS 163 Instrumentation Lab I (1)

Electrically Engineering electives chosen from the following (10 credits)
- EENG 450 Power Systems Analysis (5)
- EENG 460 Computing Systems: Organization and Design (5)
- EENG 461 Embedded System Design (5)
- EENG 470 Control Systems (5)
- EENG 495 Internship (1–6)
- PHYS 221 Physics IV (4)
- and PHYS 164 Instrumentation Lab II (1)

Required program credits 78–79 credits
Supporting credits 64 credits
Electrical engineering elective credits 10 credits
Minimum total credits for above degree 152 credits

Note: Including university requirements, the above program requires a minimum of 187 credits, or an average of 15.58 credits per quarter for a 12 quarter, four-year program. The 183 credits are based upon the following assumptions: a. Students will enter EWU prepared to take calculus. If this assumption is not true, then the student will have to complete MATH 105 Precalculus I (5) and MATH 106 Precalculus II (5); b. Students will have satisfied university competencies. If this assumption is not true, then the student will have to complete up to six more credits of classes. (See university competencies in this catalog.)
ENGINEERING

BACHELOR OF SCIENCE (BS)

MECHANICAL ENGINEERING (146–147 CREDITS)

This degree combines studies in selected areas of engineering, physics, mathematics, and science to prepare students to solve real-world problems in mechanical engineering. The Bachelor of Science in Mechanical Engineering Degree is accredited by the Engineering Accreditation Commission of ABET, www.abet.org. The first two years of the curriculum allow students to establish a solid foundation in mathematics, sciences and introduces foundation subjects in mechanical engineering. The third and fourth year curriculum explores further areas in Mechanical Engineering and a capstone is introduced into the fourth year. The senior year capstone course allows the students to consolidate their education experience. The primary objective of the Mechanical Engineering program is to prepare students to enter and progress in mechanical engineering positions in business, industry and government. Graduates are generally expected to work in the research and development of ideas, products and processes by applying engineering principles to the solution of practical problems in the mechanical engineering field.

Required Courses (101–102 credits)
MENG 201 Introduction to Matlab (4)
or CSCD 255 C Programming for Engineers (5)
MENG 207 Electricity (4)
MENG 217 3D Parametric Computer Aided Design (4)
MENG 240 Statics (4)
MENG 241 Strength of Materials (4)
MENG 242 Dynamics (4)
MENG 355 Industrial Materials (5)
MENG 380 Thermodynamics (5)
MENG 581 Laboratory Analysis and Reports (5)
MENG 582 Fluid Mechanics (5)
MENG 385 Robotics and Automation (5)
MENG 386 Engineering Numerical Analysis (5)
MENG 405 Design of Machine Elements (5)
MENG 407 Heating, Ventilating and Air Conditioning (5)
MENG 412 Fundamentals of Engineering (2)
MENG 444 Heat Transfer (5)
MENG 452 Engineering Economics (2)
MENG 490A Senior Capstone: Design Laboratory I (2)
MENG 490B Senior Capstone: Design Laboratory II (3)
MENG 492 Finite Element Analysis (5)
MENG 493 Senior Seminar (1)
MENG 495 Internship (*)
METC 456 Engineering Ethics, Contracts and Patents (2)
TECH 301 Metallic Processes (5)
TECH 393 Technology in World Civilization (4)

Supporting Courses (45 credits)
CHEM 151 General Chemistry (5)
MATH 161 Calculus I (5)
MATH 162 Calculus II (5)
MATH 163 Calculus III (5)
MATH 241 Calculus IV (5)
MATH 347 Differential Equations (5)
PHYS 151 General Physics I (4)
PHYS 152 General Physics II (4)
PHYS 153 General Physics III (4)
PHYS 161 Mechanics Lab (1)
PHYS 162 Heat and Optics Lab (1)
PHYS 163 Instrumentation Lab I (1)
PHYS 205 Mechanics and Heat Transfer (5)

Electives (from the following areas) (10 credits)
MATH electives (typically MATH 105 and 106 (10)

BACHELOR OF SCIENCE (BS)

Student Learning Outcomes—students will:

• show respect for diversity and a knowledge of contemporary professional, societal and global issues;
• develop the ability to understand professional, ethical or social responsibilities;
• function effectively on teams;
• communicate effectively;
• develop appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines;
• conduct, analyze and interpret experiments and apply results to improve processes.

MECHANICAL ENGINEERING TECHNOLOGY (146 CREDITS)

This degree combines studies of Mathematics, Computer Science, Physics and Mechanical Engineering Technology with an emphasis on applications. The Bachelor of Science in Mechanical Engineering Technology Degree is accredited by the Technology Accreditation Commission of ABET, www.abet.org. Before graduation each student will participate in a design project or an internship in industry to gain industrial experience during his or her academic career before employment. The emphasis of this program is the application of engineering principles to the solution of practical problems. MET graduates are in great demand and are employed in a variety of interesting, high-tech careers throughout the state and region. Employment opportunities are available in mechanical design, industrial engineering technology, industrial management, manufacturing, CAD, applied research and sales and service.

Required Courses (82 credits)
MENG 207 Electricity (4)
MENG 217 3D Parametric Computer Aided Design (4)
MENG 353 Industrial Materials (5)
MENG 385 Robotics and Automation (5)
MENG 412 Fundamentals of Engineering (2)
MENG 452 Engineering Economics (2)
MENG 493 Senior Seminar (1)
METC 110 Engineering Graphics (5)
METC 340 Statics (5)
METC 341 Strength of Materials (4)
METC 342 Dynamics (4)
METC 381 Thermodynamics and Heat Transfer (5)
METC 415 Design of Machine Elements (5)
METC 456 Engineering Ethics, Contracts and Patents (2)
MENG 409A Senior Capstone: Design Laboratory I (2)
MENG 409B Senior Capstone: Design Laboratory II (3)
MENG 495 Internship (*)
TECH 301 Metallic Processes (5)
TECH 393 Technology in World Civilization (4)
TECH 403 Computer-Aided Design and Project Management (4)

Supporting Courses (39–40 credits)
CHEM 151 General Chemistry (5)
CSCD 255 C Programming for Engineers (5)
or CSCD 409 Introduction to Systems Modeling (4) (see note below)
or MENG 201 MATLAB (4)
ENGL 205 Introduction to Technical Communication (5)
or MENG 381 Laboratory Analysis and Reports (5)
MATH 161 Calculus I (5)
MATH 162 Calculus II (5)
PHYS 131 Introductory Physics I (4)
or PHYS 151 General Physics I (4)
PHYS 132 Introductory Physics II (4)
or PHYS 152 General Physics II (4)
PHYS 133 Introductory Physics III (4)
or PHYS 153 General Physics III (4)
PHYS 161 Mechanics Lab (1)
PHYS 162 Heat and Optics Lab (1)
PHYS 163 Instrumentation Lab I (1)

Note: if an internship cannot be found by student, independent study METC 491 Senior Project (6) may be substituted.

Note: Including university requirements for the degree the above program requires a minimum of 186 credits or an average load of 15.5 credits per quarter, for a 12 quarter, four-year program. The 186 credits are based on the following assumption: a. Students have had one year of high school drafting. If this assumption is not true, then the student will have to take METC 102 Introduction to Engineering Graphics (4).
Choose one of the following Tracks

Design Track (15 credits)
MENG 407 Heating, Ventilation and Air Conditioning (5)
METC 417 Advanced Parametric Analysis and Simulation (5)
METC 384 Energy Management and Utilization (5)

Manufacturing Track (15 credits)
METC 468 Quality Assurance and Intro to Lean (5)
TECH 402 Machine Tool I (5)
TECH 404 Computer Numerical Control (5)

Total required credits 82 credits
Minimum total supporting credits 39 credits
Minimum total mathematics elective credits 10 credits
Total engineering technology track credits 15 credits
Minimum total credits for above degree 146 credits

* If an internship cannot be found by student, independent study METC 491 Senior Project (6) may be substituted.

Note: Including university requirements for the degree the above program requires a minimum of 188 credits or an average load of 15.67 credits per quarter, for a 12 quarter, four-year program. The 188 credits are based on the following assumption: a. Students have had one year of high school drafting. If this assumption is not true, then the student will have to take METC 102 Introduction to Engineering Graphics (4).

BACHELOR OF SCIENCE (BS)

Student Learning Outcomes—students will:

• develop an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines;
• develop a recognition of the need for, and the ability to engage in, lifelong learning;
• develop a commitment to quality, timeliness and continuous improvement;
• communicate effectively;
• identify, analyze and solve technical and creative problems;
• develop an ability to understand professional, ethical or social responsibilities.

TECHNOLOGY WITH APPLIED TECHNOLOGY OPTION (91 CREDITS)

This program is designed for students who have graduated with an associate degree in applied arts and sciences (AAS), associate degree in applied science (AAS), associate degree in technical arts (ATA) in computer technology, electronics technology, mechanical engineering technology, civil engineering technology, drafting/design technology and similarly named programs at community colleges. This degree allows these students to continue their education by taking liberal arts courses, additional advanced technology courses and supporting courses to complete a Bachelor of Science Degree.

Required Coursework (46 credits)
TECH 330 Technology Problem Analysis and Design I (3)
TECH 331 Technology Problem Analysis and Design II (3)
TECH 393 Technology in World Civilization (4)
TECH 403 Computer-Aided Design and Project Management (4)
TECH 452 Engineering Economics (2)
TECH 454 Environmental Engineering (2)
TECH 456 Engineering Ethics, Contracts and Patents (2)
TECH 458 Quality Assurance (4)
TECH 462 Industrial Safety Engineering (4)
TECH 490 Senior Capstone: Production Laboratory (4)
TECH 491 Senior Project (4)
TECH 495 Internship (10)

Supporting Courses (45 credits)
CHEM 121 Chemistry and its Role in Society (5)
or CHEM 151 General Chemistry (5)
CMST 340 Intercultural Communication (5)
ECON 100 General Education Economics (5)
ENGL 205 Introduction to Technical Communication (5)
HIST 110 American Experience: A Survey (5)
or HIST 305 Paths to the American Present (5)
MATH 106 Pre-Calculus II (5)
or MATH 115 Mathematical Reasoning (5)
PHIL 210 Critical Thinking (5)
PHYS 101 General Physics (5)

Required program credits 82 credits
Supporting credits 45 credits
Total credits for above option 91 credits

Note: Entrance into this program requires an AAS, AAAS, ATA or similar degree in an approved area from an accredited two-year college. Applicants must have a 2.5 GPA for the Technology coursework in the AAS, AAAS, or ATA degree. Graduation requires maintaining an overall GPA of 2.5 for this option.

Note: Minimum total credits for above degree 146 credits

TECHNOLOGY WITH CONSTRUCTION MANAGEMENT OPTION (122 CREDITS)

The construction option focuses on selected areas of technology, physics, construction materials and techniques, emphasizing courses such as construction estimating, soils and surveying, building codes, and architecture. This concentration prepares graduates to enter and progress in supervisory or management positions in the construction industry. Initial employment may be as an estimator, laboratory technician in materials testing, construction inspector or field engineer.

Required Courses (82 credits)
METC 110 Engineering Graphics (5)
METC 340 Statics (5)
METC 341 Strength of Materials (4)
TECH 239 Construction Materials and Techniques (5)
TECH 305 Construction Estimating (4)
TECH 320 Non-Metallic Processes (5)
TECH 330 Technology Problem Analysis and Design I (3)
TECH 331 Technology Problem Analysis and Design II (3)
TECH 335 Architecture (4)
TECH 345 Soils/Surveying (4)
TECH 354 Building Codes (4)
TECH 393 Technology in World Civilization (4)
TECH 403 Computer-Aided Design and Project Management (4)
TECH 452 Engineering Economics (2)
TECH 454 Environmental Engineering (2)
TECH 456 Engineering Ethics, Contracts and Patents (2)
TECH 458 Quality Assurance (4)
TECH 462 Industrial Safety Engineering (4)
TECH 490 Senior Capstone: Production Laboratory (4)
TECH 491 Senior Project (4)
TECH 495 Internship (6)*

Supporting Courses (40 credits)
CHEM 121 Chemistry and its Role in Society (5)
or CHEM 151 General Chemistry (5)
CMST 340 Intercultural Communication (5)
ECON 100 General Education Economics (5)
ENGL 205 Introduction to Technical Communication (5)
HIST 110 American Experience: A Survey (5)
or HIST 305 Paths to the American Present (5)
MATH 106 Pre-Calculus II (5)
PHIL 210 Critical Thinking (5)
PHYS 131 Introductory Physics I (4)
PHYS 161 Mechanics Lab (1)

Required program credits 82 credits
Supporting credits 40 credits
Total credits for above option 122 credits

Note: Including university requirements, the above program requires a minimum of 180 credits, an average of 15 credits per quarter for a 12 quarter, four-year program. The 180 credits are based upon the following assumptions: a. Students have had one year of high school drafting. If this assumption is not true, then the student will have to take METC 102 Introduction to Engineering Graphics (4); b. Students will have satisfied university competencies. If this assumption is not true, then the student will have to complete up to six more credits of classes. (See university competencies in this catalog.)
TECHNOLOGY WITH DESIGN OPTION (129 CREDITS)

The design option prepares the graduate for placement in the world of manufacturing. A student graduating with this option should have the basic skills appropriate for the design, development, manufacturing and sale of consumer products. Students should enter the labor force at the middle-management level. The breadth of preparation in the design option provides a broad foundation from which to build and progress.

Required Courses (84 credits)
- MENG 217 3D Parametric Computer Aided Design (4)
- MENG 353 Industrial Materials (5)
- METC 110 Engineering Graphics (5)
- METC 340 Statics (5)
- METC 341 Strength of Materials (4)
- TECH 208 Survey of Electricity (4)
- TECH 301 Metalic Processes (5)
- TECH 320 Non-Metallic Processes (5)
- TECH 330 Technology Problem Analysis and Design I (5)
- TECH 331 Technology Problem Analysis and Design II (5)
- TECH 393 Technology in World Civilization (4)
- TECH 402 Machine Tool I (5)
- TECH 403 Computer-Aided Design and Project Management (4)
- TECH 452 Engineering Economics (2)
- TECH 454 Environmental Engineering (2)
- TECH 456 Engineering Ethics, Contracts and Patents (2)
- TECH 458 Quality Assurance (4)
- TECH 462 Industrial Safety Engineering (4)
- TECH 490 Senior Capstone: Production Laboratory (4)
- TECH 491 Senior Project (4)
- TECH 495 Internship (6)*

Supporting Courses (45 credits)
- CHEM 123 Chemistry and its Role in Society (5)
- or CHEM 151 General Chemistry (5)
- CMST 340 Intercultural Communication (5)
- ECON 100 General Education Economics (5)
- ENGL 205 Introduction to Technical Communication (5)
- HIST 110 American Experience: A Survey (5)
- or HIST 305 Paths to the American Present (5)
- MATH 106 Pre-Calculus II (5)
- PHYS 161 Mechanics Lab (1)
- PHYS 162 Heat and Optics Lab (1)
- TECH 393 Technology in World Civilization (4)

Required program credits 84 credits
Supporting credits 45 credits
Total credits for above option 129 credits

Note: Including university requirements, the above program requires a minimum of 180 credits, an average of 15 credits per quarter for a 12 quarter, four-year program. The 180 credits are based upon the following assumptions: a. Students have had one year of high school drafting. If this assumption is not true, then the student will have to take METC 102 Introduction to Engineering Graphics (4); b. Students will have satisfied university competencies. If this assumption is not true, then the student will have to complete up to six more credits of classes. (See university competencies in this catalog.)

TECHNOLOGY WITH MANUFACTURING OPTION (129 CREDITS)

The manufacturing option focuses on select areas of technology, science and methods of materials processing. This option prepares the student to enter and progress in industry in a variety of areas including, quality assurance, inventory control, production line supervision or process management.

Required Courses (89 credits)
- MENG 217 3D Parametric Computer Aided Design (4)
- MENG 353 Industrial Materials (5)
- METC 110 Engineering Graphics (5)
- TECH 208 Survey of Electricity (4)
- TECH 301 Metalic Processes (5)
- TECH 320 Non-Metallic Processes (5)
- TECH 330 Technology Problem Analysis and Design I (5)
- TECH 331 Technology Problem Analysis and Design II (5)
- TECH 393 Technology in World Civilization (4)
- TECH 402 Machine Tool I (5)
- TECH 403 Computer-Aided Design and Project Management (4)
- TECH 404 Computer Numerical Control (5)
- TECH 406 Welding Technology (4)
- TECH 490 Senior Capstone: Production Laboratory (4)
- TECH 491 Senior Project (4)
- TECH 495 Internship (6)*

Supporting Courses (40 credits)
- CHEM 121 Chemistry and its Role in Society (5)
- or CHEM 151 General Chemistry (5)
- CMST 340 Intercultural Communication (5)
- ECON 100 General Education Economics (5)
- ENGL 205 Introduction to Technical Communication (5)
- HIST 110 American Experience: A Survey (5)
- or HIST 305 Paths to the American Present (5)
- MATH 106 Pre-Calculus II (5)
- or MATH 135 Mathematical Reasoning (5)
- PHYS 201 Critical Thinking (5)
- PHYS 100 Physical Science (5)

Required program credits 89 credits
Supporting credits 40 credits
Total credits for above option 129 credits

Note: For the above minor the following assumption has been made: students have had one year of high school drafting. If this assumption is not true then the student will have to take METC 102 Introduction to Engineering Graphics (4);

MINOR

TECHNOLOGY MINOR (24 CREDITS)

Required Courses (9 credits)
- METC 110 Engineering Graphics (5)
- TECH 393 Technology in World Civilization (4)

Electives (15 credits)
- With prior approval of your Department of Engineering & Design advisor, select Technology courses, 8 credits of which must be upper-division courses.

Required program credits 9 credits
Elective credits 15 credits
Total credits for above minor 24 credits

MECHANICAL ENGINEERING MINOR (81 CREDITS)

Required courses (16 credits)
- MENG 217 3D Parametric Computer Aided Drafting (4)
- MENG 240 Statics (4)
- MENG 241 Strength of Materials (4)
- MENG 242 Dynamics (4)

Choose from the following (15 credits minimum)
- MENG 353 Industrial Materials (5)
- MENG 380 Thermodynamics (5)
- MENG 381 Laboratory Analysis and Reports (5)
- MENG 382 Fluid Dynamic (5)
- MENG 385 Robotics and Automation (5)
- MENG 405 Design of Machine Elements (5)
- MENG 407 Heating, Ventilating and Air Conditioning (5)
- MENG 444 Heat Transfer (5)
- MENG 492 Finite Element Analysis (5)

Total minimum number of credits 81 credits

GRADUATE PROGRAM

Engineering & Design offers courses that students may use as part of a degree in communications, multimedia programming and other interdisciplinary areas. These programs are listed in their respective graduate catalog sections.
Electrical Engineering Courses

Terms offered: check with the department or EagleNET.

EENG 160 Digital Circuits (4)
Prerequisite: MTHD 104 or equivalent.
Fundamentals of digital computer design including appropriate number systems, Boolean algebra and basic digital circuits. Methods introduced will include the use of Karnaugh Maps and the Quine-McCluskey procedure. Computer laboratory work will involve the use of current software for the design, analysis and simulation of digital circuits.

EENG 209 Circuit Theory I (5)
Prerequisites: PHYS 153 or permission of the instructor.
This course is intended to provide electrical engineering students with an understanding of electricity and its applications. Topics include AC/DC circuit-analysis methods such as nodal and mesh analysis, superposition, Norton Theorems, Thevenin Theorems and transient analysis.

EENG 210 Circuit Theory II (5)
Prerequisites: EENG 209 or permission of the instructor.
This course continues to cover analysis, DC operating point, first-order circuits, second-order circuits, circuit simulation methods, sinusoidal steady state, phasors, poles and zeros of network functions, ideal transformer, linear and non-linear two-port networks.

EENG 250 Digital Hardware (2)
Prerequisite: EENG 160.
A continuation of ENGR 160, this course presents logic families, hardware characteristics, noise control and modern programmable logic.

EENG 260 Microcontroller Systems (4)
Prerequisite: EENG 160, CSCD 255 or permission of the instructor.
This is an introductory course on microprocessor and microcontroller systems organization. It provides low-level programming principles for microcomputer-based systems. The course emphasizes assembly and C language programming techniques and laboratory experiments in input/output programming, memory organization, interrupts and interfacing methods.

EENG 320 Signals and Systems I (5)
Prerequisite: EENG 210 or concurrent enrollment in EENG 210 or permission of the instructor.
This course is an introduction to continuous-time signal analysis. Topics include: generalized functions and the relationship to basic signals including impulses, pulses and unit step system, properties such as linearity, time-invariance and causality; and Fourier analysis.

EENG 321 Signals and Systems II (5)
Prerequisite: EENG 320.
Introduction to Laplace Transform, Z-transform, the Fourier Series, the Fourier Transform, the Discrete Fourier Transform (DFT), and Sampling Theorem. Introduction to analysis of Linear Time Invariant (LTI) system using above techniques for continuous and discrete time.

EENG 330 Microelectronics I (5)
Prerequisites: EENG 210, concurrent enrollment in EENG 210 or permission of instructor.
This course introduces modeling, characterization and application of semiconductor devices and integrated circuits. It includes the development of models for circuit-level behavior of diodes, bipolar transistors, field effect transistors and op-amps and applies the models to the analysis and design of linear amplifiers.

EENG 331 Microelectronics II (5)
Prerequisite: EENG 330 or permission of the instructor.
This course is the second in modeling and application of semiconductor devices and integrated circuits. Topics include advanced transistor amplifier analysis, feedback effects, power amplifiers, op-amps, analog filters, oscillators, A/D and D/A converters, and power converters.

EENG 350 Energy Systems (5)
Prerequisites: EENG 210.
This course provides an introduction to the different energy sources, methods of electric energy conversion, the electric power system, transformers and electrical machines.

EENG 360 Hardware Description Languages (4)
Prerequisite: EENG 160.
This course introduces methodologies and computer-aided design (CAD) tools for the design of complex electronic systems. The emphasis is on high-level description languages and their use for specifying, designing, simulating and synthesizing digital very large scale integration (VLSI) circuits in MOS (metal-oxide-semiconductor) technologies. Theoretical knowledge will be complemented by hands-on use of several commercial CAD tools.

EENG 383 Applied Stochastic Processes (4)
Prerequisites: MATH 163 or permission of the instructor and must be taken concurrently with EENG 388.
This course provides an introduction to the basic concepts of stochastic processes and their applications to engineering problems. Topics include analysis of continuous and discrete random signals and systems, as well as modern estimation techniques.

EENG 388 Applied Stochastic Processes Laboratory (1)
Prerequisite: EENG 160 or permission of the instructor and must be taken concurrently with EENG 383.
This laboratory course introduces basic concepts of stochastic processes and their application to engineering problems.

EENG 401 Engineering Applied Electromagnetics (5)
Prerequisite: EENG 210.
This course provides students with the technical basis to analyze electromagnetic applications systems. Topics include coordinate systems, vector calculus, static and dynamic fields, Maxwell’s equations, power flow, circuit representation of transmission lines, electromagnetic transmission and introductory waveguides.

EENG 420 Digital Signal Processing (5)
Prerequisite: EENG 321.
This course provides an introduction to digital signal processing. Convolution, time invariance and stability of discrete-time systems are presented. In addition, various signal processing techniques such as Z-transform, discrete Fourier transform (DFT) and fast Fourier transform (FFT) are studied. Time and frequency domain techniques for designing and applying infinite impulse response (IIR) and finite impulse response (FIR) digital filters are introduced.

EENG 430 CMOS Integrated Circuits Design (5)
Prerequisites: EENG 160, EENG 330 or permission of the instructor.
This course provides students with the theoretical and practical knowledge required for designing and simulating very large scale integration (VLSI) circuits and systems in complementary metal-oxide-semiconductor (CMOS) technology. Lab includes hands-on use of a variety of state-of-the-art computer-aided design (CAD) tools and design techniques.

EENG 440 Digital Communication Systems (5)
Prerequisite: EENG 321.
This course provides students with a solid background in modern digital communication systems. Random processing is applied in the realm of communication theory. Common digital modulation and demodulation techniques are presented. Other topics include bandwidth transmission of binary data, coherent/noncoherent communications, intersymbol interference and equalization.

EENG 450 Power System Analysis (5)
Prerequisite: EENG 350.
The course provides students with the ability to analyze power systems from technical and economic perspectives. It includes symmetrical component calculations, application of line parameters, power flow control, representation of transmission lines and power components.

EENG 460 Computing Systems: Organization and Design (5)
Prerequisites: EENG 160, CSCD 255 or permission of the instructor.
This course provides the theoretical and practical knowledge required for analyzing and designing complex computing systems. Emphasis is on the impact that the organization and interfacing of hardware/software components have on system performance. Hands-on design skills using HDL (Hardware Design Language) will be offered in weekly labs.

EENG 461 Embedded System Design (5)
Prerequisites: EENG 160 or permission of the instructor.
This course provides students with the theoretical and practical knowledge required for analyzing and designing embedded computing systems. The key challenge of embedded systems is to optimize the various design metrics and assess the impact that the organization and interfacing of hardware/software components have on system performance. Hands-on experience using various hardware, such as Field Programmable Gate Arrays (FPGA) and microcontrollers, will be offered in weekly labs.

EENG 470 Control Systems (5)
Prerequisite: EENG 321.
This course reviews basic topics such as transfer function, step response and stability conditions. Other topics include feedback systems, analysis techniques such as root-locus analysis, transient and steady-state response analyses and frequency response analysis are studied. In addition, state-space analysis techniques are examined within the context of state-space model systems. Analysis and design of proportional, integral and derivative (PID), PI and PD controllers are presented.

EENG 490A Senior Capstone: Design Laboratory I (2)
Prerequisites: senior standing.
Satisfies: senior capstone university graduation requirement.
This course will simulate the industrial environment, where students will have to work in a team to solve a real world problem, from design to implementation. Team dynamics will be strictly monitored and each student’s unique skills will be utilized in different stages of the design process. Dealing with problems typical of a team environment will result in an invaluable learning experience both in the professional and personal lives of the students.

EENG 490B Senior Capstone: Design Laboratory II (3)
Prerequisites: EENG 490A.
Satisfies: senior capstone university graduation requirement.
See description for EENG 490A.

EENG 491 Senior Project (1–6)
Prerequisite: permission of instructor.
Independent and/or group study and implementation of a design and development project. (variable time)
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Mechanical Engineering Courses

Terms offered: check with the department or EagleNET.

MENG 201 Introduction to MATLAB (4)
Prerequisite: MATH 105
This course introduces the student to the application of basic MATLAB building blocks to engineering problems. Students will get a thorough introduction to data visualization, data analysis, symbolic calculation, numeric computations and other basic skills related to MATLAB.

MENG 207 Electricity (4)
Prerequisite: MATH 162, PHYS 153 or PHYS 153.
This course is intended to provide students with a basic understanding of electricity and its applications. In this course, basic concepts of current, voltage and resistance will be presented as well as basic circuit-analysis methods including inductor and capacitor.

MENG 217 3D Parametric Computer Aided Design (4)
Prerequisite: METC 110 or High School AUTOCAD or permission of instructor.
This course uses a computer to draft parametric models in three dimensions. File management methods, rapid prototyping and 2D drawing development techniques are discussed. (Four hours per week.)

MENG 240 Statics (4)
Prerequisites: PHYS 151, MATH 161 or Technical Calculus I or equivalent.
Fundamentals of applied mechanics, equivalent force systems, equations of equilibrium, structures, three dimensional force systems and friction. (Two hours lecture, four hours laboratory per week.)

MENG 241 Strength of Materials (4)
Prerequisites: MENG 240, MATH 162, PHYS 152 or Technical Calculus II or equivalent.
A study of the internal stresses, internal deformations and deflections of materials. Topics may include: shear and moment diagrams for beams, combined loading on beams, temperature stresses and torsional loading. (Four hours lecture per week.)

MENG 242 Dynamics (4)
Prerequisite: MENG 240.
Kinematics and kinetics of particles and rigid bodies using vector analysis; force mass acceleration, work and energy, impulse and momentum, translating and rotating coordinate system. (Four hours lecture per week.)

MENG 353 Industrial Materials (5)
Prerequisite: CHEM 121 or 151.
Students in this course achieve a thorough understanding of engineering materials, their properties, responses and applications. Laboratory work includes destructive and non-destructive testing and imaging of microscopic structures of industrial materials.

MENG 380 Thermodynamics (5)
Prerequisite: PHYS 152, MATH 162; MENG 381 (may be taken concurrently).
This course explores properties of materials, work, heat, conversion of energy, conservation of mass and energy transformation processes. Emphasis is on application of the first and second laws to engineering systems.

MENG 381 Laboratory Analysis and Reports (5)
Prerequisite: PHYS 153 or PHYS 153; MATH 162.
This course examines the different aspects of laboratory analysis and report writing. This includes descriptions of engineering problems, analysis of data including error analysis and data interpretation, instrumentation and measurements. In addition, the application of spreadsheets for solving and analyzing engineering problems, creating technical graphs, trending and curve fitting and project management will be addressed.

MENG 382 Fluid Mechanics (5)
Prerequisites: PHYS 152, MATH 162; MENG 381 (may be taken concurrently).
This course introduces the student to theory, concepts and applications of fluid mechanics. Topics include static and dynamic forces; conservation of mass, energy and momentum; flow in pipes and ducts; and fan and pump performance. Laboratory work is included.

MENG 385 Robotics and Automation (5)
Prerequisite: MENG 207 or TECH 208 or permission of the instructor.
This course covers various electrical and mechanical systems used in robotics and other automated industrial systems. It includes automated equipment programming and industrial planning as applied to automated systems. (Three hours lecture, four hours laboratory per week.)

MENG 386 Engineering Numerical Methods (5)
Prerequisites: PHYS 153, MATH 163, and either MENG 201 or CSCI 255.
This course covers a multitude of numerical approximation methods used to solve specific structural engineering problems and highlights the algorithms used in many common scientific software packages.

MENG 405 Design of Machine Elements (5)
Prerequisites: MENG 244 or MENG 341 and MATH 162 or permission of instructor.
This course covers the design of machine components and mechanisms and utilizes the concepts of engineering mechanics and strength of materials.

MENG 407 Heating, Ventilating and Air Conditioning (5)
Prerequisite: PHYS 132 or PHYS 152.
The study of the principles of Heating, Ventilating and Air Conditioning (HVAC) including the investigation of the basic calculations to determine heating and cooling loads and the study of the basic equipment design for HVAC.

MENG 412 Fundamentals of Engineering (2)
Prerequisite: senior standing or permission of instructor.
This course reviews the fundamentals of engineering. It provides an overview of principles of the practice of engineering and assists students in preparation for the first steps in professional licensure.

MENG 444 Heat Transfer (5)
Prerequisites: MATH 241, MATH 347, MENG 380 and MENG 381. (MENG 381 may be taken concurrently.)
This course provides a detailed calculus-based analysis of the heat transfer through solids, fluids and vacuums. Concepts include convection, conduction, radiation, heat transfer in one and two dimensions for steady and unsteady states.

MENG 452 Engineering Economics (2)
Cross-listed: TECH 452.
Prerequisite: junior standing or permission of instructor.
This course focuses on the systematic evaluation of the economic benefits and costs of projects involving engineering design and analysis. Engineering economics quantifies the benefits and costs associated with engineering projects to determine whether they make (or save) enough money to warrant their capital investment.

MENG 490 Internship (1–6)
Prerequisite: senior standing or permission of instructor.
Note: graded Pass/Fail.
This course provides the students firsthand exposure to the latest technological advances directly from the manufacturer or researcher. This helps students in their lifelong learning and provides an opportunity to inquire about particular topics or fields of interest.

MENG 495 Internship (1–6)
Note: graded Pass/Fail.
Prerequisite: senior standing or permission of instructor.
See description for MENG 490A.

MENG 490A Senior Capstone: Design Laboratory A (2)
Prerequisites: MATH 241 and senior standing.
Satisfies: senior capstone university graduation requirement.
This course simulates the industrial environment, where students work in teams to solve a real world problem from design to implementation. Team dynamics and project constraints are strictly monitored and each student’s unique skills are utilized in different stages of the design process.

MENG 490B Senior Capstone: Design Laboratory II (3)
Prerequisites: MENG 490A.
Satisfies: senior capstone university graduation requirement.
See description for MENG 490A.

MENG 491 Senior Project (1–6)
Prerequisite: permission of instructor.
Independent and/or group study and implementation of a design and development project. (Variable time)

MENG 492 Finite Element Analysis (5)
Prerequisites: METC 341 or MENG 241 and MATH 162 or permission of the instructor.
This course introduces the student to computational methods to solve engineering problems using the finite element approach. Modeling techniques for different engineering structures such as truss, beams, frames, two and three dimensional solids, and thin-walled structures are introduced in this course. Students solve a wide variety of engineering problems dealing with statics, dynamics, fluid mechanics, heat transfer and design and material selections using the state of art FEA software.

MENG 493 Senior Seminar (1)
Note: graded Pass/Fail.
Prerequisite: senior standing or permission of instructor.
This course offers an introduction to the fundamentals of technical drawing. It emphasizes the technical methods used to describe the size and shape of objects. This course will not satisfy elective requirements for a major or minor in Technology.

MENG 494B Senior Capstone: Design Laboratory I (2)
Prerequisites: MATH 241 and senior standing.
Satisfies: senior capstone university graduation requirement.
This course simulates the industrial environment, where students work in teams to solve a real world problem from design to implementation. Team dynamics and project constraints are strictly monitored and each student’s unique skills are utilized in different stages of the design process.

MENG 495B Senior Capstone: Design Laboratory II (3)
Prerequisites: MENG 490B.
Satisfies: senior capstone university graduation requirement.
See description for MENG 490A.

Mechanical Engineering Technology Courses

Terms offered: check with the department or EagleNET.

METC 102 Introduction to Engineering Graphics (4)
Note: graded Pass/Fail.
This course offers an introduction to the fundamentals of technical drawing. It emphasizes the technical methods used to describe the size and shape of objects. This course will not satisfy elective requirements for a major or minor in Technology.

METC 110 Engineering Graphics (5)
Prerequisites: METC 102, two years of high school drafting or equivalent.
A study of the technical portion of the graphics language. This language, technical drawing, is used by engineers to communicate proposed designs and new ideas. Includes the theory and practice of descriptive geometry and the graphic representation of data.

METC 340 Statics (5)
Prerequisites: PHYS 141 and MATH 106 or equivalent.
A study of applied mechanics and the principles of statics dealing with forces and with the effects of forces acting upon rigid bodies at rest. (Four hours lecture per week.)
METC 341 | Strength of Materials (4)  
Prerequisite: METC 340.  
A study of the relationship that exists between externally applied forces and internally induced stresses in members and parts, including the relationship existing between these same externally applied forces and the resulting deformations. (Four hours lecture per week)

METC 342 | Dynamics (4)  
Prerequisite: METC 340 and MATH 162.  
This course is a study of the motion of rigid bodies and forces affecting their motion. Topics include kinematics and kinetic of motion, curvilinear motion, plane motion, work, energy, and power, impulse and momentum. (Four hours lecture per week.)

METC 384 | Energy Management and Utilization (5)  
Prerequisite: MENG 380.  
The study of energy usage and energy management within industrial facilities. The development of Energy audit procedures including the energy saving calculations for industrial settings. Students will develop and explain the creation of industrial energy audits through the extensive use of case studies.

METC 387 | Fluid Mechanics (5)  
Prerequisite: PHYS 132 or 152; MATH 205 and (METC 384 or MENG 380 may be taken concurrently).  
This course introduces the student to theory, concepts and applications of fluid mechanics. Topics include static and dynamic forces; conservation of mass, energy and momentum; flow in pipes and ducts; and fan and pump performance. Laboratory work is included.

METC 388 | Thermodynamics and Heat Transfer (5)  
Prerequisite: PHYS 132 or 152; MATH 162; ENGR 205 and METC 340.  
This course introduces the student to theory, concepts and applications of thermodynamics and heat transfer. Topics include properties of materials, work, heat, conservation of mass and energy, energy transformation processes, and heat transfer via conduction, convection and radiation.

METC 415 | Design of Machine Elements (5)  
Prerequisites: METC 341, MENG 353, and MATH 162 or permission of instructor.  
This course covers the design of machine components and mechanisms and utilizes the concepts of engineering mechanics and strength of materials.

METC 417 | Advanced Parametric Design and Simulation (5)  
Prerequisites: MENG 217; MATH 162; METC 341 or MENG 241.  
Advanced techniques and best practices for parametric design of parts and assemblies. These advanced methodologies include design simulation and analysis including stress analysis, thermal analysis, flow analysis, vibration and motion studies, and design optimization.

METC 456 | Engineering Ethics, Contracts and Patents (2)  
Cross-listed: TECH 456.  
Prerequisite: junior standing or permission of instructor.  
This course investigates the elements of professional engineering practice including their relationship to the law, to the public and the ethics of the profession. Topics covered range from ethics, contracts, patents, copyrights, sales agreements and engineering specifications to professionalism, licensing, intellectual property, liability, risk, reliability and safety. Further discussion areas involve intellectual property, team tools, codes, standards, professional organizations, careers, entrepreneurship, human factors and industrial design.

METC 468 | Quality Assurance and Intro to Lean (5)  
Prerequisite: PHYS 132 or 152; MATH 162; ENGR 205 or METC 340.  
Course introduces the student to basic quality control and continuous improvement systems. This includes statistical analysis, design of experiments, development and use of process control charts, sampling processes, time and motion studies, and introduction to other Lean tools.

METC 490A | Senior Capstone: Design Laboratory I (2)  
Prerequisite: MATH 162 and senior standing.  
Satisfies: senior capstone university graduation requirement.  
This course simulates the industrial environment, where students work in teams to solve a real world problem from design to implementation. Team dynamics and project constraints are strictly monitored and each student’s unique skills are utilized in different stages of the design process.

METC 490B | Senior Capstone: Design Laboratory II (3)  
Prerequisite: METC 490A.  
Satisfies: senior capstone university graduation requirement.  
See description for METC 490A.

METC 491 | Senior Project (3–10)  
Prerequisite: permission of the instructor.  
Independent and/or group study and implementation of a design and development project. (Variable time)

METC 495 | Internship (1–15)  
Prerequisite: junior or senior status and permission of the instructor.  
This course simulates the industrial environment, where students work in teams to solve a real world problem from design to implementation. Team dynamics and project constraints are strictly monitored and each student’s unique skills are utilized in different stages of the design process.

Technology Courses

Terms offered: check with the department or EagleNET.

TECH 208 | Survey of Electricity (4)  
Prerequisite: pre-university basic skills in mathematics.  
Introduces the student to direct current, alternating current (including residential wiring) and amplifying devices. (Three hours lecture, two hours laboratory per week.)

TECH 235 | Construction Materials and Techniques (5)  
Prerequisite: METC 102, two years of high school drafting or equivalent.  
This course introduces various materials and techniques used in construction. Students gain an understanding of the fundamental principles of structural, physical and long-term performance of some of these materials through lecture and lab experiments. Students also gain an understanding of some of the mechanical and non-mechanical properties of various materials, common construction methods and knowledge of material properties and applications in construction.

TECH 299 | Special Studies (1–6)  
Prerequisite: permission of the instructor, department chair and college dean.  
(Three hours lecture, four hours laboratory per week.)

TECH 301 | Metallographic Processes (5)  
Prerequisite: MATH 105.  
Metallographic Processes is a comprehensive basic course in technical metals which is designed to survey metalworking materials and processes which have been developed by modern industry. The course provides opportunity to learn the theories and scientific principles basic to the application of metalworking tools and procedures. (Three hours lecture, four hours laboratory per week.)
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TECH 393 Technology in World Civilization (4)
Cross-listed: HONS 393.
Prerequisite: ENGL 101.
Satisfies: international studies university graduation requirement.

Students will investigate the issues surrounding technological change in discrete cultural settings with a historical perspective of the evolution of technology in a global context.

TECH 402 Machine Tool I (5)
Prerequisites: METC 110 and TECH 301.
A comprehensive course in machine tool operations, both dimensional and CNC. Course includes turning, cutting operations, precision measurement, set up and CNC programming. (Three hours lecture, four hours laboratory per week.)

TECH 403 Computer-Aided Design and Project Management (4)
Prerequisites: TECH 301 and TECH 402.
The application of spreadsheets to solve engineering problems, technical graphs, trending and curve fitting, the introduction to the use of computer-aided scheduling of projects, critical path planning, project tracking and cost collection. (Three hours lecture, three hours laboratory per week.)

TECH 404 Computer Numerical Control (5)
Prerequisite: TECH 301 and TECH 402.
This course provides the learner with experience utilizing CNC processes. Programming methods will include manual, CAM software and conversational language.

TECH 406 Welding Technology (4)
Prerequisite: TECH 301 or permission of the instructor.
Theory and practice of welding ferrous and nonferrous metals. Practice in oxyacetylene, shielded metal arc and inert gas processes. (Four hours lecture, four hours laboratory per week.)

TECH 430 Machine Tool II (5)
Prerequisites: TECH 301 and TECH 402.
Application and theory in the design, development and function of tooling, dies, molds, jigs and fixtures. Laboratory experiences provide a problem solving approach to development of prototypes in both unit and mass production applications. (Five hours lecture, four hours laboratory per week.)

TECH 452 Engineering Economics (2)
Cross-listed: MATH 106 and permission of the instructor.
Prerequisite: junior standing or permission of instructor.
This course focuses on the systematic evaluation of the economic benefits and costs of projects involving engineering design and analysis. Engineering economics quantifies the benefits and costs associated with engineering projects to determine whether they make (or save) enough money to warrant their capital investment.

TECH 454 Environmental Engineering (2)
Prerequisite: junior standing or permission of the instructor.
This course explores ways to promote the design and manufacturing of environmentally sound products and processes. Benefits include environmentally-friendly products, more efficient operations and the good will of an informed public that expects a clean, healthy environment.

TECH 456 Engineering Ethics, Contracts and Patents (2)
Cross-listed: METC 456.
Prerequisite: junior standing or permission of instructor.
This course investigates the elements of professional engineering practice including their relationship to the law, to the public and the ethics of the profession. Topics covered range from ethics, contracts, patents, copyrights, sales agreements and engineering specifications to professionalism, licensing, intellectual property, liability, risk, reliability and safety. Further discussion areas involve interdisciplinary teams, team tools, codes, standards, professional organizations, careers, entrepreneurship, human factors and industrial design.

TECH 458 Quality Assurance (4)
Prerequisite: junior standing.
Application and theory of quality control systems including development and use of process control charts, sampling, time and motion studies and statistical analysis. (Four hours lecture, one hour laboratory per week.)

TECH 462 Industrial Safety Engineering (4)
Prerequisites:  junior standing or permission of instructor.
Fundamentals of safety, classification of hazards, accident statistics, organization problems, safety codes, machine guarding, mechanical, electrical and chemical hazards, ventilation, respiratory and safety devices. (Four hours lecture per week.)

TECH 490 Senior Capstone: Production Laboratory (4)
Prerequisite: senior standing.
Satisfies: senior capstone university graduation requirement.
The course simulates the real world situation that many of the graduates from the department will face. The student will work in teams to apply techniques of production management, product design/development, plant layout, scheduling, cost accounting, assembly, inspection and quality control to produce a product. The course will simulate a real world design team concept by utilizing a design group that contains members of different program majors. The team, to accomplish its goals, is required to draw on each other’s unique skills learned in stated goal. In industry often a design team is formed to develop a new product. The team is made up of members from different departments in the company. Learning to deal with the team dynamics while learning to take advantage of the synergy that can be gained by a diverse team is a valuable learning process for our business as well as civic life. Each student team is to produce a new product (to be mass produced and demonstrated by producing a minimum quantity of 25 units built with unskilled labor utilizing jigs, fixtures and/or CNC controlled machines) and create a final written report to demonstrate how the process and goals of the course have been realized.

TECH 491 Senior Project (3–10)
Prerequisite: permission of the instructor.
Independent and/or group study and implementation of a design and development project. (Variable time)

TECH 495 Internship (1–15)
Note: May be repeated within the 6 credits allowed to fulfill the student’s goals and needs in specific areas.
Prerequisites: permission of the instructor, department chair and college dean.
A maximum of 5 credits may be earned toward electives for a Technology major. Students considering electives for a Technology minor should consult with their departmental advisor.

TECH 496 Experimental Course (1–6)

TECH 497 Workshops, Short Courses or Conferences (1–6)

TECH 498 Seminar (1–6)

TECH 499 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

TECH 504 Communication Technologies (4)
An accelerated coverage of the theory and applications of communication technologies. Emphasis is on competencies and skills required in business and industry including desktop publishing, computer-assisted image generation and manipulation, data translation and communication and presentation media development used in advertising, proposal writing, presentations and publications.

TECH 508 Designing Web Sites (4)
This course is designed to teach professional methods for designing, producing and publishing web pages and websites. Students will create XHTML and XML based pages, along with still and animated graphics. Emphasis will be on working with clients, planning, developing effective visual and logical designs, optimization for search engines, effective use of color, as well as the technical tools such as code editors, image editors and FTP. Final project involves a live job if possible. Students should discuss options and criteria for the final project with the instructor.

TECH 539 Special Studies in Technology (1–5)

TECH 550 Computer Graphics (4)
Prerequisite: METC 110.
Computer graphics hardware and software with the emphasis on computer-assisted design and graphics layout.

TECH 596 Experimental Course (1–6)

TECH 597 Workshop in Technology (1–6)
Note: may be repeated within the 6 credits allowed to fulfill the student’s goals and needs in specific areas.

TECH 598 Seminar (1–6)

TECH 599 Independent Study (1–6)
Note: may be repeated within the 6 credits allowed to fulfill the student’s goals and needs in specific areas.
Prerequisites: permission of the instructor, department chair and college dean.

TECH 695 Internship (1–6)
Prerequisites: permission of the instructor, department chair and college dean.

TECH 696 College Teaching Internship (1–5)
Prerequisites: permission of the instructor, department chair and college dean.

Teaching a lower-division college course under supervision of a regular faculty member. Includes course planning, arranging bibliographical and instructional aids, conferences with students, experience in classroom instruction and student course evaluation.