ENGINEERING & DESIGN

Martin Weiser, Chair
department page (https://www.ewu.edu/cstem/programs/engineering)
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Faculty

Undergraduate Degrees
Bachelor of Science (BS)


Undergraduate Minors


Undergraduate Programs

Students studying in the Department of Engineering & Design (DESN/EENG/MENG/METC/TECH) may select from a broad number of disciplines that include Electrical Engineering, Mechanical Engineering, Mechanical Engineering Technology, Visual Communication Design, Construction, Design and Manufacturing. The primary goal of the Department of Engineering & Design is to provide students with the technical background required for careers in business and industry. Coursework within each program offers experiences in many areas of engineering and design that enhance the preparation of our graduates.

The Department of Engineering & Design faculty, facilities and equipment reflect a commitment to maintaining program relevance. Computer-assisted drafting and manufacturing, networking, signal processing, microprocessors, power systems, digital communication, electronics, integrated circuits design, graphic design/web design, robotics, thermodynamics, fluid dynamics, heat transfer and materials processing laboratories and a variety of other engineering/engineering technology laboratories are constantly being updated with new equipment. Articulation and research with industry have resulted in programs that address the latest trends in industry. These efforts have consistently offered graduates excellent job placement and employment opportunities.

Engineering & Design Departmental Scholarship Information: The department awards two scholarships annually: the M. W. Consulting Engineering Scholarship and Aaron G. Mertens memorial scholarship. These scholarships are awarded to our majors based on academic qualifications and need.

General Admissions Information for Engineering & Design

Students entering the Bachelor of Science degree in the Engineering programs as juniors should have completed one year of physics as well as most of their mathematics. Failure to complete the mathematics and physics requirements before the junior year likely will delay graduation.

Grade Requirements

In order to graduate, students majoring in the department must earn a GPA ≥2.5 in departmental coursework. Students getting a minor in the department must also earn a GPA ≥2.5 in departmental coursework.

Required courses in the following programs of study may have prerequisites. Reference the course description section for clarification.

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.
Design (DESN)

DESN 100. DRAWING FOR COMMUNICATION. 5 Credits.
This course covers hand-drawing as a design skill. Emphasis is on sketching, design drawing, design process and composition studies for visual presentation and design solutions. Students gain drawing skills such as basics of drawing techniques, basic shapes, light, texture, pattern, gesture and perspective drawing to communicate and present their ideas visually. Students learn and develop critical thinking and creative problem solving skills using the drawing process.

DESN 216. DIGITAL FOUNDATIONS. 4 Credits.
Introduction to media design and digital culture using computer software for the creation and manipulation of images and text, file management, and preparation for print, web or multimedia uses.

DESN 243. TYPOGRAPHY. 4 Credits.
Pre-requisites: DESN 100 and DESN 216.
An introductory-level course concentrating on the fundamentals of typography with emphasis on letterforms, typographic syntax, type specification, type as image and the use of type in a variety of communicative purposes.

DESN 259. HISTORY OF DESIGN. 4 Credits.
This course considers the development of design in the broad sense of the term. Beginning with the Industrial Revolution and continuing forward to the present day, this course explores the components of design that have influenced the direction of design thinking.

DESN 263. VISUAL COMMUNICATION DESIGN 1. 5 Credits.
Notes: In order to receive the Visual Communication Design degree, students must earn ≥3.0 grade in this class, in addition to the department requirement ≥2.5 GPA in all DESN coursework.
Pre-requisites: DESN 100 and DESN 216.
This course provides an introduction to Visual Communication Design including the theories, principles and practices of visual communication, concept development, design process and design technology.

DESN 275. DIGITAL SOUND. 4 Credits.
This course provides a foundation in the techniques of sound design, recording, production and editing for digital media. Students will create and record sound files, apply effects and mix and produce a variety of multimedia audio elements using state-of-the-art digital technology. Applicable uses include websites, games, multimedia products for promotion and learning, entertainment products and virtual worlds.

DESN 300. VISUAL LITERACY. 5 Credits.
Cross listed: CMST 300.
This course helps students develop the set of skills needed to critically interpret images of the past and present and produce images that effectively communicate a message to an audience. This includes an awareness of technology’s role in the creation and dissemination of visual communication along with the role of persuasive strategies to target visual consumers. Students will both analyze and produce rhetorical-visual images and develop the skills needed to manage visual representation in a cultural context.

DESN 325. EMERGENT DESIGN. 4 Credits.
Pre-requisites: DESN 263.
This course explores benefits and risks of new design technologies. Students learn to recognize emergent design technologies and use them to address design problems and explore ways in which new tools reference past paradigms in order to create forward thinking design solutions. Through hands-on, project-based learning, students investigate the possibilities inherent in these new technologies.

DESN 338. PRINCIPLES OF INTERACTION DESIGN. 4 Credits.
Pre-requisites: DESN 368 or concurrent enrollment.
Students investigate principles of interaction design of web enabled devices and differences and similarities between physical interaction and conceptual interaction through the use of metaphor. Exploring relationships between analog and digital frameworks, students become mindful of the overlapping patterns of interaction between the two systems. The five essential principles of interaction design: consistency, visibility, learnability, predictability and feedback are evaluated through the mediums of digital interface, physical object and environment.

DESN 348. RHETORIC OF USER-CENTERED DESIGN. 4 Credits.
Pre-requisites: DESN 338, DESN 378 or concurrent enrollment.
Students examine different rhetorical frameworks that inform software user interface/experience (UI/UE) and content design. Supporting theories, such as visual rhetoric, contextual design, information architecture, gestalt, content strategy, and design ethics, are investigated. Students demonstrate their understanding of theoretical principles by creating and redesigning small UI-related deliverables and by practicing rigorous written analysis and critique.

DESN 350. DIGITAL IMAGING AND PHOTOGRAPHY. 4 Credits.
Pre-requisites: junior standing.
This introductory course teaches beginning photographers how to improve their photographic technique, use digital cameras for effective visual communication and edit images with professional software tools. Working with their own digital cameras students will practice professional shooting strategies and produce weekly practical and creative photo assignments. Topics include camera theory; digital formats; composition basics; composing within the frame; using natural and artificial lighting; texture, shape, form and line in the photograph; framing with foreground elements; digital darkroom techniques; repair and retouching; compositing, portraiture, scenic and nature photography; product photography, action photography and close-up photography.

DESN 351. ADVANCED PHOTOGRAPHY. 4 Credits.
Pre-requisites: DESN 350.
An extension of DESN 350 with considerable work in advanced enlarging techniques portraiture with emphasis on lighting, architectural photography, slidemaking, color transparencies, and color prints.

DESN 355. MOTION DESIGN. 4 Credits.
Pre-requisites: DESN 263.
This course explores the principles of design through motion, with an emphasis on effective use of typography, graphical elements, sound and motion within time and space. Students learn how to import projects, create narrative structures, storyboard, output for various devices and problem solve moving image concerns.

DESN 360. PUBLICATION DESIGN. 4 Credits.
This course covers principles of design, typography, and the use of graphic files, in both print and digital publication. Professional desktop publishing software and common web design software are used. Emphasis is on skills required for basic literacy as well as the effective design of common formats such as brochures, newsletters, books, and web pages.
DESN 363. VISUAL COMMUNICATION DESIGN 2. 5 Credits.
Notes: in order to advance into Visual Communication Design 3, students must earn ≥3.0 grade in this class.
Pre-requisites: DESN 243 and DESN 263 with a grade ≥3.0.
This course focuses on the interaction of type and image in the visual communication design process. An introduction to form and composition will be achieved through a sequence of design projects that emphasize compositional structure. The goal of class projects is the development of complex, cohesive visual systems using traditional production skills, design processes and specialized computer applications.

DESN 366. PRODUCTION DESIGN. 4 Credits.
Pre-requisites: DESN 263.
This course provides students with theory, knowledge and skill of production design for both print and web application. Students gain conceptual understanding and practical skill in areas including color management, print production and web graphics such as banners and videos.

DESN 368. WEB DESIGN 1. 4 Credits.
This course covers professional web design addressing modern technologies, processes and techniques. Students work with current web technologies, while preparing for future web enabled devices, or the progressive enhancement approach. Technologies will include HTML(5) and CSS(2/3).

DESN 374. BRAND THINK AND SERVICE DESIGN. 4 Credits.
Pre-requisites: DESN 363.
This course explores the research and strategies of service design and brand development. Through case study research, students come to understand what constitutes a successful brand solution and how shared community experiences are created.

DESN 375. DIGITAL VIDEO. 4 Credits.
Pre-requisites: DESN 216.
This course provides an introduction to digital video techniques. Students will be introduced to production, editing, theory and practical application for the creation of effective visual communication solutions. Emphasis will be on the creative application of concept and design for the moving image and understanding how to integrate textual, graphical and audio elements for the successful communication of messages created for CD, DVD and the Web.

DESN 378. WEB DESIGN 2. 4 Credits.
Pre-requisites: DESN 368.
This course covers modern user experience (UX) design, rapid prototyping, and modern user interface (UI) patterns. Web programming continues to build upon HTML(5), CSS(2/3), and with the addition of JavaScript frameworks to complement the progressive enhancement process. This course continues the foundations set by DESN 368.

DESN 385. ADVANCED DIGITAL SOUND. 4 Credits.
Pre-requisites: DESN 275.
This course provides in-depth experience in digital sound creation and editing techniques, along with related hardware and software. Topics include live and studio recording techniques, multi-track project recording, mixing and mastering, and the design and creation of sound tracks, including music, to support and enhance typical media productions. Collaborative and individual projects will be required.

DESN 396. EXPERIMENTAL COURSE. 1-5 Credits.
EXPERIMENTAL

DESN 458. USER INTERFACE DESIGN AND PRACTICE. 4 Credits.
Pre-requisites: DESN 378 and DESN 348 and concurrent enrollment in DESN 468.
This course explores the importance of user interface and emphasizes the role visual structure plays in the design of user experiences. Students apply the prototyping process: research, application, testing and iteration to create useful interactions between web enabled designs and end users. Principles and practices of digital typographic presentation to achieve communication goals and objectives are studied.

DESN 463. VISUAL COMMUNICATION DESIGN 3. 5 Credits.
Pre-requisites: DESN 243 and DESN 263 with a grade ≥3.0.
This course continues the study of visual communication design, combining theoretical studies with applied projects. It emphasizes awareness of contemporary visual culture through analysis of a wide range of design examples and continued refinement of perceptual, problem-solving and creative skills. Students employ effective design processes and solutions for issues and topics relevant to contemporary visual communication design practice.

DESN 468. WEB DESIGN 3. 4 Credits.
Pre-requisites: DESN 378.
Web Lab is a project- and team-based course focusing on the design and development of experimental websites and web applications. Students are introduced to responsive web design processes, techniques and technologies. Design addresses the challenges of mobile interactions and evolving mobile devices.

DESN 471. SENIOR EXHIBITION. 1 Credit.
Cross listed: ART 471.
Notes: must be repeated three times for credit.
Pre-requisites: senior standing and declared BFA in VCD major.
This course entails the individual preparation and presentation of work for senior exhibition.

DESN 474. ADVERTISING CONCEPTS. 4 Credits.
Pre-requisites: DESN 363 and DESN 368.
This course covers principles of advertising design, specifically developing advertising concepts. Open to students in visual communication design, journalism and marketing programs.

DESN 480. PROFESSIONAL PRACTICE. 4 Credits.
Pre-requisites: senior standing.
Professional Practice is the study of the visual design industry from both the agency and freelance perspective.

DESN 490. SENIOR CAPSTONE. 4 Credits.
Pre-requisites: senior standing; DESN 243, DESN 363, DESN 368.
Satisfies: senior capstone university graduation requirement.
This course expands on previous visual communication design knowledge and skills and also emphasizes communication, collaboration and presentation skills. In teams, students work on a comprehensive design project for a community partner which emphasizes design research and the design processes that lead to creative conceptualization and final design solutions. Students are expected to demonstrate sophisticated design decisions and appropriate design solutions that show a high level of expertise and achievement.

DESN 491. SENIOR PROJECT. 1-10 Credits.
Notes: graded Pass/Fail.
Pre-requisites: senior standing; permission of the instructor.
Independent and/or group study and production of a design project.
Electrical Engineering Courses

EENG 160. DIGITAL CIRCUITS. 4 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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 Theorem, Thévenin Theorem and transient analysis.

EENG 210. CIRCUIT THEORY II. 5 Credits.
Pre-requisites: EENG 209.
This course covers circuit analysis using Laplace transform, phasors and AC analysis, AC Power, three-phase circuits, magnetically coupled circuits and the ideal transformer.

EENG 250. DIGITAL HARDWARE. 2 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: EENG 320.
Introduction to Laplace Transform, Z-transform, the Fourier Series, the Fourier Transform, the Discrete Fourier Transform (DFT), the Discrete-Time Fourier Transform (DTFT) 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 Credits.
Pre-requisites: CHEM 151 and EENG 210.
This course introduces the characterization, modeling, and application of semiconductor devices in the context of analog integrated circuits. Emphasis is placed on the development of models for circuit-level behavior of diodes, bipolar transistors, and MOS transistors and applies the models to the analysis and design of linear amplifiers.

EENG 331. MICROELECTRONICS II. 5 Credits.
Pre-requisites: EENG 330.
This course is the second in the characterization, modeling and application of semiconductor devices in the context of analog integrated circuits. The emphasis is on the metal-oxide-semiconductor (MOS) transistor. Topics include differential amplifiers, frequency response and feedback effects.

EENG 350. ENERGY SYSTEMS. 5 Credits.
Pre-requisites: 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. 5 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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 application to engineering problems. Topics include analysis of continuous and discrete random signals and systems, as well as modern estimation techniques.
EENG 388. STOCHASTIC PROCESSES LAB. 1 Credit.
Pre-requisites: MATH 163 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 Credits.
Pre-requisites: EENG 210, MATH 241.
This course provides students with the technical basis to analyze
electromagnetic applications systems. Topics include waves and
phasors, vector analysis, electrostatics, magnetostatics, Maxwell's
equations for time-varying fields and plane wave propagation.

EENG 415. INTRODUCTION TO COMPUTER COMMUNICATION NETWORKS. 5 Credits.
Pre-requisites: junior standing.
Fundamentals of data communication, telephone/cellular/computer
networks, layered network architecture, OSI model, data link layer
functions and protocols including ARQ, network layer functions and
protocols including IP, transport layer functions and protocols including
TCP. Basic MATLAB programming experience is necessary for this
course.

EENG 420. DIGITAL SIGNAL PROCESSING. 5 Credits.
Pre-requisites: 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 425. PRINCIPLES OF DIGITAL IMAGE PROCESSING. 5 Credits.
Pre-requisites: EENG 321.
Image representation, color spaces, image filtering and enhancement,
image transforms and image/video coding.

EENG 430. CMOS DIGITAL INTEGRATED CIRCUITS DESIGN. 5 Credits.
Pre-requisites: EENG 160; EENG 331.
This course provides students with the theoretical and practical
knowledge required for analyzing and designing digital integrated
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 435. ANALOG INTEGRATED CIRCUITS DESIGN. 5 Credits.
Pre-requisites: EENG 331.
This course provides students with the theoretical and practical
knowledge required for analyzing and designing analog integrated
circuits and systems in CMOS and BJT technologies. Topics include
operational amplifier design, biasing and reference circuits, stability, and
selected applications of analog circuits (e.g. filters, comparators, data
converters, transceiver blocks).

EENG 440. DIGITAL COMMUNICATION SYSTEMS. 5 Credits.
Pre-requisites: EENG 321, EENG 383.
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 bandpass transmission
of binary data, coherent/noncoherent communications, intersymbol
interference and equalization.

EENG 442. MOBILE COMMUNICATIONS. 5 Credits.
Pre-requisites: EENG 321 and EENG 383.
This course covers antennas and propagation, signal encoding
techniques; spread spectrum, coding and error control, cellular and
wireless control.

EENG 450. POWER SYSTEMS ANALYSIS. 5 Credits.
Pre-requisites: EENG 350.
The course provides students with the ability to analyze power systems
from technical and economic perspectives. It includes symmetrical
components, calculation of line parameters, power flow control,
representation of transmission lines and power components.

EENG 452. PROTECTIVE RELAYS. 5 Credits.
Pre-requisites: EENG 450.
This course provides students with the technical basis to analyze
design protection for power systems. Topics include per unit and
phasors, symmetrical components, relay input sources, protection
fundamentals, system grounding principles and protection of power
system components.

EENG 460. COMPUTING SYSTEMS: ORGANIZATION AND DESIGN. 5 Credits.
Pre-requisites: CSCD 255, EENG 360.
This course provides the theoretical and practical knowledge required
for analyzing and designing complex computing systems. Topics
include computer performance, MIPS assembly language, integer and
floating point arithmetic, designing a processor, pipelining and memory
hierarchies. Assembly programming and design using VHDL are offered
in weekly labs.

EENG 461. EMBEDDED SYSTEM DESIGNS. 5 Credits.
Pre-requisites: 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 to 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 Credits.
Pre-requisites: 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 explained within
the context of state-space system models. Analysis and design of
proportional, integral, and derivative (PID), PI and PD controllers are
presented.

EENG 471. DIGITAL CONTROL SYSTEMS. 5 Credits.
Pre-requisites: EENG 470.
This course provides students with the technical basis to understand
and analyze digital control systems. Topics include frequency response,
modeling digital control systems, steady-state error, stability, Z-domain
design and state-space models. An introduction to Lyapunov techniques
is presented.
EENG 490A. SR CAPSTONE: DESIGN LAB I. 2 Credits.
Pre-requisites: 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 civic lives of the students.

EENG 490B. SR CAPSTONE: DESIGN LAB II. 3 Credits.
Pre-requisites: EENG 490A.
Satisfies: senior capstone university graduation requirement.
See course description for EENG 490A.

EENG 491. SENIOR PROJECT. 1-6 Credits.
Pre-requisites: permission of instructor.
Independent and/or group study and implementation of a design and development project. (variable time)

EENG 495. INTERNSHIP. 1-6 Credits.
Notes: graded Pass/Fail.
Pre-requisites: junior or senior status and permission of the instructor, department chair and dean.

EENG 496. EXPERIMENTAL COURSE. 1-5 Credits.

EENG 498. SEMINAR. 1-6 Credits.
Seminar.

EENG 499. DIRECTED STUDY. 1-10 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.
Designed for students wanting to pursue a subject beyond the scope of regular courses.

EENG 599. INDEPENDENT STUDY. 1-5 Credits.
Independent Study.

Mechanical Engineering Courses

MENG 199. DIRECTED STUDY. 1-5 Credits.
Directed Study

MENG 201. MATLAB. 4 Credits.
Pre-requisites: MATH 141.
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 calculations, numeric computations and other basic skills related to MATLAB.

MENG 207. ELECTRICITY. 4 Credits.
Pre-requisites: MATH 162, PHYS 153 or PHYS 133.
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 Credits.
Pre-requisites: METC 110 or High School AUTOCAD or permission of instructor
This course uses the 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 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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.

MENG 353. INDUSTRIAL MATERIALS. 5 Credits.
Pre-requisites: CHEM 121 or CHEM 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 image analysis of microscopic structure of industrial materials.

MENG 380. THERMODYNAMICS. 5 Credits.
Pre-requisites: PHYS 152; MATH 162; ENGR 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 Credits.
Pre-requisites: PHYS 153 or PHYS 133, MATH 162.
This course examines the different aspects of laboratory analysis and report writing. This includes description 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 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: 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. (3 hours lecture, 4 hours laboratory per week)

MENG 386. ENGINEERING NUMERICAL ANALYSIS. 5 Credits.
Pre-requisites: PHYS 153; MATH 163; and either MENG 201 or CSCD 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 398. SEMINAR. 1-5 Credits.
Seminar

MENG 399. DIRECTED STUDY. 1-5 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.

MENG 405. DESIGN OF MACHINE ELEMENTS. 5 Credits.
Pre-requisites: MATH 162, MENG 241, MENG 353.
This course covers the design of machine components and mechanisms and utilizes the concepts of engineering mechanics and strength of materials.

MENG 407. HVAC. 5 Credits.
Pre-requisites: 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 Credits.
Pre-requisites: senior standing in ME, MET, CET or EE; 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 Credits.
Pre-requisites: MATH 241, MATH 347, MENG 380, MENG 381 (MENG 381 may be taken concurrently), and MENG 386.
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 Credits.
Pre-requisites: 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 453. MATERIALS AND DESIGN. 5 Credits.
Pre-requisites: MENG 241, MENG 353.
This course expands upon the concepts covered in the Industrial Materials class. Focus is on how materials and the design of products and the processes to make them are interrelated. Students explore processing and properties of materials such as glass, ceramics, polymers and metals other than steel.

MENG 455. COMPOSITE MATERIALS. 5 Credits.
Pre-requisites: MENG 201, MENG 353.
This course covers basics of composite materials including manufacturing, design and applications. Students learn anisotropic and heterogeneous material systems; types of composite constituents; physical and mechanical properties; micro, macro and ply mechanics; composite design related to strength and different failure modes; and applications of composite beams, plates and stiffened panels.

MENG 482. ADVANCED FLUID DYNAMICS. 5 Credits.
Pre-requisites: MATH 347, MENG 217, MENG 382.
Students apply fluid principles to various technical situations and utilize advanced methods to derive a solution. Topics covered may include Computational Fluid Dynamics (CFD), turbo machinery, compressible fluid flow, turbulence, thermo-fluid system design, and fan and pump performance.

MENG 485. ADVANCED ROBOTICS AND AUTOMATION. 5 Credits.
Pre-requisites: MENG 385.
A study of the various electrical and mechanical systems used in advanced robotics and other automated systems. Topics include automated equipment, programming and industrial planning as applied to automated systems, robotic vision, cooperative robotics and service robots.

MENG 486. PROGRAMMABLE LOGIC CONTROLLERS IN AUTOMATION. 5 Credits.
Pre-requisites: MENG 385.
A study of Programmable Logic Controllers used in industrial automation and advanced robotics. Course explores automated equipment, ladder logic programming and industrial planning as applied to automated systems.

MENG 487. SENSORS THEORY FOR AUTOMATION. 5 Credits.
Pre-requisites: MENG 385.
This course introduces the common sensors used in robotics and automation, including the theory of how sensors work, the circuitry involved and the programming logic for input/output.

MENG 490A. SENIOR CAPSTONE: DESIGN LABORATORY I. 2 Credits.
Pre-requisites: MENG 217, MENG 241, TECH 301 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 Credits.
Pre-requisites: MENG 490A.
Satisfies: senior capstone university graduation requirement.
See description for MENG 490A.

MENG 491. SENIOR THESIS. 1-6 Credits.
Pre-requisites: permission of instructor.
Independent and/or group study and implementation of a design and development project. (variable time)

MENG 492. FINITE ELEMENT ANALYSIS. 5 Credits.
Pre-requisites: MATH 347, MENG 217, MENG 241.
This course introduces the 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 Credit.
Notes: graded Pass/Fail.
Pre-requisites: senior standing or permission of instructor.
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 Credits.
Notes: graded Pass/Fail.
Pre-requisites: junior or senior status and permission of the instructor, department chair and dean.

Eastern Washington University
MENG 496. EXPERIMENTAL COURSE. 1-10 Credits.
MENG 499. DIRECTED STUDY. 1-10 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.
Designed for students wanting to pursue a subject beyond the scope of regular courses.

## Mechanical Engineering Technology Courses

**METC 102. INTRODUCTION TO ENGINEERING GRAPHICS. 4 Credits.**
Notes: 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 Credits.**
Pre-requisites: 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 Credits.**
Pre-requisites: PHYS 131 and MATH 142 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 Credits.**
Pre-requisites: 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 Credits.**
Pre-requisites: 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 Credits.**
Pre-requisites: 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 explore the creation of industrial energy audits through the extensive use of case studies.

**METC 387. FLUID MECHANICS. 5 Credits.**
Pre-requisites: PHYS 132 or PHYS 152, MATH 162; TCOM 205 or 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.

**METC 388. THERMODYNAMICS AND HEAT TRANSFER. 5 Credits.**
Pre-requisites: PHYS 132 or 152; MATH 162; TCOM 205 or MENG 381 (may be taken concurrently).
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 Credits.**
Pre-requisites: 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. 5 Credits.**
Pre-requisites: 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 Credits.**
Pre-requisites: 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.

**METC 468. QUALITY ASSURANCE AND INTRO TO LEAN. 5 Credits.**
Pre-requisites: PHYS 132 or PHYS 152; MATH 162; TCOM 205 or MENG 381 (may be taken concurrently). Application and theory of 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 Credits.**
Pre-requisites: MENG 217, MATH 162, METC 341 (may be taken concurrently), TECH 301 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 Credits.**
Pre-requisites: METC 490A.
Satisfies: senior capstone university graduation requirement.
See description for METC 490A.

**METC 491. SENIOR PROJECT. 3-10 Credits.**
Pre-requisites: permission of the instructor.
Independent and/or group study and implementation of a design and development project. (variable time)
TECH 317. COMPUTER-AIDED DRAFTING. 4 Credits.
Using the computer to draft mechanical, electrical, and architectural drawings in 2- and 3-dimensions. File management methods, job management methods, and macro development techniques are discussed. (3 hours lecture, 3 hours laboratory per week)

TECH 320. NON-METALLIC PROCESSES. 5 Credits.
Pre-requisites: METC 110, junior/senior status or permission of instructor.
Survey of non-metallic materials (such as woods, plastics, and ceramics) and the industrial processes utilized to convert raw materials into finished products. Course includes characteristics and properties of non-metallic materials and utilization of industrial tools and processing equipment.

TECH 330. TECHNOLOGY PROBLEM ANALYSIS AND DESIGN I. 4 Credits.
Pre-requisites: junior standing or permission of the instructor.
Development of advanced skills in technical problem analysis, planning, research, solution strategies, critical thinking and presentation.
Computer-aided design tools such as CAD, project-planning software, spreadsheets, as well as imaging and publishing software are used. Emphasis is on consideration of interconnected systems.

TECH 335. ARCHITECTURE. 4 Credits.
Pre-requisites: METC 110.
Design, layout, and development of residential dwellings and large structures. (4 hour lecture per week)

TECH 345. SOILS/SURVEYING. 4 Credits.
Pre-requisites: TECH 335.
This course introduces soil mechanics and site surveying. Through lecture and field work the course examines characteristics and compositions of soil, soil classification systems and the strength of soil masses. Students practice fundamentals of construction surveying, including taping, leveling, angular measurement, traversing, topographic surveying, building layout and grade staking.

TECH 354. BUILDING CODES. 4 Credits.
Pre-requisites: TECH 335.
Building Codes is a comprehensive course pertaining to International Building Codes (IBC). Emphasis is placed on code requirements for both commercial and residential applications to include structural, mechanical, plumbing, fire, fuel gas and private sewage code requirements.

TECH 393. TECHNOLOGY WORLD CIVILIZATION. 4 Credits.
Cross listed: HONS 393.
Pre-requisites: ENGL 101.
Satisfies: internation 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 395. CO-OP FIELDWORK. 1-5 Credits.

TECH 396. EXPERIMENTAL COURSE. 1-6 Credits.

TECH 397. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-5 Credits.

TECH 398. SEMINAR. 4 Credits.

TECH 402. MACHINE TOOL I. 5 Credits.
Pre-requisites: TECH 301.
A comprehensive course in machine tool operations, both conventional and CNC. Course includes cutting operations, precision measurement, set up, and CNC programming. (3 hours lecture, 4 hours laboratory per week)
TECH 403. COMPUTER-AIDED DESIGN AND PROJECT MANAGEMENT. 4 Credits.
Pre-requisites: MATH 107 or permission of the instructor.
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.

TECH 404. COMPUTER NUMERICAL CONTROL. 5 Credits.
Pre-requisites: TECH 301 and TECH 402.
This course provides the learner with experience utilizing CNC processes. Programming methods will include manual, CAM software and conversational languages.

TECH 406. WELDING TECHNOLOGY. 4 Credits.
Pre-requisites: TECH 301 or permission of the instructor.
Theory and practice of welding ferrous and non-ferrous metals. Practice in oxyacetylene, shielded metal arc and inert gas processes. (4 hours lecture, 4 hours laboratory per week)

TECH 430. MACHINE TOOL II. 5 Credits.
Pre-requisites: 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. (5 hours lecture, 4 hours laboratory per week)

TECH 452. ENGINEERING ECONOMICS. 4 Credits.
Pre-requisites: junior standing or permission of the 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. 4 Credits.
Pre-requisites: 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. 4 Credits.
Pre-requisites: junior standing or permission of the 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.

TECH 458. QUALITY ASSURANCE. 4 Credits.
Pre-requisites: 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. (4 hours lecture, 1 hour laboratory per week)

TECH 462. INDUSTRIAL SAFETY ENGINEERING. 4 Credits.
Fundamentals of safety, classification of hazards, accident statistics, organization problems, safety codes, machine guarding, mechanical, electrical and chemical hazards, ventilation, respiratory and safety devices. (4 hours lecture per week)

TECH 490. SENIOR CAPSTONE: PRODUCTION LAB. 4 Credits.
Pre-requisites: 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 students 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 massed 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 Credits.
Pre-requisites: permission of the instructor.
Independent and/or group study and implementation of a design and development project. (variable time)

TECH 495. INTERNSHIP. 1-15 Credits.
Notes: graded Pass/Fail.
Pre-requisites: junior or senior status and permission of the instructor, department chair and 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 Credits.

TECH 497. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-6 Credits.
TECH 498. SEMINAR. 1-6 Credits.
TECH 499. DIRECTED STUDY. 1-5 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.
Designed for students wanting to pursue a subject beyond the scope of regular courses.

TECH 504. COMMUNICATION TECHNOLOGIES. 4 Credits.
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 Credits.
Notes: offered fall.
This course is designed to teach professional methods of designing, producing, and publishing web pages and web sites. 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 oas well as the technical tools such as code editors, image iditor, and FTP. Final project involves a live job if possible. Students should discuss options and criteria for the final project with instructor.
TECH 539. SPECIAL STUDIES TECHNOLOGY. 1-5 Credits.

TECH 550. COMPUTER GRAPHICS. 4 Credits.
Pre-requisites: METC 110.
Computer graphics hardware and software with the emphasis on computer-assisted design and graphics layout.

TECH 595. INTERNSHIP. 1-5 Credits.

TECH 596. EXPERIMENTAL COURSE. 1-6 Credits.

TECH 597. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-6 Credits.
Notes: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

TECH 598. SEMINAR. 1-6 Credits.

TECH 599. INDEPENDENT STUDY. 1-6 Credits.
Notes: may be repeated within the 6 credits allowed to fulfill the student’s goals and needs in specific areas.
Pre-requisites: permission of the instructor, department chair and college dean.

TECH 600. THESIS. 2-6 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.
Independent research study under the direction of a graduate adviser committee.

TECH 601. RESEARCH REPORT. 2-6 Credits.

TECH 695. INTERNSHIP. 1-6 Credits.
Pre-requisites: permission of the instructor, department chair and college dean.

TECH 696. COLLEGE TEACHING INTERNSHIP. 1-5 Credits.
Pre-requisites: 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.