

APPLIED ENGINEERING, SAFETY & TECHNOLOGY

The Department of Applied Engineering, Safety & Technology (AEST) offers nationally accredited programs of study leading to an A.T. in applied engineering and technology or a B.S. in applied engineering and technology management, a B.S. in occupational safety and environmental health, a B.S. in automation & intelligent robotics, a B.S. in manufacturing engineering technology, and a B.S.Ed. in Technology Education. Minors are offered in applied engineering and technology, and occupational safety and environmental health. A post-baccalaureate technology education teacher certification program is also offered.

Students may participate in the activities of the Technology & Engineering Education Collegiate Association; Association of Technology, Management and Applied Engineering (Robotics Club); Society of Manufacturing Engineers; American Society of Safety Professionals; Submersible Research Team; Construction Club and Marauder Graphics Club. An invitation to join Epsilon Pi Tau, the international honor society for professions in technology, may also be extended to department majors who excel.

Qualified department majors pursuing a bachelor's degree may earn departmental honors by proposing, conducting and defending thesis research. Eligibility for graduation with AEST departmental honors includes having a minimum CGPA of 3.0 overall, with 3.35 in the major, and a grade of B or higher on an honors thesis. Contact the department chairperson for guidelines and an enrollment application to participate in the department's honors program.

the programs

- Advanced Manufacturing Technology Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/advanced-manufacturing-minor/>)
- Applied Engineering & Technology Management, B.S. - Computer-Aided Drafting & Design Concentration (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-management-bs-computer-aided-drafting-design-concentration/>)
- Applied Engineering & Technology Management, B.S. - Construction Management (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-management-bs-construction-management/>)
- Applied Engineering & Technology Management, B.S. - General Technology (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-management-bs-general-technology/>)
- Applied Engineering & Technology Management, B.S. - Graphic & Packaging Technologies Concentration (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-management-bs-graphic-packaging-technologies-concentration/>)
- Applied Engineering & Technology, A.T. - Computer Aided Draft/Design (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-cadd/>)
- Applied Engineering & Technology, A.T.- Advanced Manufacturing Technology (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-manufacturing-technology/>)
- Applied Engineering & Technology, A.T.- Construction Technology (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-construction-technology/>)
- Applied Engineering & Technology, A.T.- Control Systems Technology (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-electronics-control-systems/>)
- Applied Engineering & Technology, A.T.- Graphics Communication Technology (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-graphic-communication-technology/>)
- Applied Engineering & Technology, A.T.- Occupational Safety and Environmental Health (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-at-occupational-safety-environmental-health/>)
- Automation and Robotics Engineering Technology, B.S. (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/automation-robotics-engineering-technology-bs/>)
- Computer Aided Drafting/Design Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/cadd-minor/>)
- Construction Technology Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/construction-technology-minor/>)
- Control Systems Technology Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/control-systems-technology-minor/>)
- General Technology Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-minor-general-applied-engineering-technology-concentration/>)
- Graphic Communication Technology Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/applied-engineering-technology-minor-graphic-communication-concentration/>)
- Integrative STEM Education Methods Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/integrative-stem-education-methods-minor/>)
- Manufacturing Engineering Technology, B.S. (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/manufacturing-engineering-technology-bs/>)
- Occupational Safety & Environmental Health Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/occupational-safety-minor/>)
- Occupational Safety & Environmental Health, B.S. (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/occupational-safety-environmental-health-bs/>)
- Technology & Engineering Education (K-12), B.S.Ed. (<https://catalog.millersville.edu/undergraduate/college-science-technology/>)

applied-engineering-safety-technology/technology--engineering-education-based/)

- Technology & Engineering Education Minor (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/technology-engineering-education-minor/>)
- Technology & Engineering Education, B.S.Ed. - Engineering Design Education Concentration (<https://catalog.millersville.edu/undergraduate/college-science-technology/applied-engineering-safety-technology/technology-engineering-education-based-engineering-design-education-concentration/>)

the faculty

Bowers, Betty-Jo; Associate Professor

College of Science and Technology

B.S., The Pennsylvania State University, 1995; M.B.A., Ibid., 1998; Ph.D., Alvernia University, 2016

Brusic, Sharon; Professor

College of Science and Technology

B.S., Illinois State University, 1981; M.S., Eastern Illinois University, 1982; Ed.D., Virginia Polytechnic Institute and State University, 1991

English, Cindy; Assistant Professor

College of Science and Technology

B.S., Bemidji State University, 1988; B.S., Pennsylvania College of Technology, 1988, M.F.A., Marywood University, 1999

Haughery, John; Assistant Professor

College of Science and Technology

B.S., Millersville University, 2006; M.S., Morehead State University, 2014; Ph.D., Iowa State University, 2017

Johnson, Alex; Associate Professor

College of Science and Technology

B.S., University of North Dakota, 2000; M.S., Ibid., 2001; Ph.D., Ibid., 2010

Khalighi, Mehdi; Associate Professor

College of Science and Technology

B.S., Iran University of Science and Technology (Tehran); M.S., University of Utah, 1994; Ph.D., Ibid., 2001

Litowitz, Leonard; Professor

College of Science and Technology

B.S., Montclair State College, 1982; M.Ed., Bowling Green State University, 1983; Ed.D., University of Minnesota, 1986

Ogutu, Jack; Professor

College of Science and Technology

B.S., University of Nairobi (Kenya), 2004; M.S., Auburn University, 2011; Ph.D., Ibid., 2013

Painter, Donna; Associate Professor

College of Science and Technology

B.S., California University of Pennsylvania, 1988; M.Ed., Seton Hall University, 2005

Snyder, Mark; Professor

College of Science and Technology

B.S.Ed., Millersville University, 1984; M.A., Eastern Michigan University, 1985; Ed.D., Virginia Polytechnic Institute and State University, 1992

Warner, Scott; Professor

College of Science and Technology

B.S., Millersville University, 1985; M.A., Ball State University; D.Ed., West Virginia University, 2000

Wright, John; Professor

College of Science and Technology

B.S.I.T., Central Connecticut State University, 1993; M.S., Ibid., 1996; Ph.D., Iowa State University 1998

the courses

AENG 101: 3 s.h.

Introduction to Engineering (G2)

This course engages learners in using scientific and mathematical reasoning to explore and engage in engineering design, covers the fundamentals of the engineering design process, and exposes students to a wide range of career paths available to engineers, including engineering, applied engineering, and engineering technology areas. In this course, students will follow the creativity-based engineering design process through laboratory-based activities. Students will design and manufacture physical artifacts to meet a specific engineering challenge, and must defend their decisions with scientific and mathematical reasoning. This course focuses on how engineers apply their creativity, resourcefulness, mathematical, scientific and technical knowledge and skills in the creation or refinement of technological products/systems.

AENG 110: 3 s.h.

Communication and Information Systems

Communication technology to design, compose, send, receive and understand ideas and information. Emphasis on graphic and electronic media. Experiences with graphic design, graphic reproduction, desktop publishing, web-page development, photography, and digital video and audio. 2 hrs. lec., 3 hrs. lab.

AENG 120: 3 s.h.

Energy Systems

An introduction to energy and power systems. Principles of conventional and alternative energy resources and energy conservation, and electrical, fluid, and mechanical power will be studied along with environmental concerns associated with power production. 2 hours lecture, 3 hours lab.

AENG 130: 3 s.h.

Production Materials & Processes

The integration and interrelationships of materials and processes for construction and manufacturing, including the application of math and scientific principles and the technological impacts on industry and society. Requires experiences in materials processing and production tooling. 2 hrs. lec., 3 hrs lab.

AENG 140: 3 s.h.

Bio-related Technologies

Agriculture, medicine and other technologies in which living organisms are used to solve problems and modify products and systems. Includes problem solving, design and research activities for understanding biorelated technologies, issues and impacts. 2 hrs. lec., 3 hrs. lab. Reserved for EDTE majors.

AENG 179: 3 s.h.

Experimental

Experimental

AENG 241: 3 s.h.**Drafting Communications**

Introductory technical sketching, conventional drafting and computer-aided drafting (CAD). Experiences with equipment use and care, lettering, geometric constructions, multiview projection, dimensioning, sectioning and pictorial representation. 2 hrs. lec., 3 hrs. lab.

AENG 243: 3 s.h.**Technical Sketching, Design & Rendering**

Freehand sketching and basic elements of two-dimensional design and rendering. Various sketching and shading techniques are developed. Elements and principles of design, methods of designing, and evaluation and design of products are included. An application software is used to render design sketches. 2 hrs. lec., 3 hrs. lab.

AENG 251: 3 s.h.**Print Media Systems**

Contemporary resources, processes and impacts of graphic reproduction. Emphasis on workflows relative to offset lithography, flexography, gravure, digital printing and screen printing. Covers graphic design; digital-image composition; digital photography; scanning; prepress, press and postpress production. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 110 or ART 244 or COMM 201 or by permission.

AENG 252: 3 s.h.**Web Publishing Systems**

Planning, creating, and publishing of web media. Topics include information design, optimization of graphic and audio files, navigation systems and website technologies. Multimedia authoring software will be utilized to produce and publish websites that include digital animations and interactive forms. 2 hrs. lec., 3 hrs. lab. Prereq: AENG 110, DESN 201 or permission of instructor.

AENG 258: 3 s.h.**Package Engineering Fundamentals**

An introduction to the packaging industry with an emphasis on package design and engineering. Includes a study of materials used in packaging and an introduction to the purposes and requirements of packaging. Laboratory activities include the structural design of package components using software. Prereq: AENG 251.

AENG 261: 3 s.h.**Electronic Systems**

Survey of electricity and electronics, including typical direct current and alternating current applications, safe practices and technological impacts. Experiences include breadboarding, design and problem solving, use of test equipment and electronic project assembly/troubleshooting. 2 hrs. lec., 3 hrs. lab.

AENG 261H: 3 s.h.**H:Electronic Systems****AENG 262: 3 s.h.****Semiconductor Electronics**

In-depth study of semiconductor theory, including diodes, transistors and silicon-controlled rectifiers. Emphasizes digital, linear and hybrid integrated circuits. Covers surface mount and emerging technologies, such as nanotechnology and biotechnology. Practical applications include prototyping circuits, design and problem solving, use of test equipment and troubleshooting. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 261 or permission of instructor.

AENG 271: 3 s.h.**Processing Nonmetallic Materials**

Various nonmetallic materials, processes, products and impacts, including polymers, ceramics, wood, clay, composites and glass. Instruction and experiences provided on safety and the use of tools and machines associated with nonmetallics. Includes production activities in each of the specified nonmetallic material areas. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 130.

AENG 279: 3 s.h.**Experimental**

ITEC 279

AENG 281: 3 s.h.**Processing Metallic Materials**

Examination of metallic materials, including their structures, properties and the processes used to convert them into products. Particular attention is paid to the relationship between microstructural characteristics, physical and mechanical properties and production methods. Connections are made between the properties of metals and their applications. Laboratory experiences include manual and automated production techniques, conditioning processes and characterization methods to quantify process-property-performance relationships. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 130.

AENG 300: 3-12 s.h.**Co-Op Ed Experience in AENG**

Co-Op Ed Experience in AENG

AENG 301: 3 s.h.**Technology and Humans (P)**

Analysis of the development of technology and its impact on humans and a realization of the importance of human technological behavior on the environment, social/cultural systems and the future. Students use analytical skills on a written independent research project and oral skills to present and defend positions on technological problems facing our society. Prereq: COMM 100, ENGL 110 and junior class standing.

AENG 301H: 3 s.h.**Hnrs:Technology and Humans (P)**

Hnrs:Technology and Humans

AENG 302: 3 s.h.**Futurology (P)**

A nontechnical interdisciplinary course to help students identify and analyze forces causing technological and social change. Using an understanding of the processes of technological and social change and research techniques for forecasting the future, students complete a written independent research project. Develops skills to project future technological and social developments and their impacts. Prereq: COMM 100, ENGL 110 and junior class standing.

AENG 302H: 3 s.h.**H: Futurology (P)****AENG 303: 3 s.h.****Tech Assessmnt:Amish and Othrs (D, P)**

A nontechnical course designed for all students to help learners analyze the use of technology, with focus on Anabaptists (particularly Amish, Old Order Mennonites and certain Brethren groups) of Lancaster County. Contrasting the way these groups assess and use technology with that of their own culture will allow students to better understand their own approach to technology. Students will develop their own technology-assessment system based on independent research. Prereq: COMM 100, ENGL 110 and junior class standing.

AENG 303H: 3 s.h.**Hon:** Tech Assessment: Amish/Others (D, P)**AENG 304: 3 s.h.****Energy, Sustainability (P)**

A non-technical course for all students dealing with energy sustainability, energy resources and conservation, and the effects of energy use on our environment. This course contains up-to-date information on essential subjects such as solar energy, wind energy, nuclear energy and energy conservation. Contemporary alternatives such as photovoltaic electricity and wind power generation will be addressed. Individual transportation to field sites is required (discuss with instructor before registering for class if this is an issue). Prereq: COMM 100, ENGL 110, MATH 100 or higher and Junior class standing.

AENG 304H: 3 s.h.**Hon:** Energy, Sustainability (P)**AENG 322: 3 s.h.****Transportation**

Includes the application of scientific and mathematical principles to the solution of land, air, space, and/or water transportation challenges. Incorporates the investigation of a variety of robotics and control systems with emphasis on computational thinking. 2 hours lecture, 3 hours lab. Prerequisites: ITEC 120, ITEC 261, Math 100 or higher

AENG 325: 3 s.h.**Power Conversion and Control**

Electric motors as conversion devices explored. Experiences include designing, creating and testing fluid and electrical energy conversion circuitry to perform specific control applications. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 120 or 261.

AENG 326: 3 s.h.**Fluid Power**

Investigation of scientific, mathematical and technological principles. Experiences with the design, creation, use and repair of hydraulic and pneumatic systems. A research and development activity required. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 120 or 325.

AENG 326H: 3 s.h.**Hon:** Fluid Power**AENG 327: 3 s.h.****Engineering Structures**

Students will design, construct, and evaluate model structures. Emphasis is placed on the use of science, technology, engineering, and mathematical (STEM) principles as they relate to structures. 2 hours lecture, 3 hours lab. Prerequisites: ITEC 120, 130, 241, and Math 100 or higher.

AENG 331: 3 s.h.**Construction Technology 1**

Utilization of materials for the construction of residential and light commercial structures. Includes the effects of these changes on people and their environment. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 271 or permission of instructor.

AENG 332: 3 s.h.**Construction Technology 2**

Methods, materials and processes employed in heavy and industrial construction technologies. Includes field-engineering techniques, equipment, civil engineering fundamentals and use of modeling and simulation techniques. Emphasis given to construction projects such as bridges, roads, industrial and commercial buildings, utilities, tunnels and dams. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 271 or permission of instructor.

AENG 342: 3 s.h.**Computer-Aided Engineering Drawing**

Advanced study of threads, gears and standard fasteners; geometric dimensioning and tolerancing (GD&T); schematic, production and assembly drawings; and introduction to solids modeling. Builds on view orientation, projection systems and basic CAD. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 241.

AENG 342H: 3 s.h.**Hon:** Cmptr-Aided Engineering Dr**AENG 344: 3 s.h.****Product Design**

An exploration of the thinking processes, problem solving strategies, documentation techniques, and making skills used by designers toward creating new products. The use of the elements and principles of design, aesthetics, ergonomics, and social/cultural considerations as tools toward designing for manufacture, designing for sustainability, and universal design are emphasized. Other topics explored include the role of human emotion toward design and design's influence on human history.

AENG 344H: 3 s.h.**Hnrs:** Product Design**AENG 345: 3 s.h.****Statics/Strength of Materials**

Elementary, analytical and practical approaches to the principles and physical concepts of statics. Covers force systems; equivalent force/moment systems; distributed forces; internal forces; principles of equilibrium; application to trusses, frames and beams; stress and strain; and mechanical properties of materials. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 241 and MATH 151, 160 or 161; or permission of instructor.

AENG 346: 3 s.h.**Architectural Drawing**

Study of principles of residential design and architectural styles with an emphasis on the development of a complete set of original working and presentation drawings using computer-aided design (CAD) and Building Information Modeling (BIM). 2 hours lecture, 3 hours lab. Prerequisite: ITEC 241.

AENG 347: 3 s.h.**Engineering Visualization**

Students study the relationships of three-dimensional lines, angles, surfaces, and solids by projecting three-dimensional reality onto a two-dimensional surface such as a computer screen. The students gain the necessary tools and principles to graphically visualize, manipulate, and solve engineering and architectural design problems. Traditionally these problems were solved by doing mathematical calculations. In contrast, this class uses descriptive geometry to solve three-dimensional spatial problems graphically. The computer is used as the main drafting tool. Engineering visualization extends beyond the principles of descriptive geometry. Students use visualization techniques and spatial reasoning to solve fundamental engineering concepts and related problems, represent their design proposals, view the 3D environment from any angle using a flying camera, and support their spatial, numeric, algebraic and quantitative thinking. 2 hrs. lec., 3 hours lab. Prereq: ITEC 241.

AENG 348: 3 s.h.**Green Building and Sustainable Systems**

This course covers fundamentals of green buildings and sustainable energy technologies and their dynamic costs and benefits. Green buildings are designed and constructed to maximize the energy efficiency of the envelope and provide superior quality in the indoor environment. This course allows students to explore the integration of design principles and application of renewable energy, natural building materials, and ecological landscape into building design and community development. Pre-requisite: MATH 130 and ITEC 241

AENG 351: 3 s.h.**Digital Imaging**

Create digital images using cameras and scanners. Set up and characterize a digital workstation and produce digitally imaged products. Hands-on activities will require students to demonstrate their proficiency using contemporary hardware and software to compose, capture, convert, color and tonal correct, manipulate and print digital images and products. 2 hrs. lec., 3 hrs. lab. Offered annually.

AENG 355: 3 s.h.**Contemporary Printing**

Advanced study of today's major printing processes, especially offset and screen. Experiences include layout and design, computerized electronic composition, copy preparation, line and halftone photography, special-effects photography, exposure unit calibration, image assembly, platemaking, printing and finishing complex graphic products. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 251.

AENG 356: 3 s.h.**Desktop Publishing (W)**

Utilization of desktop microcomputer systems to design, compose and publish graphic materials. A research and development activity required. 2 hrs. lec., 3 hrs. lab. Prereq: ENGL 110.

AENG 357: 3 s.h.**Packaging Specialty Printing**

In-depth study of problems and processes related to printing and converting in package, label and specialty printing. Students study and experience package design structures, materials flexographic printing, screen container printing, converting methods and bar code applications. Current industry practices explored. 2 hrs. lec., 3 hrs. lab. Prereq: AENG 241, 251, and 258; or DESN 348.

AENG 357H: 3 s.h.**Hon: Packaging Spec Prnting****AENG 364: 3 s.h.****Digital Electronics**

Practical applications of digital logic for processing electronically encoded information. Covers numbering systems, logic design, basic gates, sequential and combination logic, and digital troubleshooting. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 262 or permission of instructor.

AENG 364H: 3 s.h.**Hon: Digital Electronics****AENG 375: 3 s.h.****Polymer and Ceramic Technology**

Design, development and production of polymer and ceramic products. Covers contemporary pattern and molding materials along with industrial forming processes. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 271.

AENG 376: 3 s.h.**Woodworking Technology**

Use of hand tools and machine woodworking techniques to fabricate wood products. Covers technological problems and contributions of using wood in daily living. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 271.

AENG 379: 3 s.h.**Experimental**

Experimental

AENG 382: 3 s.h.**Automated Manufacturing**

A comprehensive experience in the design, programming and implementation of computer-controlled manufacturing processes. Emphasis is placed on understanding machine code, utilizing computer-aided design and manufacturing (CAD/CAM) software and identifying proper process controls to increase productivity and reduce cost. Laboratory experiences develop a combination of software and hardware competencies. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 130; and ITEC 241; and ITEC 271 OR 281 OR 342; or permission of instructor.

AENG 392: 3 s.h.**Intro to Industrial Training (W)**

Techniques and procedures required to conceptualize, prepare, deliver and evaluate training programs. Includes experiences in preparing instructional media, presenting a unit of instruction and developing appropriate evaluation instruments. Prereq: ENGL 110.

AENG 400: 3-12 s.h.**Co-Op Ed Experience in AENG**

Co-Op Ed Experience in AENG

AENG 400H: 3-12 s.h.**H: Co-Op Ed Experience in AENG****AENG 425: 3 s.h.****Industrial Robotic Systems**

This course focuses on the study of industrial robotics and modern machine vision technology. Topics include the evaluation, justification, programming, safety, and integration of industrial robotic devices with machine vision systems. 2 hours lecture, 3 hours lab. Prerequisite: ITEC 325.

AENG 427: 3 s.h.**Programmable Logic Controllers**

Focus on the integration and application of the programmable logic controller (PLC). Students design, construct and troubleshoot a variety of industrial control systems utilizing programmable logic controllers, networks, human-machine interfaces, variable frequency drives, control loops and sensors. 2 hrs. lec., 3 hrs. lab. Prereq: AENG 325; and MATH 151 or 161 or permission of instructor.

AENG 433: 3 s.h.**Construction Project Management**

Methods, processes and information necessary to manage a construction project. Includes cost and risk control; developing and applying policies and procedures; subcontractor management; specifying and purchasing materials; scheduling; and contract development. Experiences include use of project-planning and cost-estimation software for development of a complete project plan. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 332 or permission of instructor.

AENG 435: 3 s.h.**Manufacturing Enterprise**

Exploration of the technological and management processes for conceptualizing and manufacturing a product. Experiences with product engineering, production engineering, manufacturing management and enterprise operations in a student-centered learning environment. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 110, 120, 130, 140, 241 and 271 or 281, and a major in technology education (TECE).

AENG 446: 3 s.h.**Advanced Applications in Drafting and Design**

Focuses on advanced techniques, applications, and field-related career interactions in drafting, design, modeling, and rendering based on industry standards and advancements. Research, development, and presentation activities, plus completion of projects are required. 2 hrs. lecture, 3 hrs. lab. Prereq: AENG (ITEC) 342.

AENG 448: 3 s.h.**Machine Tool Design**

Analysis, planning, design, construction and application of tools, methods and procedures necessary to increase manufacturing productivity. Integrated with machining and fabrication practices. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 342.

AENG 455: 3 s.h.**R&D in Graphic Communications and Packaging**

This course involves testing various components of the manufacturing processes involved in creating print and digital/web media. Typical activities will involve testing colorants (e.g., inks, toners, etc.) and substrates used in lithography, flexography, screen-printing and digital printing systems. Optimum conditions for specific printing methods will be determined through controlled testing and examination. Students may also propose to examine specific interrelationships between production procedures used in various digital media processes. The course will also cover color separation and reproduction, which includes the study of process color theory, desktop color separations and color reproduction. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 355 or permission of instructor.

AENG 457: 3 s.h.**Print Production Management & Cost Estimating**

A study of current topics and systems for setting printing production standards, cost estimating, production scheduling, job planning and the consideration of new equipment and technologies. Students will integrate the technical knowledge learned through previous graphics laboratory classes with other course work in management, marketing, science, business, etc., with a focus on how it all relates specifically to the printing production process. The course is structured to offer an overview in several areas of print production management, with emphasis on cost estimating and current printing industry topics. 2 hours lecture/3 hours lab. Prereq: ITEC 355 and MATH 130, or permission of instructor.

AENG 467: 3 s.h.**Mobile Robotics**

Study of the development of mobile robotic solutions. Emphasis is placed on the programming and interfacing of microcontrollers to control autonomous mobile robots in known environments. A research and development activity is required. 2 hrs. lec., 3 hrs. lab. Prereq: ITEC 262 or permission of instructor.

AENG 467H: 3 s.h.**Hon: Mobile Robotics****AENG 468: 3 s.h.****Control Network Integration**

This course utilizes both theory and applications related to industrial network architectures for system control and data acquisition integration. Course topics include design methodologies, installation, commissioning, troubleshooting, grounding/bonding, standards, serial, parallel, wired and wireless protocols. A research and development project is required. 2 hours lecture, 3 hours lab. Prerequisite: AENG 427; Prerequisite or Co-requisite: AENG 425.

AENG 479: 3 s.h.**Experimental****AENG 485: 3 s.h.****Adv Manufacturing Systems**

Computer-integrated manufacturing (CIM) systems, strategies and implementation across the manufacturing enterprise. Focus on the integration of systems such as design of products; computer-aided engineering (CAE); the control of quality, design and construction of production tooling, rapid prototyping, computer-aided process planning (CAPP), finite element analysis (FEA), computer-aided design (CAD), computer-aided manufacturing (CAM) and computer numerical control (CNC). Manufacturing, automation and robotics emphasized. Advanced-level production experiences with an intensive research and development component required. 2 hrs. lec., 3 hrs. lab.

AENG 489: 1-4 s.h.**Honors Course**

Preparation of honors thesis proposal. For the definition of honors course and student eligibility, refer to the departmental honors section of this catalog. EDTE, ARET, MFET, PET, AETM and OSEH majors may enroll in the Department of Applied Engineering, Safety & Technology honors program. Contact the department office for guidelines and an application.

AENG 492: 3 s.h.**Technical Entrepreneurship**

A capstone Applied Engineering & Technology Management course in which students study and apply technical, managerial, and entrepreneurial concepts to the development and operation of a student-centered venture. Students organize and operate a model enterprise to develop manufacture and market a consumer product.

AENG 494: 3 s.h.**Total Quality Management**

The history and development of quality movements; factors influencing the total quality concept; the scope of modern quality systems; management organization and strategies for quality; engineering technology for quality; and statistical tools for measurement and monitoring of quality. 2 hrs. lec., 3 hrs. lab. Prereq: MATH 130 or permission of instructor.

AENG 498: 1-4 s.h.**Independent Study**

See Independent Study section of this catalog. Written permission of faculty sponsor and department chairperson required.

AENG 499: 1-4 s.h.**Departmental Honors (W)**

Completion and defense of thesis research. See departmental honors section of this catalog. Contact the Department of Applied Engineering, Safety & Technology office for guidelines.

AENG 499H: 1-4 s.h.**Hon: Departmental Honors**

AENG 500: 3-12 s.h.**Co-Op Ed Experience in AENG**

Co-Op Ed Experience in AENG

EDTE 179: 1-4 s.h.**Experimental**

Experimental

EDTE 290: 3 s.h.**Children's Engineering**

The intent of this course is to teach students about fundamentals of electricity, mechanisms, fluidics (liquids and gases under pressure), computer-control, and structures. Content will be delivered through a series of hands-on activities that will allow the students to immerse themselves in the content through problem-based learning by doing. Simple knowledge and skill building activities will lead to more complex open-ended problem solving and prototyping activities to build deeper understandings of scientific, technological, engineering, and mathematical (STEM) concepts for teachers of young children. Cross-listed with ERCH 290, students may not receive credit for both courses.

EDTE 291: 3 s.h.**Foundations of Technology & Engineering Ed**

An introduction to the social, historical and philosophical foundations of technology & engineering education, leading to contemporary programs. Provision is made for observation of classroom and laboratory practices in selected schools. Prereq: Sophomore standing. Must meet current university requirements for field experiences (e.g., current clearances, negative TB test results on file). Not offered during summer sessions. Must achieve a "C" or higher to register for professional block courses.

EDTE 391: 3 s.h.**Curr & Inst in Tech & Eng Ed (W)**

An investigation of curriculum design, instructional planning, and lesson delivery in K-12 technology and engineering education. The focus is on engaging teacher candidates in using contemporary strategies and technologies to plan, implement, and assess a standards-based curriculum that promotes students' technological literacy, creativity, engineering problem-solving, and design thinking abilities. Emphasis is placed on meeting the needs of all learners, including English language learners and students with disabilities. Field experiences are required in technology and engineering education classrooms. Prerequisites: Grade of "C" or higher in EDTE 291, EDFN 211, EDFN 241. Grade of "C" or higher in ENGL 110. Admission to advanced professional studies (APS) required. Co-requisites: EDSE 340 and SPED 346. A minimum grade of "C" must be earned in this class in order to progress to student teaching.

EDTE 461: 9 s.h.**Edte Stu Teaching**

Student teachers are assigned full-time to selected mentors in the Lancaster area. They are supervised by University faculty and gain experience in the responsibilities of the teacher. Prereq: EDTE 391 with a "C" or higher and EDTE 496. Co-requisites: EDTE 491 and EDSE 471.

EDTE 462: 4.5,6 s.h.**EDTE Stu Teaching****EDTE 490: 3 s.h.****Integrative Learning Using Experiential Strategies**

The purpose of this course is to engage students in curriculum planning, design and assessment that will enable them to identify, use, and evaluate experiential and integrative teaching-learning strategies that facilitate connections between all subjects in grades Pre-K to 6 (e.g., literacy, science, mathematics, social studies, arts, technology, physical education, engineering). Prerequisites: ERCH 110, ERCH 190, EDTE/ERCH 290, and AENG 344.

EDTE 491: 1 s.h.**Seminar in Techn & Engring Ed**

A seminar dealing with professional education issues and effective teaching and learning during the technology and engineering education student teaching experience. Emphasis on planning, teaching, managing, and assessing technology and engineering education units of instruction. Attention given to legal issues, safety, professional development, and meeting the needs of all learners in the technology and engineering education environment, including English language learners and students with disabilities. Pre-Requisites: EDTE 391 and EDTE 496; Co-Requisites: EDTE 461 and EDSE 471

EDTE 495: 3 s.h.**Integrative STEM Practicum**

This clinical practicum course provides opportunities for teacher candidates to bridge theory and practice. Students will demonstrate and apply knowledge, skills, and dispositions related to the implementation of integrative science, technology, engineering and math (STEM) education at the pre-K to grade 4 level. Emphasis is placed on the planning, development, implementation and assessment of integrative STEM instructional activities and lessons that use problem-based and experiential learning techniques targeted for Pre-K to grade 4 students. Includes field experiences. Prerequisites ERCH 110, ERCH 190, EDTE/ERCH 290, ITEC 344, EDTE 490 or 690 or Permission of Instructor; Advanced Professional Studies (APS) status required. Cross-listed with ERCH 495, credit may not be received for both courses.

EDTE 496: 2 s.h.**Innovatn/Design Methodologies**

Technology education methodologies for instruction in advanced design and innovation. Teams of students develop solutions to technological problems. 1 hr. lec., 3 hrs. lab. Prereq: ITEC 110, 120, 130, 140, 344; MATH 130 or higher; and ENGL 312 or 316.

EDTE 498: 1-6 s.h.**Ind Stdy:**

Independent Study in Technology Education

OSEH 120: 3 s.h.**Fundamentals of Safety, Health, Environmental Issues (G3)**

Introduction to safety, health and environmental issues that impact people and workplaces. Includes the historical development of safety, the impact of accidents on society, a legislative overview and basic principles of personal risk assessment and management.

OSEH 120H: 3 s.h.**Hon: Fund of Safety, Hlth, Env I (G3)****OSEH 179: 3 s.h.****Experimental**

Experimental

OSEH 220: 3 s.h.**Legal Aspects Environmental Safety**

Legal issues relative to occupational safety and environmental health. Includes federal and state legislation, resolution of legal and ethical challenges, product safety and professional liability.

OSEH 221: 3 s.h.**Industrial Fire Prevention, Protection and Control**

Basic principles, chemistry of fire, fire hazards determination, workforce notification, alarm and sprinkler systems, protective equipment, evacuation procedures and fire fighting methods.

OSEH 221H: 3 s.h.**Hon: Fire Prevention**

OSEH 222: 3 s.h.**Construction Safety**

Methodology for the anticipation, recognition, evaluation and control of safety and health hazards associated with construction industries. Topics include engineering principles and risks associated with multiple types of facilities and infrastructures. Prereq: OSEH 120

OSEH 279: 3 s.h.**Experimental**

Experimental

OSEH 300: 3-12 s.h.**Co-Op Ed Experience in OSEH**

Co-Op Ed Experience in OSEH

OSEH 320: 3 s.h.**Safety Engineering Principles**

Methods for the identification and analysis of industrial hazards. Emphasis on application of basic safety engineering principles for the control of losses in an industrial environment. Prereq: OSEH 120.

OSEH 320H: 3 s.h.**Hon: Safety Engineering Princi****OSEH 321: 4 s.h.****Environmental & Industrial Hygiene I - Chemical and Biological Hazards**

Course covers the anticipation, recognition, evaluation, and control of chemical and biological hazards in the workplace. Topics include: toxicology, gases, vapors, solvents, particulate matters, respiratory protection, fit testing, air sampling protocols and strategies, microbial and biological hazards, and government regulations. The challenging concerns of health hazards related to nano size particles in the workplace is addressed. Prereq: OSEH 120, CHEM 104, MATH 101 or Math 151 or Math 160 or Math 161, or permission of instructor.

OSEH 323: 3 s.h.**Human Factors in OSEH**

Ergonomic study of interaction between people and their work. Emphasis on the application of biological sciences to engineering principles in an effort to optimize efficiency, productivity and safety. Topics include anthropometrics, biomechanics, design principles, physiological and cognitive capabilities and task-evaluation techniques. Prereq: OSEH 120 or permission of instructor.

OSEH 333: 3 s.h.**Introduction to System Safety**

Qualitative and quantitative system safety methods used to analyze and control risk. Includes a variety of analytical engineering techniques that are applied to practical system-analysis problems. Prereq: OSEH 320 and MATH 130.

OSEH 379: 3 s.h.**Experimental**

Experimental

OSEH 400: 3-12 s.h.**Co-Op Ed Experience in OSEH**

Co-Op Ed Experience in OSEH

OSEH 410: 3 s.h.**Safety and Hygiene Management**

Principles and practices of occupational safety and environmental health management. Includes the development of safety objectives and policy, evaluation and management of risk, and program implementation and evaluation. Offered annually. Prereq: OSEH 220 and 320 or permission of instructor.

OSEH 422: 4 s.h.**Environmental & Industrial Health II - Physical Hazards**

Fundamental theory and methods used in the anticipation, recognition, evaluation and control of the physical hazards of noise, ionizing/nonionizing radiation, illumination, thermal stress, local exhaust ventilation, and dilution ventilation. Covers regulatory standards and control methods. Prereq: OSEH 120, MATH 101 or 151 or 160 or 161 and PHYS 103 or 104 or 131, or permission of instructor.

OSEH 430: 1 s.h.**Topics in Occupational Safety & Environmental Health**

A review of industry specific hazards and operations related to Occupational Safety and Environmental Health. Topics vary according to the needs and interest of students involved. The course is intended to build on basic safety management concepts and an understanding of how these concepts are applied in specific sectors. Challenges and specific regulatory requirements, which may be unique to the business sectors covered, will be included. Emphasis is placed on leadership and mentorship of OSEH students. Reserved for Senior OSEH majors or by instructor permission.

OSEH 435: 3 s.h.**Environmental Health**

Environmental health review of scientific and technical foundations, with an examination of problems, regulations and control strategies. Covers identification of pollution sources, evaluation strategies, engineering controls, federal and state regulatory and permitting processes. Emphasis is on practical information needed by environmental health professionals to resolve issues affecting industry. Prereq: OSEH 321 or ENVI 330 or permission of instructor.

OSEH 440: 6,12 s.h.**Internship**

Students work full-time for nine weeks or more under the direct supervision of an OSEH professional in industry, insurance, government agencies or other approved location. University supervision, seminars and evaluation are provided. Students experience problems, practices and principles in the management of occupational safety and/or industrial hygiene programs. To be taken twice, concurrently or consecutively, with increased work and research responsibilities. Prereq: senior OSEH majors and permission of OSEH coordinator.

OSEH 479: 1-6 s.h.**Experimental**

Experimental

OSEH 489: 1-4 s.h.**Honors Course**

Preparation of honors thesis proposal. For the definition of honors course and student eligibility, refer to the departmental honors section of this catalog. EDTE, AETM and OSEH majors may enroll in the Department of Applied Engineering, Safety & Technology honors program. Contact the department office for guidelines and an application.

OSEH 499: 1-3 s.h.**Departmental Honors**