### Applied Engineering (AENG)

**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 creative process used to develop new products or modify existing ones. They will work on projects that involve brainstorming, planning, and analysis, 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, 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 packaging 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 nonmetals. 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.
Hrs: Technology and Humans (P)
Hrs: 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 Assessment: Amish and Others (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 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.
H: 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 hours lecture, 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: Cmpt-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.
Hrs: 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 Prntng

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

AENG 379: 3 s.h.
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 manufactoring 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

AENG 515: 3 s.h.
Adv Prob:
Resources, processes and outcomes of selected technical areas in technology education. Technical area emphasized (e.g., computer-aided drafting and design, computer numerical control, desktop publishing, digital electronics, manufacturing, photography and robotics) varies with the course offering. Laboratory experiences focus on technological problem solving. 2 hrs. lec., 3 hrs. lab.

AENG 525: 3 s.h.
Adv Prob:
Resources, processes and outcomes of selected technical areas in technology education. Technical area emphasized (e.g., computer-aided drafting and design, computer numerical control, desktop publishing, digital electronics, manufacturing, photography and robotics) varies with the course offering. Laboratory experiences focus on technological problem solving. 2 hrs. lec., 3 hrs. lab.

AENG 535: 3 s.h.
Adv Prob:
Resources, processes and outcomes of selected technical areas in technology education. Technical area emphasized (e.g., computer-aided drafting and design, computer numerical control, desktop publishing, digital electronics, manufacturing, photography and robotics) varies with the course offering. Laboratory experiences focus on technological problem solving. 2 hrs. lec., 3 hrs. lab.

AENG 579: 3 s.h.
Experimental

AENG 587: 3 s.h.
Special Topics:
Investigation of one or more topics of current interest in technology and innovation. Topics vary according to needs and interests of students and faculty involved. Offered periodically.

AENG 588: 1-3 s.h.
Special Topics:
Investigation of one or more topics of current interest in technology and innovation. Topics vary according to needs and interests of students and faculty involved. Offered periodically.

AENG 589: 1-3 s.h.
Special Topics:
Investigation of one or more topics of current interest in technology and innovation. Topics vary according to needs and interests of students and faculty involved. Offered periodically.