# 2025 – 2026

## ENGINEERING EDUCATION COURSES

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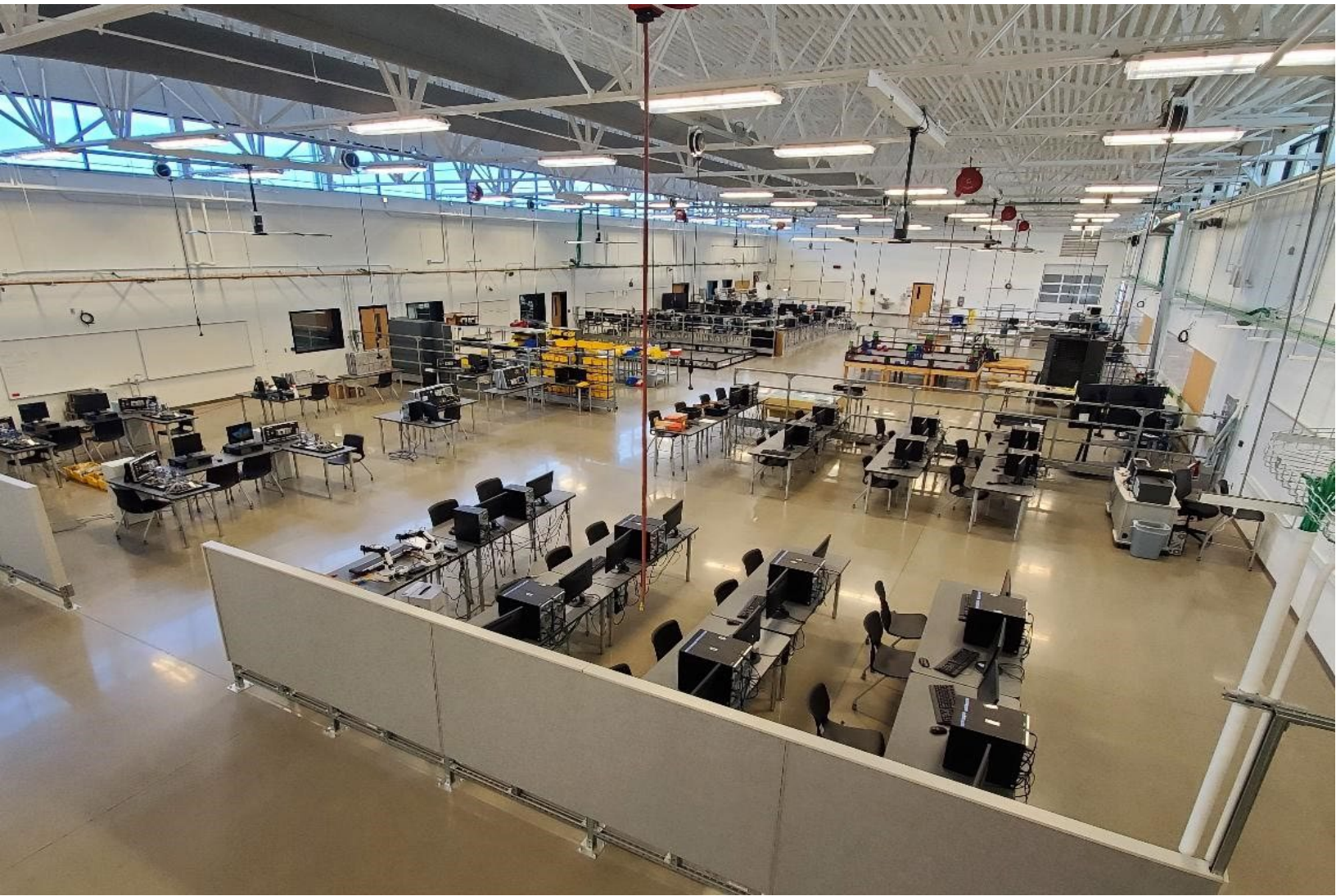

# ENGINEERING EDUCATION COURSES
# 2025 – 2026

# Table of Contents

# ENERGY COURSES

## Alternative Energy 210243

This course provides students with the foundation in content and skills associated with various energy sources, and electrical power generation, transmission, and distribution. Students will develop competencies in the area of energy history and the global impact of renewable and nonrenewable resources, career opportunities, environmental principles, working with AC/DC electrical circuits, and the transfer of various energy forms to produce DC current. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisite:** Introduction to Alternative Energy 210242

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Prepare labs to demonstrate an understanding of AC/DC electrical circuits.
3. Demonstrate knowledge of the viability of biomass and biofuel.
4. Understand and utilize communication skills to plan for and accomplish objectives/goals.
5. Understand that chemical bonds require energy to form and release that energy when broken.
6. Evaluate the pros and cons of biodiesel and develop a persuasive argument for the use of biodiesel as an alternative to fossil fuels.
7. Identify and explore the impacts (intended and unintended) of technological advancements in Agriculture and related biotechnologies, Energy and Power, and Transportation Technologies.
8. Explore the ecological and economic impacts of unethical decisions (case studies and scenarios of regulation violations, whistleblowing, kickbacks, pay-offs, labor disputes, illegal dumping, and straight-pipe sewage).
9. Design and fabricate evaluation tools (instruments, models, simulations, software) that assess the impact of products and systems through information collection and data synthesis.
10. Explain the properties and atomic structure of radioactive elements.
11. Describe how electricity can be generated from radioactive sources.
12. Demonstrate an understanding of careers in Energy Generation and Transmission/Distribution.

# Energy I: Energy Industry Basics 210245

Investigates competencies required for employment by various industries that manufacture energy sources. Addresses the competencies identified by the Center for Energy Workforce Development (CEWD) organization that are needed for energy industries. Combined with Energy II and Energy III qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 12**

**Recommended Credit: 1**

## Energy II: Power Generation and Distribution 210246

Introduces students to methods of power production, power distribution, and physics principles that are associated with both. Addresses the competencies identified by the Center for Energy Workforce Development (CEWD) organization that are needed for energy industries. Combined with Energy I and Energy III qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

## Energy III: Emerging Technologies in Energy 210247

Introduces students to emerging technologies and careers in the energy industry. It is the third of three modules that address the competencies identified by the Center for Energy Workforce Development (CEWD) organization that is needed for energy industries. Combined with Energy I and Energy II qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

# Energy IV: Sustainability Management 210248

Examines the management of corporations as it relates to sustainability. Includes an overview of energy technology, energy resources, and emerging future energy technologies coupled with social and environmentally related legislation and its effect on corporations' triple bottom line (people, profit, and planet). Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 12**

**Recommended Credit: 2**

# Engineering Co-op* 210330

Cooperation Education is a paid education program consisting of in-school instruction combined with the program related to on-the-job work experience in a business or industrial establishment. These are planned experiences supervised by the school and the employer to ensure that each phase contributes to the student's Individual Learning Plan (ILP). Refer to the KDE Work-Based Learning Manual for further specifications. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

# Engineering Internship 210331

Internship for CTE courses provides supervised work-site experience for high school students associated with their identified career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

# Foundations of Energy 210341

The course provides an overview of renewable and nonrenewable energy resources, reflecting how energy impacts the environment and economy from regional, state, national and global perspectives. Extensive hands-on laboratory activities are vital components of this course. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 11**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop competencies and skills in the areas of energy.
3. Engage in meaningful, hands-on, minds-on, conceptual-based activities in the areas of energy.
4. Develop competencies in the safe and efficient use of the tools, machines, materials and processes of energy technology.
5. Demonstrate employability and social skills relative to careers in the energy industry.
6. Understand electric power generation, transmission and distribution.
7. Use computer-based skills related to concepts of energy in various technologies.
8. Demonstrate knowledge and skills in blueprint reading in energy technology.
9. Demonstrate and develop fundamental skills and knowledge of tools in the energy industry.
10. Apply basic electricity concepts and knowledge as it applies to energy technologies.
11. Describe similarities and differences between renewable and nonrenewable sources of energy.
12. Develop core competencies in the area of safety.
13. Identify ways to conserve energy.
14. Compare the advantages and disadvantages of the use of the various energy sources.
15. Assess the impact of the various energy sources on the economy in Kentucky.
16. Differentiate between the terms energy and electricity.
17. Describe the difference in potential and kinetic energy.
18. Analyze how supply and demand impact Kentucky's economy in relation to energy.
19. Investigate the role of technology in the future development of energy usage.
20. Map the major sources of energy used in Kentucky.
21. Analyze the impact energy has on the environment.

# Global Energy Issues 210244

The course critically examines issues associated with the technical, economic, societal, environmental, and geopolitical aspects of energy and sustainability. Students will develop competencies in the area of energy history and the global impact of renewable and nonrenewable resources, career opportunities, and environmental principles. The course is taught through lectures, discussions, hands-on activities, field trips and invited speakers. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Describe basic concepts of energy and power, including types of energy, conversion of energy, and conservation of energy and energy analysis.
3. Understand and apply sustainability in various aspects of the world around them, including the campus, local, national and global initiatives.
4. Explore, review and discuss the current mix of energy sources in use around the world, including coal, natural gas, oil, nuclear, solar, wind, geothermal, hydro, and biomass.
5. Prepare a presentation on the basics of electric power, including emerging issues of smart grid transmission and distribution.
6. Understand and discuss the basic environmental issues with energy generation and use the basic policy issues of power and energy, including environmental regulation, pricing, and development.
7. Explain the basic economic aspects of power and energy, including energy markets.
8. Describe the relationships between energy use and economic activities, standard of living, and cultures.
9. Investigate and interpret the basic geopolitical issues of power, including national security and economic security. By using critical and creative inquiry, students will demonstrate a grasp of the global inequalities and diversities that exist with respect to energy across the world.

# Introduction to Alternative Energy 210242

This course provides students with the foundation in content and skills associated with various energy sources, and electrical power generation, transmission, and distribution. Students will develop competencies in the area of energy history and the global impact of renewable and nonrenewable resources, career opportunities, environmental principles, working with AC/DC electrical circuits, and the transfer of various energy forms to produce DC current. Laboratory-based activities are an integral part of the course that includes the safe use and application of appropriate technology, scientific testing and observation equipment. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 10 – 11**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Summarize the value of alternative energy.
3. Describe the importance of professional ethics and legal responsibilities with regard to alternative energy opportunities.
4. Explain the significance of various alternative sources of energy.
5. Demonstrate personal money-management concepts, procedures, and strategies for alternative energy use.
6. Identify the pioneers in the field of developing energy alternatives.
7. Identify how the characteristics of goal-directed research impact technology.
8. Describe factors that motivate technological development, such as profit, function, form, and quality.
9. Differentiate between petroleum diesel and biodiesel and between the operation of a gasoline engine and a diesel engine.
10. Trace the flow of energy through an ecosystem.
11. Know the basic structure and characteristics of atoms, including how they bond.
12. Analyze current and emerging issues (such as ethical, social, legal, environmental, political, and privacy) related to technology to identify appropriate and inappropriate applications of technology.
13. Describe how electricity can be generated from radioactive sources.
14. Design, construct, and assess alternative solutions to technological problems that minimize/alleviate negative impacts.
15. Understand and utilize communication skills to plan for and accomplish objectives/goals.

# Power and Energy Equipment Technology 210142

Power and Energy Equipment is used every day in many different ways. To become a more environmentally friendly society, students will have a basic understanding of the various types of energy equipment and how energy is obtained or generated. Everyone should know what energy sources are available that do not pollute the environment and how this energy can be converted into a useful power supply. This course provides students with a foundation in content and skills associated with various energy sources, electrical power generation, working with AC/DC electrical circuits, and the transfer of various energy forms to produce DC current. Laboratory-based activities are an integral part of the course that includes the safe use and application of appropriate technology, scientific testing and observation equipment. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Describe sources of energy.
3. Demonstrate an understanding of the cultural, social, economic, and political effects of power and energy technology.
4. Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem-solving.
5. Demonstrate the ability to use and maintain technological products and systems.
6. Demonstrate an understanding of and be able to select and use energy and power technologies.
7. Demonstrate safe and appropriate use of tools, machines, and materials in power and energy technology.
8. Demonstrate technical knowledge and skills related to power and energy systems.
9. Demonstrate technical knowledge and skills in steam power technology.
10. Demonstrate technical knowledge and skills in hydraulic and pneumatic power technology.
11. Demonstrate technical knowledge and skills in electric power technology.
12. Demonstrate technical knowledge and skills about solar cells and fuel cells.
13. Measure and report the power and efficiency of power-producing systems.
14. Conduct a research and experimentation project on an energy and power system.
15. Demonstrate an understanding of career opportunities and requirements in the field of power and energy technology.

# ENGINEERING COURSES

## Additive Manufacturing Applications 332003

Allows students to gain intermediate-level experience in additive manufacturing technologies. Through hands-on projects, students will hone their 3D printing and computer-aided design (CAD) skills. This team-focused course will utilize an engineering iterative design process to solve real-world problems. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Introduction to 3D Printing Technology 332001 and Engineering Mechanics for 3D Printing 332002

**Recommended Grade Level: 11 – 12**

**Students will:**

1. Demonstrate basic, practical design and fabrication applications related to additive manufacturing.
2. Present basic working models and prototypes in related fields of interest.
3. Apply a broad range of research techniques for the purpose of gathering information related to a design problem.
4. Understand the stages of preliminary product or solution design.
5. Demonstrate a basic understanding of the team design process and iterative design changes.

# Advanced Design Applications 210117

This course focuses on how engineers and technicians apply their creativity, resourcefulness, mathematical, technical and scientific knowledge and skills to solve authentic design problems. This course can be offered as a dual credit course offered by Eastern Kentucky University (EKU). More information about this partnership can be found on EKU's Dual Credit webpage. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit:**

**Students will:**

1. Explain the different scales and be able to convert different measurements.
2. Develop a design and create a scale drawing and a scale three-dimensional model of that design.
3. Employ common techniques for residential housing design.
4. Sketch elementary construction details such as foundations, framing, roofing, and sheathing.
5. Identify physical characteristics that promote or hinder interaction among residents of a neighborhood.
6. Design appropriate features for a new or existing neighborhood to encourage community interaction.
7. Demonstrate appropriate residential building techniques.
8. Identify the key ideas of green building.
9. Describe the process and requirements of LEED certification.
10. Design/model buildings that utilize optimum value engineering (OVE).
11. Explain the use of survey equipment and the purpose of surveying equipment.
12. Explain how to read a leveling rod and how to take readings.
13. Understand key surveying terminology.
14. Explain how to determine elevations by surveying/leveling.
15. Explain common mistakes made when surveying/leveling.
16. To understand that construction technology involves the design of structures to meet various requirements.
17. Students will design and construct architectural models.
18. Refine a design by using scale drawings and models.
19. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals in the design process in order to check for proper design and to note where improvements are needed.
20. Evaluate final solutions and communicate observations, processes, and results of the entire design process using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.
21. Explain the term "spinoff" and provide an example.
22. Explain the function of a tradeoff and provide an example.

23. Identify and explain how external factors affect the design of a product before it is manufactured.
24. Identify and change a set of characteristics within a design as they pertain to a set of design principles (for example, function, efficiency, aesthetics, ergonomics, and anthropometrics) and apply those characteristics to the development of a product and a system.
25. Use tables, charts, and graphs in making arguments and claims in oral, written, and visual presentations.
26. Make decisions about units and scales that are appropriate for problem situations.
27. Classify manufacturing systems as customized production, batch production, and continuous production.
28. Explain the essential aspects of mass customization practices.
29. Explain how physical sketch models, 2D sketches, and digital models can be used as visualization tools for design ideation.
30. Explain how design changes developed require revisions to critical data such as costs, materials, and component requirements.
31. Explain how quality control is affected by input and output factors when applied to a manufacturing process.
32. Identify how people, materials, tools, and training affect product quality.
33. Produce multiple products that are controlled for quality.
34. Create functional fixtures and jigs for creating their product.
35. Develop a program to logically control a set of inputs to achieve a desired output.
36. Generate a viable solution to a technological problem using a design model (the design loop).
37. Utilize appropriate design principles while developing an automated manufacturing machine.
38. Explain how sensors work and how they are used in manufacturing to control technological systems and devices.
39. Describe how a microprocessor is used to control devices and systems and to provide information to humans.
40. Understand how relays work.
41. Create a working relay.
42. Construct a circuit using a commercial relay.
43. Classify materials as natural, synthetic, or mixed based on the mechanical, thermal, and electrical properties of the material.
44. Examine that materials have different qualities and may be classified as natural, synthetic, or mixed.
45. Define the mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them.
46. Explore the manufacturing process of designing, developing, making, and servicing products and systems.

# Aerospace Engineering 210229

This course introduces the principles of flight and aerodynamics and lays the groundwork for applying engineering principles. This aerodynamics course focuses on the study of the flow of air in an airfoil. Students will interact with technology that simulates various airfoil designs and determines airflow around various shapes. This course also introduces aerospace engineering as an interdisciplinary profession, including other areas of engineering. Students will learn the engineering design process, which includes defining the need or problem, researching related principles and solutions, creating designs, testing prototypes, evaluating, and redesigning. Relationships between aircraft performance and other aspects of engineering (such as designing runways) will also be explored. Students will learn to analyze and interpret data to improve performance. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Identify the various vehicles used for human flight.
3. Identify and explain the forces acting on an airplane, how the main components of the airplane control these forces, and how changes to the design of the airplane affect performance.
4. Conduct model analysis and verification.
5. Create model documentation, including working drawings, dimensioning, and annotations.
6. Use modeling and spreadsheet software to design and analyze data from various airfoil shapes.
7. Identify the various instruments used to measure the lift and drag forces generated by an airfoil in a wind tunnel.
8. Communicate test results through a technical report and a presentation to the class.
9. Develop knowledge about the evolving technology of aerial navigation, including VFR, IFR, VOR, Wide Areas Augmentation System (WAAS), Local Area Augmentation Systems (L.A.A.S.), and Synthetic Vision systems to the Global Positioning System.
10. Define terms and concepts of the design, flight, and forces on a rocket and be able to explain how they interact.
11. Use trigonometry to calculate the performance of rockets.
12. Explain basic orbit theory, satellite motion and orbit parameters.
13. Work cooperatively in a team to design and conduct experiments related to positive G-force.
14. Analyze various materials to determine their appropriate application in spacecraft.
15. Design a computer-driven system for a robot to perform a series of predetermined

functions without having anything impede its progress while successfully delivering a payload to a predetermined location.

16. Design, build and test an intelligent vehicle that will meet the criteria determined by students.

# Architectural Design 210140

This course is for students who wish to broaden their basic skills in the field of residential architectural drafting and surveying. Covers procedures used in developing a complete set of residential plans, the history of surveying, mathematics, measurement and computations, and the proper use of basic drafting and surveying instruments, equipment and software. Students will develop projects in accordance with drafting and building code requirements. Projects will emphasize the importance of communication and organization as they participate in the roles of civil engineers, architects, land developers, surveyors, and/or general contractors in residential planning and construction. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Employ technological tools to expedite workflow, including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendars, contacts, email, and internet applications.
3. Employ computer operations applications to access, create, manage, integrate, and store information.
4. Prepare architectural drawings, such as floor plans, site plans, elevations, and prepare roof plans.
5. Demonstrate understanding of civil drawings.
6. Develop architectural models.
7. Set up surveying equipment and apply its use to real-world applications.
8. Use oral and written communication skills in creating, expressing and interpreting information and ideas.

# Building Construction Technologies 210141

Students explore architectural design foundations and increase their understanding of working drawings, construction techniques, and codes regulating building design. They learn the design process and apply the elements and principles of design to architectural projects. Through producing models and illustrations of all aspects of a building, students create architectural design solutions using CAD (computer-aided design). Students design and build scale or full-size structures and work with projects that help them understand the jobs of architects, carpenters, electricians, plumbers, surveyors, contractors, masons, design engineers, and a variety of other construction careers. They also explore aspects of the construction industry. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Use basic drafting tools and techniques and develop accurate measurement techniques to communicate drafting ideas.
3. Demonstrate various drawing scales used in technical drawing.
4. Through the use of basic drafting equipment, students will produce geometric shapes and figures that describe various objects, structures, and designs.
5. Demonstrate knowledge and skill with illustration techniques and working drawings.
6. Demonstrate basic mathematic concepts in basic arithmetic, algebra, geometry, and trigonometry to solve problems and apply multiple discipline calculations.
7. Describe basic house design concepts.
8. Summarize modern innovations and techniques used in new construction
9. Describe personal and job site safety rules and regulations that maintain safe and healthy work environments.
10. Describe the development of construction technology, its impact on the built environment and the impact of growth on the construction industry.
11. Define the roles and responsibilities of the general contractor, specialty contractor, construction management and design build firms.
12. Describe the process of applying for building permits and variances.
13. Select and safely use hand and power tools and describe their operations.
14. Demonstrate carpentry skills through the construction of various forms, layout and framing of floors, walls, and building structures and components.

# Civil Engineering 210223

This is an introduction to residential and light commercial building construction and design. Students will learn basic sketching and architectural drafting skills with an emphasis on computer-aided drafting. In this class, students will design a structure relevant to today's modern architecture and create models of their designs with various materials and tools. Students will experience and solve many problems in designing or building structures with regard to environment and community impact and limitations from town planning, urban design and landscape architecture to furniture and objects. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Perform basic computer-aided drafting functions and develop knowledge and skills in the use of various software programs.
3. Create project planning documentation, including site information and development options.
4. Conduct site planning including grading, public ingress/egress, utilities, landscaping, water supply, and wastewater management.
5. Develop architecture plans reflecting various architectural styles that include floor plans, elevations, sections and details, schedules, HVAC, plumbing, and electrical systems, as well as communication and protection systems.
6. Define and evaluate structural engineering components, including foundations, columns, beams, and roof systems.
7. Develop presentations of potential construction projects.
8. Use principles and elements of design including portfolio development containing various written work, drawings, models, and other documentation.
9. Perform sketching and visualization using proper techniques and tools to produce pictorial, annotated sketches, multi-view or orthographic drawings using proper and accurate measurements.
10. Perform modeling using conceptual, graphical, physical, mathematical, and computer-generated techniques, including 3-dimensional software.
11. Conduct model analysis and verification.
12. Create model documentation, including working drawings, dimensioning, and annotations.
13. Develop product presentations using proper communication techniques and appropriate presentation aids.

# Electrical/Electronics Engineering 210232

In this course, students will gain skills and knowledge through classroom and lab activities in the areas of basic DC and AC circuits, circuit components, codes, testing, electromagnetism and inductance, capacitance, power supplies, power generation and distribution, amplification, digital circuits, and computer fundamentals. Students will develop a basic understanding of the various types of energy and how energy is obtained. Students will learn the safe use of the tools, test instruments, equipment and supplies used in this course, plus information on career opportunities in this field. Hands-on and problem-solving activities will expose students to areas of electron theory, Ohm's Law, insulators, conductors, electronic components, oscillators, and electronic fabrication. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop knowledge and understanding of programmable logic controllers and electrical motors.
3. Demonstrate safe and appropriate use of tools, machines, and materials in electrical and electronic technology.
4. Demonstrate understanding and apply knowledge of direct current circuits and alternating current circuits as related to electrical technology.
5. Describe, construct, conduct, and analyze experiments with basic DC and AC circuits and with circuits using magnetism.
6. Describe the structure of matter related to electricity and electronics.
7. Use Ohm's Law and Watt's Law to analyze and experiment with resistive circuits.
8. Describe, construct, analyze and experiment with capacitive circuits.
9. Demonstrate the use of electrical and electronic equipment.
10. Demonstrate proper electronic assembly methods.
11. Demonstrate an understanding of basic electrical circuits and electronic systems.
12. Describe and experiment with integrated circuits.
13. Describe, construct, and experiment with circuits using semiconductors.

# Engineering I 210221

This course applies the skills, concepts, and principles of engineering. Students explore various technological systems and engineering processes in related career fields. Topics include investigating technological systems, design optimization, and problem-solving. Students utilize CAD (computer-aided design) and physical and virtual modeling concepts to construct, test, collect and report data. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Perform basic computer-aided drafting functions and develop knowledge and skills in the use of CAD (computer-aided design) software.
3. Research information about professional engineering-related organizations.
4. Use principles and elements of design including portfolio development containing various written work, drawings, models, and other documentation.
5. Perform sketching and visualization using proper techniques and tools to produce pictorial, annotated sketches, multi-view or orthographic drawings using proper and accurate measurements.
6. Apply geometric relationships of forms and shapes, lines, various polygons, geometric constraints, Cartesian coordinate system, and origin planes.
7. Perform modeling using conceptual, graphical, physical, mathematical, and computer-generated techniques, including 3-dimensional software.
8. Conduct model analysis and verification.
9. Create model documentation, including working drawings, dimensioning, and annotations.
10. Develop product presentations using proper communication techniques and appropriate presentation aids.

# Engineering II 210222

A project and research-based course that extends the learning experiences where students focus on mechanical, electrical, fluid and thermal systems allowing in-depth exploration in selected disciplines of engineering areas such as manufacturing, power/energy/ transportation, robotics, hydraulics, electricity/electronics, communications, construction systems, alternative energy, computer-aided design, and problem-solving. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisite:** Engineering I 210221

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Recognize how the history of design (including artistic periods, styles, and form and function) influences product development.
3. Research information about professional engineering-related organizations.
4. Develop and demonstrate competencies with various engineering drawings.
5. Research selected disciplines of engineering areas such as manufacturing, power/energy/transportation, bio-medical, robotics, hydraulics, electricity/electronics, communications, construction systems, and/or alternative energy, and incorporate computer-aided design and problem-solving.
6. Develop solutions to problems within engineering areas such as manufacturing, power/energy/transportation, bio-medical, robotics, hydraulics, electricity/electronics, communications, construction systems, and/or alternative energy, and incorporate computer-aided design and problem-solving.
7. Apply geometric relationships of forms and shapes, lines, various polygons, geometric constraints, Cartesian coordinate system, and origin planes.
8. Perform modeling using conceptual, graphical, physical, mathematical, and computer-generated techniques, including 3-dimensional software.
9. Develop knowledge and understanding of basic electric, welding and industrial processes and symbols.
10. Develop knowledge and understanding of concepts of CAD (computer-aided design), construction/fabrication techniques, structural systems, hydraulics, and pneumatics systems.
11. Conduct model analysis and verification.
12. Create model documentation, including working drawings, dimensioning, and annotations.
13. Develop product presentations using proper communication techniques and appropriate presentation aids.

# Engineering Capstone 210110

Engineering scope, content, and professional practices are presented through practical applications in this capstone course. Students in engineering teams apply technology, Kentucky Academic Standards, and skills to solve engineering design problems and create innovative designs. Students research, develop, test and analyze engineering designs using criteria such as design effectiveness, public safety, human factors and ethics. Participation in Kentucky Technology Student Association will greatly enhance instruction.

One option is UK's College of Engineering Transition to Engineering course. This course introduces students to creativity that is inherent in how engineers and computer scientists approach innovation, design, and problem-solving. Students are introduced to general engineering content, tools of the trade, and the ethical implications of creative engineering endeavors. Students will engage in a hands-on project with an emphasis on problems and techniques common across various engineering domains with a focus on coding.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Identify, define, and justify a technical design problem for resolution.
3. Conduct research and investigation into the stated problem.
4. Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications.
5. Design a solution to the problem and create a working prototype for testing.
6. Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results.
7. Create and deliver a formal presentation of the solution to the problem to community stakeholders.

# Engineering Co-op* 210330

Cooperative education is a paid educational program consisting of in-school instruction combined with program-related on-the-job work experience in a business or industrial establishment. These are planned experiences supervised by the school and the employer to ensure that each phase contributes to the student's Individual Learning Plan (ILP). Refer to the KDE Work-Based Learning Manual for further specifications. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

# Engineering Internship 210331

An internship provides supervised work-site experience for high school students associated with their identified career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

# Engineering Mechanics for 3D Printing 332002

To enhance students' skills with this technology, students will learn to apply engineering principles and additive manufacturing technologies to improve design functionality, product performance, and improved 3D printing success. This hands-on, project-based course will apply math and science principles to the new and emerging field of additive manufacturing. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisite:** Introduction to 3D Printing Technology 332001

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Describe, using appropriate terminology, the basic concepts of force, stress, and deformation.
2. Demonstrate a basic understanding of beam theory.
3. Demonstrate a basic understanding of materials and their properties in relation to 3D printing applications.
4. Use software to design and analyze objects for failure based on applied forces and stress.
5. Apply acceptable industry techniques and features to designs to improve functional performance.
6. Design custom modifications to objects to improve performance based on analysis results.
7. Select appropriate materials for improved design performance.
8. Demonstrate a basic understanding of post-processing techniques and options for finishing prints.

# Environmental Engineering 210250

This course will use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. Students will work to improve recycling, waste disposal, public health, and water and air pollution control. They also address global issues, such as unsafe drinking water, climate change, and environmental sustainability. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Describe what environmental engineering is and what you may do as an environmental engineer.
2. Describe the similarities and differences of the environmental engineering career options.
3. Apply the professional codes of engineering ethics to evaluate situations that you may encounter in various environmental engineering careers.
4. Define sustainability.
5. Demonstrate knowledge of the main forms of air, water and land pollution.
6. Understanding how a wastewater and water treatment plant works.
7. Demonstrate knowledge of methods of pollution prevention inside a manufacturing plant.
8. Examine major forms of energy used to power humanity.
9. Compare various forms of energy and recognize the advantages and disadvantages of each type.
10. Design and conduct reliable scientific experiments.
11. Analyze and interpret laboratory data.
12. Construct graphs (by hand and using graphing software).
13. Interpolate and extrapolate data from a graph.
14. Draw conclusions based on experimental data.
15. Thoroughly and clearly communicate results and conclusions both orally and in writing.

# Introduction to 3D Printing Technology 332001

An introduction to additive rapid prototyping manufacturing (three-dimensional printing) and its applications in conjunction with computer technology, including hardware, software, three-dimensional printing technology, file management, internet, security, and computer intellectual property ethics. Presents basic use of applications, programming, systems and utility software. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Describe, using appropriate terminology, the concepts and applications of 3D (three-dimensional) printing.
2. Demonstrate a basic understanding of various 3D (three-dimensional) printing materials, chemical/mechanical properties, and necessary equipment settings to process them.
3. Describe, using correct computer terminology, basic computer functions, uses of computers in society, and different types of software.
4. Utilize computer and 3D (three-dimensional) printing-related technology as a tool to manage, manipulate, use and present information both in a virtual model and general form.
5. Discuss ethical and responsible computing and 3D (three-dimensional) printing issues, such as copyright, patent, intellectual property rights, privacy, dangers of use, sustainability, security and internet safety.
6. Demonstrate awareness of the use and impact of computers and 3D (three-dimensional) printers in different areas of business, education, the home, and the global realm.
7. Effectively use computer application programs and related graphical interfaces.
8. Describe how 3D (three-dimensional) printing and computer technology globalization impacts varying cultures, commerce, materialism, and business opportunities.
9. Transfer and share files and information using physical methods, networks, email, and cloud-based data storage systems.
10. Demonstrate a basic understanding and application of computer-based or mobile 3D (three-dimensional) imaging/scanning methods and equipment.
11. Locate and access relevant information sources found on networks such as the internet and be familiar with web browsers, search sources, sources of online help, and sources of information related to the field of study.
12. Demonstrate an awareness of different types of software applications and operating systems, as well as software distribution, upgrading, and cloud computing.
13. Perform common file-management functions effectively.
14. Search, access, and transfer files to and from websites dedicated to functioning as 3D (three-dimensional) printing model file repositories.
15. Effectively generate and manipulate 3D (three-dimensional) computer models using a variety of CAD (Computer-Aided Design) tools and techniques.

16. Demonstrate an understanding of foundational 3D (three-dimensional) printing and slicing features such as support material, rafts, brims, and skirts.
17. Skillfully create effective presentations, spreadsheets, and basic word-processing documents.
18. Demonstrate an understanding of how continual growth in innovative reasoning, technological skills, and presentation impact personal economic opportunities as well as employability.
19. Identify how to maintain computer and 3D (three-dimensional) printing equipment and solve common hardware problems.

# Industrial Engineering 210135

This course allows students the opportunity to develop a project from vision to reality by working with teams to design, engineer, manufacture, construct, test, redesign, and produce a finished project. This course can serve as a capstone course working with business and industry as part of their design, development, fabrication, and marketing using skills and knowledge from previous manufacturing courses. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop and demonstrate strategies and work habits that will lead to success and prepare the student for future careers in a technological world.
3. Employ the manufacturing process, including designing, development, fabrication, troubleshooting and testing, problem-solving and marketing various products.
4. Research and identify consumer demands for a manufactured product.
5. Prepare a plan for marketing and distributing a manufactured product.
6. Identify current and emerging careers related to technology.
7. Demonstrate safe and appropriate use of tools, machines, and materials.
8. Identify statics and strengths of materials as they relate to their specific project(s).
9. Identify material classifications and properties utilizing appropriate testing methods as they relate to their specific project(s).
10. Use appropriate engineering methodology for maximizing product reliability.
11. Demonstrate technical knowledge and skills associated with processing activities and practices of industrial materials.
12. Evaluate various types of wood, wood composites and industry-related materials as they relate to their specific projects.

# Introduction to Aerospace and Aviation 210226

This core aerospace and aviation course provides the foundation for all flight and aviation pathways. Students will gain an appreciation for the similarities and differences between aviation and aerospace. Students will also gain a historical perspective, starting from the earliest flying machines to the wide variety of modern aircraft and the integral role they play in making today's world work. Students will learn about the history and impact of space exploration and have opportunities to build and fly historical and contemporary aircraft and spacecraft designs. Students will also begin to drill down into the various sectors of aviation and the parts that make up the aviation and aerospace ecosystem. They will discover how advances in aviation created a need for regulation and will learn about the promulgation of civil aviation oversight. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 10**

**Recommended Credit: 1**

**Students will:**

1. Demonstrate an understanding of the history and development of aviation and space transportation.
2. Explain and demonstrate an understanding of the principles of flight, including Bernoulli's Principle, Newton's Laws of Motion, Universal Gravitation, and the forces that affect flight.
3. Describe and demonstrate an understanding of basic aerodynamics and airfoils.
4. Describe how flight simulators are used for training and their importance.
5. Perform flight maneuvers in a simulator: straight and level, turns, climbs and descents.
6. Demonstrate practical knowledge of digital technology and communications related to aviation/aerospace projects.
7. Identify and model specific functions of various aircraft structures.
8. Describe and demonstrate an understanding of the materials that are used in aircraft design and development.
9. Understand various aviation professional organizations and government resources/entities.
10. Introduce aviation safety, risk management, and aeronautical decision-making.
11. Explore and demonstrate the layout and general operations of the airport environment, including chart supplements, runway layout, and airport information database.
12. Define and safely demonstrate Unmanned Aircraft Systems (UAS) types and operations and regulations.
13. Describe and demonstrate an understanding of rocketry/space system technology and its application in space environments.
14. Explore the role of spacecraft in the exploration and colonization of space.
15. Describe the aviation/aerospace industry nationally and in Kentucky.
16. Demonstrate an understanding of career opportunities and requirements in the field of aerospace technologies.

# Introduction to Geographical Information Systems (GIS) 210241

This is an introductory course designed to provide basic theories and concepts of geographical information systems, including basic GIS capabilities, data collection, data types, GPS, and basic mapping concepts. Introduces GIS software using industry-specific applications and technology to provide a conceptual base to build expertise in GIS. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Explain what GIS is and the practical applications used in this field.
2. Use GIS software to edit basic spatial and attribute data.
3. Use GIS software to create and use basic geo-databases.
4. Explain basic topics of GIS, such as spatial data and attribute data management.
5. Explain the human and organizational issues.
6. Explain the differences between vector and raster data.
7. Use GIS software to create basic query features.
8. Use GIS software to build basic graphs, reports and personal systems.
9. Solve route problems from sets of interconnected lines using a network analysis program.
10. Combine layers of GIS data and locate areas of special concern using a spatial analysis program.
11. Create 3-dimensional representations of landscapes and other surfaces using satellite and aerial photographic images using a 3D analysis program.

# Manufacturing Engineering 210225

This comprehensive course is designed for the study of general concepts and principles of manufacturing and manufacturing systems. This course provides a hands-on learning experience that enhances the understanding of various metallic/nonmetallic materials, processes, and products. Materials studied may include polymers, ceramics, woods, composites, and metal materials associated with manufacturing. Students have the opportunity to engage in product design, prototyping, computer-assisted manufacturing applications, CNC machines, robotics, and production management. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Identify the basic processes, systems, designs, and materials used in manufacturing.
3. Identify product families.
4. Conduct model documentation as the process of recording details such as size and material development process that describes a model for communication of ideas.
5. Apply the principles of design for manufacturing, enabling the efficient and effective production of products.
6. Distinguish the difference between custom and industrial furniture production.
7. Demonstrate safe and appropriate use of tools, machines, and materials in materials and processes technology.
8. Select and defend a material for use in a product, explaining material properties and characterization based on manufacturing processes, chemical composition, internal defects, temperature, previous loading, dimensions and other factors.
9. Demonstrate an understanding of mechanisms and how they relate to manufacturing systems.
10. Apply the principles of robotics to automated systems.
11. Integrate control systems and equipment with production and production support mechanisms.
12. Demonstrate proficiency in the set-up and operation of manual and CNC wood and/or metalworking machines.
13. Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.

# Mechanical Engineering 210118

This course includes activities and real-world projects with state-of-the-art equipment and trainers. Students explore and study an introduction to engineering, engineering design problem solving, and engineering graphics with 3-D parametric modeling software. Students prototype a part design and prepare the manufacturing process using a 3-D printer, computer numeric control (CNC) Vertical Mill, computer numeric control (CNC) turning center, a material handling robot and/or plastic molding machine. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Demonstrate an understanding of manufacturing, its history, models, and procedures.
3. Demonstrate an understanding of control systems and methods to describe or document their processes.
4. Demonstrate an understanding of the cost of manufacturing.
5. Demonstrate proficiency in designing products for manufacturability.
6. Demonstrate an understanding of manufacturing processes.
7. Demonstrate an understanding of computer numeric control (CNC) as it relates to product design and development.
8. Demonstrate an understanding of automation and robotics relative to the manufacturing process.
9. Demonstrate an understanding of the elements of power and the associated mathematics.
10. Build, program, and configure a robot to perform predefined tasks.
11. Demonstrate an understanding of the elements of Computer Integrated Manufacturing (CIM).
12. Demonstrate proficiency in designing an efficient, flexible manufacturing system (FMS) that contains Computer Integrated Manufacturing (CIM) elements.

# Mechatronics Engineering 210230

Mechatronics Engineering is an electromechanical systems course that provides students with instruction and experience with mechanical devices, actuators, sensors, electronics, intelligent controllers and computers. Students gain an understanding of the principles of electricity and mechanics and their application to gears, including hydraulic/ pneumatic equipment, cams, levers, circuits, and other devices used in the manufacturing process or within manufactured goods. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 9 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Define engineering systems, including mechanisms, thermodynamics, fluid systems, electrical systems and control systems.
3. Demonstrate a fundamental understanding of electronics and electricity.
4. Apply troubleshooting and critical thinking skills to define the problem.
5. Identify material classifications and properties utilizing appropriate testing methods.
6. Calculate work and power in mechanical systems.
7. Measure forces and distances related to simple machines and mechanisms.
8. Calculate mechanical advantage and drive ratios of mechanisms.
9. Design, create, analyze and produce a mechanical system.
10. Demonstrate proficiency in using tools, instruments and test devices.
11. Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
12. Demonstrate an understanding of industrial safety, health, and environmental requirements.
13. Apply the principles of robotics to industrial automation systems.
14. Demonstrate proficiency in computer control and robotics.
15. Operate and troubleshoot pneumatic, hydraulic and electromechanical components or systems.
16. Use machine interfaces to control automated systems.
17. Define dynamics/kinematics, including linear and trajectory motion.

# Robotics Automation and Design 210239

This course provides students with content and skills essential to the design and operation of robotic systems. Students' activities will include artificial intelligence, specialized sensors, electronic applications, engineering technologies, environmental physics, manufacturing, topographical considerations, programming, motion physics, electric motors, communications, simulations, simulation and modeling, and critical thinking skills. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Correlate elements of artificial intelligence to their functions in robotics.
3. Describe the various classification schemes of sensors applicable to robotics.
4. Explain how electronic devices are used in the operation of a robotic assembly.
5. Demonstrate an understanding of various technologies used in the design of robotic assemblies.
6. Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly.
7. Create a program to control a robotic mechanism.
8. Describe the operation and use of various forms of electrical motors in robotic assemblies.
9. Demonstrate an understanding of basic 3D modeling concepts as they relate to robotics.
10. Analyze and apply data and measurements to solve problems and interpret documents.
11. Design, build, program, and configure a robot to perform predefined tasks.
12. Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
13. Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems.
14. Describe the role of specialized sensors in the design/operation of robotic systems.
15. Describe the use of specialized electronic applications used in robotic systems.
16. Demonstrate an understanding of the impact of robotics on the manufacturing process.
17. Create a program to control a robotic system.
18. Demonstrate an understanding of technologies for communication with and among robotic systems.

# Robotics Engineering 210238

This course provides students with the foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisites:** Engineering I 210221 and/or Engineering II 210222

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Demonstrate an understanding of robotics, its history, applications, and evolution.
3. Describe Artificial Intelligence (AI) and the forms of applied logic.
4. Describe the role of sensors in the field of robotics.
5. Demonstrate an understanding of the foundations of electronics.
6. Describe the operation of basic electronic devices used in robotics.
7. Demonstrate an understanding of engineering principles.
8. Explain fundamental physics concepts applicable to the field of robotics.
9. Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.
10. Build, program, and configure a robot to perform predefined tasks.
11. Employ technological tools to expedite workflow, including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendars, contacts, email, and internet applications.

# Technical Design I 210138

This course will provide students with instruction in the characteristics and evolution of drafting technology, underlying principles of design and fundamental knowledge and skills in the use of mechanical drawing, illustrations, and various forms of mechanical drawings, geometry and applied mathematics that apply to engineering design. Introduction to various forms of computer-aided software to gain basic skills and knowledge. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 9 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Define and demonstrate appropriate technical drawings based on a design solution.
3. Use basic drafting tools and techniques and develop accurate measurement techniques to communicate drafting ideas.
4. Demonstrate various drawing scales used in technical drawing.
5. Using basic drafting equipment, students will produce geometric shapes and figures that describe various objects, structures, and designs.
6. Demonstrate knowledge and skill with illustration techniques and working drawings.
7. Demonstrate basic mathematic concepts in basic arithmetic, algebra, geometry, and trigonometry to solve problems and apply multiple discipline calculations.
8. Prepare mechanical drawings that consist of, but are not limited to, isometric, oblique, 3-view orthographic projections, auxiliary views, sectional and dimensions.

# Technical Design II 210108

This course contributes to the development of each high school student's capability to understand how technology's development, control, and use are based on design constraints and human wants and needs. The structure of the course challenges students to use technological design processes so that they can think, plan, design, and create solutions to engineering and technological problems. Students are actively involved in the organized and integrated application of technological resources, engineering concepts, and scientific procedures. Students address the complexities of technology that stem from designing, developing, using, and assessing technological systems. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Prerequisite:** Technical Design I 210138

**Recommended Grade Level: 10 – 12**

**Recommended Credit: 1**

**Students will:**

1. Apply the design process involving problem identification, conceptualization, research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Use the design process to fabricate products related to one or more of the seven contexts of technological literacy (agriculture, bio-related, medical, construction, manufacturing, transportation, and communications).
3. Engage in meaningful, hands-on, minds-on, technology-based activities using tools, machines, materials, and processes.
4. Analyze various design concepts, constraints, and processes related to product development employing critical thinking skills.
5. Work individually, in teams, or as a total class to solve design-related activities.
6. Identify opportunities, characteristics, and preparation requirements for current and emerging design-related occupations.

# Unmanned Aircraft Systems 210251

This course is an introduction to unmanned aircraft systems (UAS). A history of UAS, typical applications and an overview of regulations, airframe and powerplant systems, sensors, ground control stations, airspace, weather, and other foundational skills needed to operate UAS in the U.S. airspace systems safely will be covered. This course will incorporate hands-on practical applications and will give students the opportunity to design, build, and pilot UAS, both remotely and autonomously. Students will be prepared to complete the *Federal Aviation Administration's Part 107 Remote Pilot* written exam upon completion of this course. Participation in Kentucky Technology Student Association will greatly enhance instruction.

**Recommended Grade Level: 11 – 12**

**Recommended Credit: 1**

**Students will:**

1. Explain some of the significant milestones in the history of UAS.
2. Describe several commercial and military applications of UAS.
3. Identify and define the major components of a UAS.
4. Explain how sensing systems function in a UAS.
5. Describe the fundamentals of airframe and powerplant design for UAS
6. Describe the fundamentals of communication, command, and control for UAS.
7. Explain the basic principles of detect and avoid.
8. Interpret a VFR sectional aeronautical chart.
9. Locate and interpret NOTAMs.
10. Evaluate launch sites for UAS operations.
11. Explain the different classes of airspace and the restrictions on UAS operations in each.
12. Read and interpret aviation weather reports, including METARs, TAFS, SIGMETS, and AIRMETS.
13. Describe the rules for UAS operations as defined in FAA CFR part 107.
14. Determine the effects of aircraft loading, weight and balance on UAS operation.
15. Design, build, and pilot a UAS safely and effectively.
16. Operate a UAS both remotely and autonomously.
17. Use proper radio communication procedures.
18. Identify physical and psychological factors that affect UAS operations.
19. Describe preflight and preventative maintenance procedures for a UAS.
20. Explain airport operations that could impact UAS operations.
21. Apply aeronautical decision-making and judgment during the use of UAS.