

Middle School Engineering Technology Education Standards

Academic

- A1 Utilize effective verbal and non-verbal communication skills
- A2 Participate in conversation, discussion and group presentations
- A3 Locate and interpret written information
- A4 Identify relevant details, facts and specifications
- A5 Record information accurately and completely
- A6 Demonstrate competence in organizing, writing and editing using correct vocabulary, spelling, grammar and punctuation
- A7 Demonstrate the ability to write clearly and concisely
- A8 Implement effective decision-making skills
- A9 Perform basic and higher-level math operations (e.g., addition, subtraction, multiplication, division, decimals, fractions, units of conversion, averaging, percentage, proportion, ratios)
- A10 Use tables, graphs, diagrams and charts to obtain or convey information
- A11 Identify the components of a budget and how one is created
- A12 Set personal financial goals and develop a plan for achieving them
- A13 Identify and apply Internet security practices (e.g., password security, login, logout, log off, lock computer)
- A14 Use technology appropriately to enhance task
- A15 Demonstrate appropriate etiquette when using e-communications (e.g., cell phone, e-mail, conference calls)

Employability

- E1 Demonstrate positive work ethic when completing new tasks
- E2 Abide by workplace policies and procedures
- E3 Demonstrate honesty and reliability
- E4 Demonstrate ethical characteristics and behaviors
- E5 Demonstrate polite and respectful behavior toward others
- E6 Demonstrate personal accountability in the workplace
- E7 Demonstrate pride in work
- E8 Demonstrate ability to stay on task to produce high quality deliverables on time
- E9 Explain the importance of respect for feelings, values and beliefs of others
- E10 Identify strategies to bridge cultural/generational differences and use differing perspectives to increase overall quality of work
- E11 Recognize the challenges and advantages of diversity in the workplace
- E12 Demonstrate effective team skills and evaluate their importance in the workplace (e.g., setting goals, listening, following directions, questioning, dividing work)

- E13 Contribute new ideas while valuing varying ideas and opinions
- E14 Implement conflict resolution strategies and problem-solving skills
- E15 Recognize the importance of maintaining an age appropriate job and pursuing a potential career
- E16 Define jobs associated with a specific career path or profession
- E17 Seek and capitalize on self-improvement opportunities
- E18 Accept and provide constructive criticism

Personal Growth

- OA1 Examine the impact of heredity, environment and other factors on human growth and development across the lifespan (i.e. Maslow's Hierarchy of Needs)
- OA2 Examine individual and family values to make choices to satisfy needs, wants and goals
- OA3 Implement the decision making process
- OA4 Demonstrate verbal and nonverbal communication skills that contribute to positive relationships
- OA5 Examine the positive and negative impacts of technology on individuals, families, and society
- OA6 Determine factors and behaviors that contribute to healthy and unhealthy relationships
- OA7 Examine the effect of self-esteem and self-image on relationships
- OA8 Analyze the resources available to address the impact of risky behaviors on individuals and families
- OA9 Evaluate effective conflict prevention and management techniques in relationships

General Lab Safety Rules and Procedures

- OB1 Describe general lab/shop safety rules and procedures
- OB2 Comply with the required use of personal protection equipment (PPE) (e.g., safety glasses, ear protection, gloves, shoes) during lab/shop activities
- OB3 Identify and wear appropriate clothing for lab/shop activities
- OB4 Secure hair and jewelry for lab/shop activities
- OB5 Perform housekeeping duties
- OB6 Follow verbal and written instructions to complete work assignments
- OB7 Demonstrate ergonomically safe use of lab equipment, furniture and materials
- OB8 Identify the location of the posted evacuation routes

Hand Tools

- OC1 Identify hand tools and their appropriate usage
- OC2 Demonstrate proper techniques when using hand tools
- OC3 Demonstrate safe handling and use of appropriate tools

Power Tools and Equipment

- OD1 Identify power tools/equipment (e.g., band saw, drill press, table saw, sanders, portable power tools) and their appropriate usage
- OD2 Demonstrate safe and proper techniques when using power tools and equipment
- OD3 Demonstrate proper cleaning, storage and maintenance of power tools and equipment

History of Science, Technology, Engineering and Mathematics (STEM)

- OE1 Define Science, Technology, Engineering and Mathematics and their relationship to each other
- OE2 Identify engineering & technology achievements (e.g., space race, computer technology, aqueducts, skyscrapers, bridges, subways, airports) throughout history
- OE3 Identify famous inventors (e.g., Edison, Tesla, Bell, da Vinci, Washington Carver, Ford) and their achievements throughout history
- OE4 Analyze how an invention or innovation was influenced by its historical context
- OE5 Compare various technologies and how they have contributed to human progress
- OE6 Investigate the evolution of a product and describe product life cycle
- OE7 Explain how technology and engineering are closely linked to creativity, which can result in both intended and unintended innovations

Careers in STEM

- OF1 Investigate STEM careers, training, professional organizations and associated opportunities
- OF2 Describe similarities and differences in various STEM Careers
- OF3 Explore career opportunities and list the educational requirements for several STEM fields of interest
- OF4 Research careers related to various engineering fields and their education requirements
- OF5 Research STEM fields including non-traditional career paths to understand workload, education, job outlook and salary
- OF6 Research the pros/cons of STEM careers and what their impact is on the Kentucky workforce

Ethics in Engineering

- OG1 Introduce, discuss and explore ethical and technical issues contributing to an engineering disaster
- OG2 Examine the ways that technology can have both positive and negative effects at the same time
- OG3 Connect with Engineering and Engineering Technology professionals in your community to discuss engineering ethics

Engineering Design Process

- OH1 Identify several design processes
- OH2 Explain how a design process is a systematic, iterative, problem-solving method that produces solutions to meet human needs and wants
- OH3 Identify the activities that occur during each phase of a design process
- OH4 Apply the steps of a design process to solve a variety of design problems
- OH5 Utilize conceptual, mathematical and physical models to evaluate design solutions
- OH6 Incorporate computer technology to assist in organizing and analyzing data collected during a design process
- OH7 Document various design process solutions and communicate to the intended audience
- OH8 Adapt and change as problems arise in the design process
- OH9 Demonstrate best practices when working through the design process on a team

Utilize a Digital Portfolio to Apply an Engineering Design Process

- OI1 Present and justify the problem
- OI2 Document and analyze prior solution(s) attempt
- OI3 Present and justify a solution's criteria and constraints
- OI4 Generate, analyze and select a viable concept
- OI5 Construct a testable prototype
- OI6 Collect and analyze data
- OI7 Document external evaluations
- OI8 Reflect on the design process
- OI9 Present the digital project portfolio and design solution
- OI10 Write like an engineer

Freehand Technical Sketching Techniques

- OJ1 Develop design ideas using freehand sketching
- OJ2 Identify the six primary orthographic views
- OJ3 Create pictorial and multiview sketches
- OJ4 Create rough, refined and presentation sketches
- OJ5 Utilize the alphabet of lines (i.e. object, hidden, center)
- OJ6 Legibly annotate sketches
- OJ7 Interpret basic symbols and terminology

Measuring and Scaling Techniques

- OK1 Identify industry standard units of measure
- OK2 Convert between industry standard units of measure
- OK3 Demonstrate proper use of precision measuring tools
- OK4 Make precision measurements to the degree of accuracy required by the specifications using appropriate instruments
- OK5 Measure effectively and accurately to accomplish engineering-related tasks

Engineering Documentation and Communication Procedures

- OL1 Demonstrate record keeping procedures by utilizing an engineering notebook
- OL2 Utilize appropriate digital file management techniques
- OL3 Identify basic components of a computer system and their function
- OL4 Present design solutions in a clear and concise manner
- OL5 Utilize appropriate presentation techniques

Computer Aided Design (CAD)

- OM1 Describe the purpose of CAD software
- OM2 Interpret basic elements of a technical drawing (e.g., title block, dimensions, line types)
- OM3 Describe and construct various types of CAD drawings (i.e., part, assembly, drawing)
- OM4 Create various mock-ups, scale models and working prototypes based on CAD drawings

Rapid Prototyping Technology

- ON1 Discuss current and emerging rapid prototyping applications in a variety of industries
- ON2 Demonstrate an understanding of rapid prototyping using a 3D printer to solve engineering related problems
- ON3 Demonstrate an understanding of rapid prototyping using a laser engraver to solve engineering related problems
- ON4 Describe the difference between additive and subtractive modeling

Aviation and Flight

- OO1 Identify the principles of flight (e.g., lift, drag, thrust, gravity)
- OO2 Develop and construct models to test flight characteristics of specified vehicles using appropriate materials
- OO3 Explore the application of Newton's laws and Bernoulli's principle of flight
- OO4 Research and explain the role and future of autonomous/unmanned aircraft
- OO5 Execute a mission for an Unmanned Aerial System (UAS)
- OO6 Explain applications for UAS in various engineering fields

Structures

- OP1 Research various types of structures (e.g., bridges, towers, trusses)
- OP2 Identify forces (e.g., tension, compression, torque, shear) that act on structures
- OP3 Construct structures to calculate forces

Electricity and Electronics

- OQ1 Interpret basic electrical schematics
- OQ2 Compare and contrast the behavior of electrical circuits with parallel and series circuit designs

- OQ3 Distinguish between digital and analog components
- OQ4 Demonstrate soldering through various projects
- OQ5 Demonstrate breadboarding through various projects
- OQ6 Determine resistor values based on a color code chart
- OQ7 Demonstrate proper use of various electrical equipment used to measure electrical properties
- OQ8 Demonstrate an understanding of electronics using a microcontroller to solve engineering related problems

Machine Design and Manufacturing Systems

- OR1 Distinguish between the six simple machines, their attributes and components
- OR2 Measure forces and distances related to simple machines
- OR3 Calculate mechanical advantage of all simple machines
- OR4 Design, construct and test various simple machines
- OR5 Design, construct and test a compound machine
- OR6 Identify and calculate the advantages and disadvantages of different types of gears
- OR7 Design, construct and calculate various gear ratios
- OR8 Define, identify and demonstrate forms of potential and kinetic energy
- OR9 Identify different machine elements (e.g., cam mechanisms, linkages, belt drives) in motion and their components
- OR10 Design, build and test a machine utilizing multiple machine elements and components that also meets safety requirements
- OR11 Create a control program to accomplish an objective using various inputs and outputs
- OR12 Apply basic physics concepts (e.g., velocity, speed, force, distance, torque, fluid power) to solve various design problems
- OR13 Calculate work and power
- OR14 Create an open-loop system that has no feedback path and requires human intervention
- OR15 Create a closed-loop system that has a feedback path and requires no human intervention

Thermodynamics

- OS1 Describe convection, conduction and radiation as they apply to thermal energy transfer
- OS2 Design, construct and test insulation materials for reducing thermal energy transfer

Dynamics

- OT1 Describe Newton's three laws of motion
- OT2 Describe and calculate the impact of torque on a rotating system

Robotics

- OU1 Define common types of robots

- OU2 Define work envelope
- OU3 Construct basic robotic systems using technical drawings
- OU4 Identify various inputs and outputs used in robotic systems
- OU5 Describe accuracy and repeatability in the field of robotics
- OU6 Demonstrate an understanding of robotics, its history, applications, evolution and future
- OU7 Demonstrate an understanding of the impact of robotics on the manufacturing process
- OU8 Demonstrate an understanding of 3D modeling concepts as it relates to robotics
- OU9 Design and build a working model of a robot
- OU10 Construct and evaluate advantages and disadvantages of different structures/chassis
- OU11 Predict robot motion resulting from movement of an actuator
- OU12 Apply basic programming to robotic systems to solve various engineering related problems
- OU13 Explore Artificial Intelligence (AI) and Automation