

### **Engineering and Technology – Middle Level**

*Engineering and Technology Education – Middle Level* provides students with hands-on, problem-based learning opportunities that introduce the principles to develop, produce, use, and assess product related to engineering and technology. Students additionally develop individual and teamwork skills to participate in society and the workplace. The four domains included in these standards are general engineering and technology concepts, engineering design and development, producing and using technology, and technology careers. Activities should focus on content related to engineering and technology as a body of knowledge, using resources and actions to: (1) apply engineering design, (2) use processes to produce artifacts and systems, (3) use devices tools and systems safely and appropriately, (4) and assess impacts on society and the environment.

- DOE Code: 0490
- Recommended Grade Level: 6-8

#### **Middle School Requirement:**

Middle School students are to receive instruction every year in a minimum of two of the following areas: Agriculture, Business, Family and Consumer Science, and Engineering Technology Education. (511 IAC 6.1-5-3.6(b)(6))

#### **Implementation Guidance:**

Engineering and Technology Education at the middle school covers a wide variety of topics in order to prepare students for course choices at the high school level. Domains 1, 2, and 4 are considered **essential**. Domain 3 could be considered “as time permits”. In order to allow students to have experiences in transportation, construction, manufacturing, energy and power, biotechnology, and communications, it is *recommended* that students receive instruction in engineering and technology education every year.

#### **Career and Technical Student Organizations (CTSOs)**

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in Technology Students of America (TSA) if available.

## Domain 1 – General Engineering and Technology Concepts

**Core Standard 1** *Students will examine how engineering and technology helps improve, manage, and control natural and engineered environments.*

- ETE – 1.1 Illustrate the purpose of engineering and technology in society.
- ETE – 1.2 Identify how engineering and technology impacts individuals, society, and the environment.
- ETE – 1.3 Apply the universal systems model when studying areas of engineering and technology.
- ETE – 1.4 Demonstrate safe practices and procedures with tools and equipment.

**Core Standard 2** *Students will integrate engineering and technology into academic fields, including the STEM disciplines.*

- ETE – 2.1 Analyze the interdisciplinary nature of engineering and technology.
- ETE – 2.2 Apply knowledge and skills learned in science, mathematics, language arts, fine arts, and social studies classes when completing engineering and technology-based assignments.

**Core Standard 3** *Students will investigate the evolution of engineering and technology of products, structures, and systems.*

- ETE – 3.1 Analyze how the eras in history are based on technological innovations and practices of the period.
- ETE – 3.2 Investigate inventions and innovations of products, processes, materials, and tools.
- ETE – 3.3 Compare technology inventions and innovations and the positive/negative impacts on society and the environment.

## Domain 2 – Engineering Design and Development

**Core Standard 4** *Students will apply engineering principles when planning, developing, implementing, and analyzing technological solutions.*

- ETE – 4.1 Apply the steps of the design process.
- ETE – 4.2 Use the design process to create a product that addresses a real world problem.
- ETE – 4.3 Create a technical sketch of a design with appropriate annotation.
- ETE – 4.4 Develop a product using the design process, while maintaining appropriate documentation.
- ETE – 4.5 Develop various types of models (graphical, physical, or mathematical) that help communicate solutions to peers.

**Core Standard 5** *Students will apply the principles of automation and robotics.*

- ETE – 5.1 Differentiate between the functions of motors, gears, sensors, wheels and control systems.
- ETE – 5.2 Interpret a technical document to build a working prototype of an automated system.
- ETE – 5.3 Design a working prototype or mechanical system to solve a pre-designated task.
- ETE – 5.4 Utilize the principles of computer science and information technologies by developing applications and codes applying to automation and robotics.

**Domain 3 – Producing and Using Technology**

**Core Standard 6** *Students will select, use, create, and evaluate transportation technologies.*

- ETE – 6.1 Compare and contrast the different types and uses of land, sea, air, space, and intermodal transportation.
- ETE – 6.2 Differentiate between the technical sub-systems common of all vehicles, including propulsion, structural, suspension, control, information, and support systems.
- ETE – 6.3 Design, develop, and evaluate transportation systems.

**Core Standard 7** *Students will select, use, create, and evaluate construction technologies.*

- ETE – 7.1 Investigate various types of construction systems including residential, industrial, commercial, and civil.
- ETE – 7.2 Utilize appropriate designs, techniques, tools, and processes for construction systems.
- ETE – 7.3 Construct simulations, models, and/or structures for specific construction systems.

**Core Standard 8** *Students select, use, create, and evaluate manufacturing technologies.*

- ETE – 8.1 Investigate various types of manufacturing systems including continuous, batch, and custom.
- ETE – 8.2 Utilize appropriate designs, techniques, tools, materials, and processes for manufacturing systems.
- ETE – 8.3 Produce simulations, models, and/or prototypes for specific manufacturing systems.
- ETE – 8.4 Describe and create a logistical path a product takes from its point of origin to its destination.

**Core Standard 9** *Students select, use, create, and evaluate biotechnologies.*

- ETE – 9.1 Investigate various types of biotechnologies including agricultural, genetics, medical, and imaging technologies.
- ETE – 9.2 Examine appropriate designs, techniques, tools, and processes for medical or genetic engineering.
- ETE – 9.3 Construct simulations, models, and/or prototypes for specific biotechnology disciplines.

**Core Standard 10** *Students will identify, select, and use energy and power technologies.*

- ETE – 10.1 Analyze a variety of power and energy technology systems.
- ETE – 10.2 Solve a simple power and energy challenge and create an efficient solution.
- ETE – 10.3 Utilize appropriate designs, techniques, tools, and processes for energy and/or power systems.
- ETE – 10.4 Design and construct simulations, models, and/or prototypes for specific power systems.

**Core Standard 11** *Students will select, use, create, and evaluate communication technologies.*

- ETE – 11.1 Evaluate the parts of a communication system.
- ETE – 11.2 Investigate various types of communication technologies including analog and digital technologies.
- ETE – 11.3 Design and construct simulations/models/prototypes for specific communication systems.
- ETE – 11.4 Analyze how information technology impacts modes of communication.

**Domain 4 – Engineering and Technology Careers**

**Core Standard 12** *Students will explore engineering and technology related careers.*

- ETE – 12.1 Investigate careers in engineering and technology pathways.
- ETE - 12.2 Analyze education and skill requirements for engineering and technology professions.
- ETE – 12.3 Report the outlook, demand, and projected wages for engineering and technology careers.