

PROGRAM CONCENTRATION:	Engineering and Technology
CAREER PATHWAY:	Electronics
COURSE TITLE:	Foundations of Electronics

This course is designed for beginning students who are interested in careers related to the design, production, analysis, repair, and operation of devices that use electronics. The course should be designed around major individual and class projects that promote critical thinking, problem solving, and abstract reasoning that encourages the student to become an investigative life long learner. Teachers should develop units around real-life work centered situations that integrate content across the curriculum. The integrated project should provide the student with opportunities to develop and demonstrate technical, academic, cognitive, and personal competencies. Job shadowing, interviews, and internships are encouraged. A variety of teaching methods such as class discussions, demonstrations, class activities, homework, and modules should be used to prepare and assist the student with developing a competency base. At the end of each unit, students should be evaluated using a variety of assessments that consider multiple learning styles, abilities, and skills. Assessments should include daily work habits, class assignments, homework, tests, organization, and project evaluation. Students are expected to set goals, research careers, and develop plans for achieving desired goals.

ENGR-FE-1. Students will be introduced to the history and development of electron theory.

- a. Discuss the history of electron theory.
- b. Identify the atom: protons, neutrons, and electrons.
- c. Identify material conductivity/insulators.

Academic Standards:

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh6. Students will communicate scientific investigations and information clearly.

SCSh8. Students will understand important features of the process of scientific inquiry.

SP2. Students will evaluate the significance of energy in understanding the structure of matter and the universe.

ENGR-FE-2. Students will be introduced to the techniques and processes in electronics systems.

- a. Explain basic soldering.
- b. Explain procedures for connecting circuit components.
- c. Conduct laboratory experiments utilizing appropriate soldering techniques.

- d. Evaluate prototype produced.

Academic Standards:

MM1P1. Students will solve problems (using appropriate technology).

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulation scientific equipment and materials.

SCSh6. Students will communicate scientific investigations and information clearly.

ENGR-FE-3. Students will be introduced to various measuring apparatus appropriate to electronic systems.

- a. Identify a multi-meter.
- b. Identify an oscilloscope.
- c. Discuss virtual computer simulation testing.
- d. Construct a continuity prototype device.

Academic Standards:

MM1P1. Students will solve problems (using appropriate technology).

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulation scientific equipment and materials.

ENGR-FE-4. Students will be introduced to electronic components that comprise an electronic system.

- a. Identify Resistor Color Code and component polarity.
- b. Identify and describe various resistors, capacitors, transistors, coils, semiconductors, etc.
- c. Discuss circuit design and construction.
- d. Develop and evaluate a prototype device.

Academic Standards:

MM1P1. Students will solve problems (using appropriate technology).

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh3. Students will identify and investigate problems scientifically.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulation scientific equipment and materials.

ENGR-FE5- Students will identify electronic theories applicable to electronic processes.

- a. Define Ohm's law and formula component parts.
- b. Define Kirchoff's law and component parts.
- c. Define Watt's law and component parts.
- d. Design and analyze a simple circuit to determine the values of the various electronic component parts.
- e. Demonstrate the use of metric prefixes and value conversions.

Academic Standards:

MM1P1. Students will solve problems (using appropriate technology).

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh3. Students will identify and investigate problems scientifically.

SP5. Students will evaluate relationships between electrical and magnetic forces.

ENGR-FE-6. Students will construct an electronic device as a culminating experience.

- a. Construct Series, Parallel and Series/Parallel circuits.
- b. Simulate test circuits utilizing electronic software.
- c. Design, construct, and test an electronic device from component parts.
- d. Construct an electronic device utilizing a vender kit.

Academic Standards:

MM1P1. Students will solve problems (using appropriate technology).

MC3P4. Students will make connections among mathematical ideas and to other disciplines.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students will use tools and instruments for observing, measuring, and manipulation scientific equipment and materials.

SCSh8. Students will understand important features of the process of scientific inquiry.

STEM Standards (Common to all Engineering & Technology Courses)

Nature of Technology

ENGR-STEM-1. Students will recognize the systems, components, and processes of a technological system.

- a. Describe the core concepts of technology.
- b. Identify the relationships among technologies along with connections to contemporary issues.
- c. Apply lifelong learning strategies necessary to understand the characteristics and scope of technology.

Academic Standards:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

SCSh7. Students analyze how scientific knowledge is developed.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

Technology and Society

ENGR-STEM-2. Students will identify the impact of engineering and technology within global, economic, environmental, and societal contexts.

- a. Describe the social, economic, and environmental impacts of a technological process, product, or system.
- b. Demonstrate ethical and professional behavior in the development and use of technology.
- c. Explain the influence of technology on history and the shaping of contemporary issues.

Academic Standards:

SCSh7. *Students analyze how scientific knowledge is developed.*

MM3P4. *Students will make connections among mathematical ideas and to other disciplines.*

Design

ENGR-STEM-3. Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.

- a. Demonstrate fundamental principles of design.
- b. Design and conduct experiments along with analysis and interpretation of data.
- c. Identify and consider realistic constraints relevant to the design of a system, component, or process.

Academic Standards:

SCSh1. *Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.*

SCSh3. *Students will identify and investigate problems scientifically.*

SCSh4. *Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.*

SCSh5. *Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.*

SCSh8. *Students will understand important features of the process of scientific inquiry.*

MM3P1. *Students will solve problems (using appropriate technology).*

MM3P2. *Students will reason and evaluate mathematical arguments.*

Abilities for a Technological World

ENGR-STEM-4. Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.

- a. Work cooperatively in multi-disciplinary teams.
- b. Apply knowledge of mathematics, science, and engineering design.
- c. Demonstrate strategies for identifying, formulating, and solving technological problems.
- d. Demonstrate techniques, skills, and knowledge necessary to use and maintain technological products and systems.

Academic Standards:

SCSh3. *Students will identify and investigate problems scientifically.*

SCSh4. *Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.*

SCSh5. *Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.*

SCSh6. *Students will communicate scientific investigations and information clearly.*

SCSh8. *Students will understand important features of the process of scientific inquiry.*

MM3P4. *Students will make connections among mathematical ideas and to other disciplines.*

The Designed World

ENGR-STEM-5. Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.

- a. Use common tools correctly and safely.
- b. Describe strategies for selecting materials and processes necessary for developing a technological system or artifact.
- c. Demonstrate fundamental materials processing and assembly techniques.
- d. Evaluate the interdependence of components in a technological system and identify those elements that are critical to correct functioning.
- e. Apply analytical tools to the development of optimal solutions for technological problems.

Academic Standards:

SCSh2. *Students will use standard safety practices for all classroom laboratory and field investigations.*

SCSh3. *Students will identify and investigate problems scientifically.*

SCSh4. *Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.*

SCSh5. *Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.*

MM3P1. *Students will solve problems (using appropriate technology).*

MM3P2. Students will reason and evaluate mathematical arguments.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

Reading

ENGR-STEM-6. Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.

- a. Read in all curriculum areas.
- b. Discuss books.
- c. Build vocabulary knowledge.
- d. Establish context.

Academic Standards:

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

Leadership Development

ENGR-STEM-7. Students will develop leadership and interpersonal problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.

- a. Demonstrate effective communication skills.
- b. Participate in teamwork to accomplish specified organizational goals.
- c. Demonstrate cooperation and understanding with persons who are ethnically and culturally diverse.

Academic Standards:

MM3P3. Students will communicate mathematically.

MM3P5. Students will represent mathematics in multiple ways.

SCSh6. Students will communicate scientific investigations and information clearly.

CTAE Foundation Skills

The Foundation Skills for Career, Technical and Agricultural Education (CTAE) are critical competencies that students pursuing any career pathway should exhibit to be successful. As core standards for all career pathways in all program concentrations, these skills link career, technical and agricultural education to the state's academic performance standards.

The CTAE Foundation Skills are aligned to the foundation of the U. S. Department of Education's 16 Career Clusters. Endorsed by the National Career Technical Education Foundation (NCTEF) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), the foundation skills were developed from an analysis of all pathways in the sixteen occupational areas. These standards were identified and validated by a national advisory group of employers, secondary and postsecondary educators, labor associations, and other stakeholders. The Knowledge and Skills provide learners a broad foundation for managing lifelong learning and career transitions in a rapidly changing economy.

CTAE-FS-1 Technical Skills: Learners achieve technical content skills necessary to pursue the full range of careers for all pathways in the program concentration.

CTAE-FS-2 Academic Foundations: Learners achieve state academic standards at or above grade level.

CTAE-FS-3 Communications: Learners use various communication skills in expressing and interpreting information.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

CTAE-FS-5 Information Technology Applications: Learners use multiple information technology devices to access, organize, process, transmit, and communicate information.

CTAE-FS-6 Systems: Learners understand a variety of organizational structures and functions.

CTAE-FS-7 Safety, Health and Environment: Learners employ safety, health and environmental management systems in corporations and comprehend their importance to organizational performance and regulatory compliance.

CTAE-FS-8 Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

CTAE-FS-9 Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

CTAE-FS-10 Career Development: Learners plan and manage academic-career plans and employment relations.

CTAE-FS-11 Entrepreneurship: Learners demonstrate understanding of concepts, processes, and behaviors associated with successful entrepreneurial performance.