

PROGRAM CONCENTRATION:
CAREER PATHWAY:
COURSE TITLE:

Engineering & Technology
Electronics
Digital Electronics

Digital Electronics is the third course in the Electronics pathway. Students have opportunities to apply prior learning in electronics to the digital world in which they live. Students use applications of mathematics and science to predict the success of an engineered solution and complete hands-on activities with tools, materials, and processes as they develop functional devices and working prototypes aided by computer simulations.

ENGR-DE-1. Students will analyze characteristics of digital and analog systems.

- a. Differentiate between digital and analog systems.
- b. Identify numbering systems used in digital electronics and demonstrate conversion between systems.
- c. Apply Boolean concepts to simplification processes.

Academic Standards:

SCSh3. Students will identify and investigate problems scientifically.

SCSh7. Students analyze how scientific knowledge is developed.

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

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

MM3P3. Students will communicate mathematically.

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

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.

ENGR-DE-2. Students will demonstrate the use of names, symbols, truth tables, and Boolean expression for each of the seven basic logic gates.

- a. Identify AND, OR, NOT, NOR, NAND, exclusive OR, and exclusive NOR gates.
- b. Identify practical TTL and CMOS logic gates.
- c. Identify IEEE logic symbols.
- d. Discuss simplification techniques.

Academic Standards:

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

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

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

MM3P3. *Students will communicate mathematically.*

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

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.*

ENGR-DE-3. Students will demonstrate the use of several commonly used digital codes, including the conversion of decimal numbers and letters to code.

- a. Define and discuss 8421 BCD, Excess-3, and ASCII codes.
- b. Define and discuss encoders/decoders.
- c. Explain displays.

Academic Standards:

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

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

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

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

MM3P3. *Students will communicate mathematically.*

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

MM3P5. *Students will represent mathematics in multiple ways.*

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

ENGR-DE-4. Students will use truth tables and interpret waveforms to determine flip-flop modes of operation and outputs.

- a. Discuss RS, D, and JK flip-flop circuits.
- b. Discuss IC Latches and Schmitt Triggers.
- c. Identify IEEE Logic Symbols.

Academic Standards:

SCSh3. Students will identify and investigate problems scientifically.

SCSh6. Students will communicate scientific investigations and information clearly.

SCSh7. Students analyze how scientific knowledge is developed.

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

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

MM3P3. Students will communicate mathematically.

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

MM3P5. Students will represent mathematics in multiple ways.

ENGR-DE-5. Students will determine the output for a variety of counters based on a series of inputs.

- a. Discuss ripple, synchronous, down, and self-stopping counters.
- b. Discuss frequency dividers.
- c. Discuss shift registers.
- d. Discuss counting real world events.

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.

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

MM3P3. Students will communicate mathematically.

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

ENGR-DE-6. Students will design and draw block-style logic diagrams for several parallel adder and subtractor circuits.

- a. Discuss adders.
- b. Discuss subtractors.
- c. Discuss binary multiplication.

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 data and developing reasonable scientific explanations.

SCSh6. Students will communicate scientific investigations and information clearly.

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

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

ENGR-DE-8. Students will list and characterize common memory and storage devices used in a microcomputer system.

- a. Discuss fundamentals.
- b. Discuss RAM, Static RAM, ROM, and PROMs.
- c. Discuss non-volatile read/write.

Academic Standards:

SCSh3. Students will identify and investigate problems scientifically.

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.

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.