

PROGRAM CONCENTRATION:
CAREER PATHWAY:
COURSE TITLE:

Engineering and Technology
Manufacturing
Production Enterprises

The purpose of this course is to give students an understanding of how to design and implement a production system. Students learn how businesses engage in the production of products beginning with pre-production activities and continuing through post-production activities. Additionally, students will learn about the historical and societal impact of production. Students will also develop an understanding of careers available in manufacturing and the skills and education required for those careers.

ENGR-PE-1. Students will explain the historical and societal impact of production.

- a. Track the evolution of production and its impact on society.
- b. Describe the impact of production throughout American history.
- c. Describe how production has influenced American safety and environmental policy.

ACADEMIC STANDARDS:

SSUSH12. The student will analyze important consequences of American industrial growth.

ENGR-PE-2. Students will research careers in manufacturing.

- a. Develop an understanding of career opportunities in manufacturing.
- b. Identify the skills and education required for various careers in manufacturing.

ENGR-PE-3. Students will explain how and why production enterprises value safe work environments.

- a. Identify the historical reasons for workplace safety initiatives.
- b. Identify the costs of accidents.
- c. Develop a safety engineering process emphasizing hazard recognition and accident prevention.
- d. Identify federal environmental regulations that impact production enterprises.

ENGR-PE-4. Students will conduct pre-production market research, product design, and product development.

- a. Conduct and compile market research.
- b. Choose appropriate materials and processes for the specified product.
- c. Develop a product prototype.
- d. Determine the cost of production, develop a break even analysis and develop a cost analysis report.

- e. Investigate funding opportunities for the production enterprise.
- f. Use market research and cost analysis to prepare and execute a persuasive presentation to generate support from a decision making group.

ACADEMIC STANDARDS:

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

MM1P4. Students will make connections among mathematical ideas and other disciplines.

MM1P5. Students will represent mathematics in multiple ways.

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

ELA11LSV1. The student participates in student-to-teacher, student-to-student, and group verbal interactions.

ENGR-PE-5. Students will design a production system.

- a. Compare and contrast various production techniques.
- b. Decide on an appropriate production technique for the specified product.
- c. Evaluate the appropriateness of the chosen technique and make necessary changes to maximize efficiency.
- d. Perform a time/motion study.
- e. Design, develop, and implement an efficient plant layout.
- f. Develop a plan for procurement of material and human resources.
- g. Develop a process for in-process and pre-shipping product testing.

ACADEMIC STANDARDS:

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

SCSh3. Students will identify and investigate problems scientifically.

ENGR-PE-6. Students will implement a production system.

- a. Execute production of the chosen manufactured product.
- b. Use data analysis techniques to improve product quality.
- c. Apply statistical process control to improve product quality.
- d. Use data analysis and continuous improvement techniques to enhance the production process.
- e. Perform in-process and pre-shipping product testing.

ACADEMIC STANDARDS:

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

MM1P3. Students will communicate mathematically.

MM1P4. Students will make connections among mathematical ideas and other disciplines.

MM1P5. Students will represent mathematics in multiple ways.

SCSh3. Students will identify and investigate problems scientifically.

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

ENGR-PE-7. Students will develop a reflective document on the completion of the production activity.

- a. Critique the effectiveness of the chosen production process used to manufacture the chosen product.
- b. Evaluate personnel performance of self and workforce.
- c. Suggest improvements to the chosen production process.
- d. Address impacts of production of this product.

ACADEMIC STANDARDS:

MM1P5. Students will represent mathematics in multiple ways.

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

ELA11W1. The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.

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.