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PROGRAM CONCENTRATION: **Architecture, Construction, Communications & Transportation**
CAREER PATHWAY: **METALS TECHNOLOGY**
COURSE TITLE: **Introduction to Metals**
Prerequisite: **Occupational Safety and Fundamentals**

The metals technology curriculum, Introduction to Metals, is designed to acquaint participants with the three major technical occupations (welding, sheet metal, and machining) that are available in the metal forming, manufacturing, and metals/construction industries. The various activities equip high school students with the skills needed to select a metal industry occupation, enter the work force, and continue to advance in one of these specialized metals occupations. Experiences include an introduction to the basic requirements of each of these fields, exposure to the structure and nature of career opportunities, and an introduction to types of training and skills required and the use of specialized tools, equipment, and materials. This course is designed to familiarize students with fundamentals of various metal occupations for the purpose of preparing them to select either welding, sheet metal, or machining for more highly specialized training in subsequent courses. Minimum performance requirements for this course are based on successful student completion according to the National Center for Construction Education and Research Center (NCCER) Occupation Standards and the National Institute for Metalforming Skills (NIMS) standards. Students who successfully complete the course in accordance with NCCER standards are eligible for registration with the NCCER National Craft Worker Registry or obtain NIMS credentials.

CAREERS, ETHICS, AND HISTORY OF MACHINING, SHEETMETAL, AND WELDING

This course will acquaint the students with the history of the machining trade, equipment used in the trade, attributes of successful machinists, sheet metal workers, welders, industry credentialing, and career opportunities. Course topics include safety, applied mathematics, measuring instruments, blueprint reading, and metallurgy. Practical experience will be gained in the proper use and maintenance of hand tools, power tools and equipment used in the industry. Additional topics address quality control, environmental protection, and housekeeping. Co-curricular activities of Skills USA are incorporated in the course. Students who successfully complete the course are eligible to enroll in machining operations I, sheet metal I, or welding I courses.

HISTORY
> **ACCT-ITM-1. Students will explore the history of the machining, welding, and sheet-metal trade**
> > a. Summarize the history of the machining, welding, and sheet-metal trade.

Academic Standards*:*

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SSUSH7   Students will explain the process of economic growth, its regional and national impact in the first half of the 19th century, and the different responses to it.

SAFETY
ACCT-ITM-2. Students will demonstrate knowledge of safety in the metals laboratory.
  a. Identify some common hazards in machining, sheet metal, and welding.
  b. Explain and identify proper personal protection used in machining, sheet metal, and welding.
  c. Demonstrate proper material handling methods.
  d. Demonstrate safety rules for operating tools in the metals lab.

Academic Standards:
SEV5. Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems.

  e. Describe the effects and potential implications of pollution and resource depletion on the environment at the local and global levels (*e.g.* air and water pollution, solid waste disposal, depletion of the stratospheric ozone, global warming, and land uses).

TOOLS OF THE TRADE
ACCT-ITM-3. Students will demonstrate proficiency in the use of hand tools and power tools specific to the trade.
  a. Demonstrate proficiency using tools related to the metals trade in a safe and appropriate manner.
  b. Demonstrate proficiency in proper maintenance and care of tools in the metals trade.

MEASURING INSTRUMENTS
ACCT-ITM-4. Students will demonstrate the ability to use measuring instruments specific to the metals trade.
  a. Demonstrate proficiency measuring work pieces with a standard steel rule to the nearest 1/64".
  b. Demonstrate proficiency in the proper care, cleaning, and storage of measuring instruments.
  c. Demonstrate proficiency in the use of measuring tools used in machining, sheet metal, and welding.

Academic Standards:
MM1G3. Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons.

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    a. Determine the sum of interior and exterior angles in a polygon.
    b. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality.
    c. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL).

INTRO TO WELDING

ACCT-ITM-5. Students will demonstrate the ability to safely set up and use the oxyfuel cutting torch and SMAW equipment.

    a. Identify and explain the use of oxyfuel cutting equipment.
    b. Demonstrate proficiency in safely set up and shutting down an oxyfuel cutting outfit.
    c. Perform basic oxyfuel cutting
    d. Identify and explain shielded metal arc welding (SMAW) safety.
    e. Identify and explain welding electrical current.
    f. Identify and explain arc welding machines.
    g. Demonstrate proficiency in safely setting up SMAW equipment.
    h. Demonstrate proficiency striking an arc.
    i. Demonstrate proficiency running stringer beads.

Academic Standards:

SPS10. Students will investigate the properties of electricity and magnetism.

    a. Investigate static electricity in terms of
- friction
- induction
- conduction

    b. Explain the flow of electrons in terms of
- alternating and direct current.
- the relationship among voltage, resistance and current.

SPS4. Students will investigate the arrangement of the Periodic Table.

    a. Determine the trends of the following:
- Location of metals, nonmetals, and metalloids

INTRO TO SHEET METAL

ACCT-ITM- 6. Students will demonstrate the ability to use basic hand tools and equipment specific to sheet metal.

    a. Demonstrate proficiency in the selection and use of layout and marking tools used by sheet metal workers.
    b. Demonstrate proficiency in the selection of hand tools used for cutting out sheet metal parts and patterns.
    c. Demonstrate proficiency in the selection and use of sheet metal equipment as applied to straight line development.

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Academic Standards:
MM1G1. Students will investigate properties of geometric figures in the coordinate plane.
    a. Determine the distance between two points.
    b. Determine the distance between a point and a line.
    c. Determine the midpoint of a segment.
    d. Understand the distance formula as an application of the Pythagorean theorem.
    e. Use the coordinate plane to investigate properties of and verify conjecture related to triangles and quadrilaterals.

MM1G3. Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons.
    d. Determine the sum of interior and exterior angles in a polygon.
    e. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality.
    f. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL).
    g. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite.
    h. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

MM2G1. Students will identify and use special right triangles.
    a. Determine the lengths of sides of 30°-60°-90° triangles.
    b. Determine the lengths of sides of 45°-45°-90° triangles.

MM2G3. Students will understand the properties of circles.
    a. Understand and use properties of chords, tangents, and secants as an application of triangle similarity.
    b. Understand and use properties of central, inscribed, and related angles.
    c. Use the properties of circles to solve problems involving the length of an arc and the area of a sector.
    d. Justify measurements and relationships in circles using geometric and algebraic properties.
MM2G4. Students will find and compare the measures of spheres.
    a. Use and apply surface area and volume of a sphere.
    b. Determine the effect on surface area and volume of changing the radius or diameter of a sphere.

<u>INTRO TO MACHINING</u>

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ACCT-ITM-7. Students will demonstrate the ability to use basic hand tools and equipment specific to machining.

a. Demonstrate proficiency in the selection and use of basic layout tools used by machinist.
b. Demonstrate proficiency in the selection and use of machine shop equipment to produce basic layout projects.

Academic Standards:

MM2G1. Students will identify and use special right triangles.

a. Determine the lengths of sides of 30°-60°-90° triangles.
b. Determine the lengths of sides of 45°-45°-90° triangles.

MM1G3. Students will discover, prove, and apply properties of triangles, quadrilaterals, and other polygons.

a. Determine the sum of interior and exterior angles in a polygon.
b. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality.
c. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL).
d. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite.
e. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

MM1G1. Students will investigate properties of geometric figures in the coordinate plane.

a. Determine the distance between two points.
b. Determine the distance between a point and a line.
c. Determine the midpoint of a segment.
d. Understand the distance formula as an application of the Pythagorean theorem.
e. Use the coordinate plane to investigate properties of and verify conjecture related to triangles and quadrilaterals.

Reading Across the Curriculum

Reading Standard Comment

After the elementary years, students engage in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal they experience text in all genres and modes of discourse. In the study of various disciplines of learning

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(language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas in context.

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

CTAE-RC-1 Students will enhance reading in all curriculum areas by:
   a. Reading in all curriculum areas
      - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
      - Read both informational and fictional texts in a variety of genres and modes of discourse.
      - Read technical texts related to various subject areas.
   b. Discussing books
      - Discuss messages and themes from books in all subject areas.
      - Respond to a variety of texts in multiple modes of discourse.
      - Relate messages and themes from one subject area to messages and themes in another area.
      - Evaluate the merit of texts in every subject discipline.
      - Examine author's purpose in writing.
      - Recognize the features of disciplinary texts.
   c. Building vocabulary knowledge
      - Demonstrate an understanding of contextual vocabulary in various subjects.
      - Use content vocabulary in writing and speaking.
      - Explore understanding of new words found in subject area texts.
   d. Establishing context
      - Explore life experiences related to subject area content.
      - Discuss in both writing and speaking how certain words are subject area related.

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- Determine strategies for finding content and contextual meaning for unknown words.

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.

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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.