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PROGRAM CONCENTRATION:	**Architecture, Construction, Communications & Transportation**
CAREER PATHWAY:	**METALS TECHNOLOGY**
COURSE TITLE:	**Sheet Metal IV**
PREREQUISITE:	**Sheet Metal III**

COURSE DESCRIPTION: This course is designed to allow students to master intermediate sheet metal practices by using advanced radial line development and the fabrication of gutters and downspouts. Minimum performance requirements for this course are based on successful student completion according to the National Center for Construction Education and Research (NCCER) Occupation Standards. Students who successfully complete the course in accordance with the NCCER standards are eligible for registration with the NCCER National Craft Worker Registry.

<u>ADVANCED RADIAL LINE DEVELOPMENT</u>

ACCT-SMIV-1 Students will demonstrate proficiency in advanced radial line development.

a. Demonstrate skill in the layout and fabrication of selected sheet metal fittings and related tasks.

<u>Academic Standards:</u>

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.
   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

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        quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite.

e. 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 $30°\text{-}60°\text{-}90°$ triangles.
b. Determine the lengths of sides of $45°\text{-}45°\text{-}90°$ 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.

GUTTERS AND DOWNSPOUTS

ACCT-SMIV-2 Students will demonstrate proficiency calculating and fabricating gutters and downspouts.

a. Demonstrate skill in understanding the principles of roof design and drainage systems.
b. Demonstrate skill in the calculating downspout and gutter sizes.
c. Identify, lay out, and fabricate selected drainage components.

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.

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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.

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.

SHEET METAL DUCT FABRICATION STANDARDS

ACCT-SMIV-3 Students will demonstrate the ability to interpret, understand and use the sheet metal duct fabrication standards as they apply to sheet metal fabrication.

    a. Understand the effect of operating pressure on the design of a duct system.
    b. Determine sealing requirements for a selected ductrun by using reference charts and tables.
    c. Determine minimum gage requirements for selected ductruns by using reference charts and tables.

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      d. Determine minimum connector and reinforcing requirements for selected ductruns by using reference charts and tables.

      e. Describe the purpose of a tie rod and determine when a tie rod is optional or mandatory by using reference charts and tables.

      f. Identify the different types of acceptable longitudinal seams, including application and any limitations.

<u>BEND ALLOWENCES</u>

ACCT-SMIV-4 Students will demonstrate proficiency in calculating and determining bend allowances on selected sheet metal problems.

      a. Describe the factors that influence bend allowances on sheet metal blanks.

      b. Demonstrate an understanding of the calculations necessary for determining proper bend allowances on selected sheet metal problems.

      c. Demonstrate skill in the determining bend allowances on selected sheet metal problems.

<u>Academic Standards:</u>

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.

      e. Determine the sum of interior and exterior angles in a polygon.

      a. Understand and use the triangle inequality, the side-angle inequality, and the exterior-angle inequality.

      b. Understand and use congruence postulates and theorems for triangles (SSS, SAS, ASA, AAS, HL).

      c. Understand, use, and prove properties of and relationships among special quadrilaterals: parallelogram, rectangle, rhombus, square, trapezoid, and kite.

      d. Find and use points of concurrency in triangles: incenter, orthocenter, circumcenter, and centroid.

MM2G1. Students will identify and use special right triangles.

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      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.

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 (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:
      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.

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- Read both informational and fictional texts in a variety of genres and modes of discourse.
- Read technical texts related to various subject areas.

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.

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.

Establishing context

- Explore life experiences related to subject area content.
- Discuss in both writing and speaking how certain words are subject area related.
- 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.

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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.