

Implementation date

Fall 2010

**PROGRAM CONCENTRATION:**

**Architecture, Construction,  
Communications & Transportation**

**CAREER PATHWAY:**

**CLIMATE CONTROL SYSTEMS TECHNOLOGY**

**COURSE TITLE:**

**Introduction to Mechanical Systems**

This course is preceded by the Occupational Safety course. The course offers an opportunity for trainees to build on their knowledge and skills developed in Occupational Safety. It introduces them to two construction craft areas. It is also the second step towards gaining a Level One Industry Certification in one of two craft areas. It is the first of three courses.

The goal of this course is to introduce trainees to the basic building blocks of the HVACR and Low Voltage Electrical craft trades. Trainees will explore how these crafts affect the mechanical systems in a building. The trainee will also learn and apply knowledge of the electrical, electronic, and mechanical components related to each trade. In addition, trainees will be introduced to, and develop skills to differentiate between tools used in each individual craft area.

**ACCT-IMS-1 Students will identify and/or demonstrate general HVACR and specific OSHA and EPA safety concepts and practices.**

- a. Demonstrate safe working procedures in the low voltage electrical environment.
- b. Identify electrical hazards and explain how to minimize them in the HVACR workplace.
- c. Explain safety issues concerning lockout/tagout, PPE, assured grounding and isolation, confined spaces, and fall protection.

**Academic Standard(s):**

*SSCG15. The student will explain the functions of the departments and agencies of the federal bureaucracy.*

- a. Compare and contrast the organization and responsibilities of independent regulatory agencies, government corporations, and executive agencies.*
- b. Explain the functions of the Cabinet.*

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

- a. Follow correct procedures for use of scientific apparatus.*
- b. Demonstrate appropriate techniques in all laboratory situations.*
- c. Follow correct protocol for identifying and reporting safety problems and violations.*

Implementation date  
Fall 2010

**ACCT -IMS-2 Students will demonstrate an understanding of electrical concepts, theories, laws, and simple circuits.**

- a. Demonstrate knowledge of atomic theory, Ohm's law, Kirchoff's law and how they apply in an electrical circuit.
- b. Demonstrate a working knowledge of the math needed to calculate amperage, voltage, wattage, and resistance.
- c. Distinguish between series, parallel, and series parallel circuits.
- d. Demonstrate proper use of a multimeter and ammeter.

**Academic Standard(s):**

*SPS1 Students will investigate our current understanding of the atom.*

*a. Examine the structure of the atom in terms of*

- *proton, electron, and neutron locations.*
- *atomic mass and atomic number.*
- *atoms with different numbers of neutrons (isotopes).*
- *explain the relationship of the proton number to the element's identity.*

*b. Compare and contrast ionic and covalent bonds in terms of electron position.*

*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.*
- *simple series and parallel circuits.*

*c. Investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to*

- *electromagnets*
- *simple motors*
- *permanent magnets*

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

Implementation date  
Fall 2010

- a. Describe the transformation of mechanical energy into electrical energy and the transmission of electrical energy.
- b. Determine the relationship among potential difference, current, and resistance in a direct current circuit.
- c. Determine equivalent resistances in series and parallel circuits.
- d. Determine the relationship between moving electric charges and magnetic fields.

**ACCT -IMS-3 Students will compare components to their schematic symbols.**

- a. Compare components to their schematic symbol.
- b. Read and interpret schematic diagrams.
- c. Identify the sequence of operation for a basic HVACR schematic diagram.

**Academic Standard(s):**

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

- a. Recognize and use connections among mathematical ideas.
- b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- c. Recognize and apply mathematics in contexts outside of mathematics.

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

- a. Demonstrates an understanding of contextual vocabulary in various subjects.
- b. Uses content vocabulary in writing and speaking.
- c. Explores understanding of new words found in subject area texts.

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

- a. Trace the source on any large disparity between estimated and calculated answers to problems.
- b. Consider possible effects of measurement errors on calculations.
- c. Recognize the relationship between accuracy and precision.
- d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
- e. Solve scientific problems by substituting quantitative values, using dimensional analysis and/or simple algebraic formulas as appropriate.

**ACCT -IMS-4 Students will investigate the basic theory of electronics and semiconductors and identify how they are used in HVACR.**

Implementation date  
Fall 2010

- a. Investigate the basic theory of electronics and semiconductors.
- b. Describe the operation, use, and testing of components used in HVACR equipment.
- c. Identify different types of resistors and explain how their resistance values can be determined.
- d. Identify the connectors on a personal computer.

**Academic Standard(s):**

*MM4P4. Students will make connections among mathematical ideas and to other disciplines.*

- a. Recognize and use connections among mathematical ideas.*
- b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.*
- c. Recognize and apply mathematics in contexts outside of mathematics.*

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

- a. Suggest reasonable hypotheses for identified problems.*
- b. Develop procedures for solving scientific problems.*
- e. Develop reasonable conclusions based on data collected.*
- f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.*

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

- a. Develop and use systematic procedures for recording and organizing information.*
- c. Use technology to develop, test, and revise experimental or mathematical models.*

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

- a. Build new mathematical knowledge through problem solving.*
- b. Solve problems that arise in mathematics and in other contexts.*
- c. Apply and adapt a variety of appropriate strategies to solve problems.*
- d. Monitor and reflect on the process of mathematical problem solving.*

**ACCT -IMS-5 Students will identify and demonstrate basic mechanical installation and maintenance practices.**

- a. Identify different types of threaded and non-threaded fasteners.

Implementation date

Fall 2010

- b. Identify different types of gaskets, seals, and seal parts.
- c. Align and properly adjust V-belts.
- d. Identify different types of drive couplings
- e. Compare different types of bearings.
- f. Distinguish between and use bearing pullers and feeler gauges.
- g. Demonstrate the proper use of a grease gun.
- h. Demonstrate the proper method for joining metal duct sections and fittings
- i. Demonstrate the proper way to install takeoffs and attach flexible duct.

**Academic Standard(s):**

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

- a. *Follow correct procedures for use of scientific apparatus.*
- b. *Demonstrate appropriate techniques in all laboratory situations.*
- c. *Follow correct protocol for identifying and reporting safety problems and violations.*

*SPS8 Students will determine relationships among force, mass, and motion.*

- b. *Apply Newton's three laws to everyday situations by explaining the following:*
  - *Inertia*
  - *Relationship between force, mass and acceleration*
  - *Equal and opposite forces*
- c. *Relate falling objects to gravitational force*
- d. *Explain the difference in mass and weight.*
- e. *Calculate amounts of work and mechanical advantage using simple machines.*

*MA1P1 Students will solve problems (using appropriate technology).*

- a. *Build new mathematical knowledge through problem solving.*
- b. *Solve problems that arise in mathematics and in other contexts.*
- c. *Apply and adapt a variety of appropriate strategies to solve problems.*
- d. *Monitor and reflect on the process of mathematical problem solving.*

## 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

Implementation date

Fall 2010

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.

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

Implementation date  
Fall 2010

## FOUNDATION SKILLS

**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.*

Implementation date

Fall 2010

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