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PROGRAM CONCENTRATION:

**Architecture, Construction,
Communications & Transportation**

CAREER PATHWAY:

CLIMATE CONTROL SYSTEMS TECHNOLOGY

COURSE TITLE:

**Heating, Ventilation, Air
Conditioning and Refrigeration I**

This course is preceded by HVACR I. The course is the third of three courses that provides the trainee a solid foundation in HVACR air distribution, venting, and other types of equipment. It is the fourth step in gaining a Level One Industry Certification in HVAC.

This course introduces the trainee to properties of air distribution in various states including forced and vented air. It provides a general knowledge of refrigeration and heating processes. It also shows the use of various other types of climate control equipment and possible accessory options. Trainees are introduced to proper handling of refrigerants. It provides an introduction to the skills and knowledge of system and component troubleshooting techniques including electrical components.

ACCT -HVACR2-1 Students will demonstrate an understanding of air properties and the distribution of conditioned air.

- a. Explain the gas laws (Dalton, Boyle, and Charles) used when dealing with air and its properties.
- b. Use a psychrometric chart to evaluate air properties.
- c. Identify and explain the differences in various fans and blowers
- d. Demonstrate or explain the installation of fittings and devices used in an air distribution system.
- e. Explain the use and installation of insulation and vapor barriers used in duct systems.
- f. Recognize and use instruments to make measurements in air distribution systems.

Academic Standard(s):

SC5 Students will understand that the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst

- a. *Demonstrate the effects of changing concentration, temperature, and pressure on chemical reactions.*

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques

- e. *Relate to a given context the characteristics of a function, and use graphs and tables to investigate its behavior.*

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SPS7 Students will relate transformations and flow of energy within a system.

- a. *Identify energy transformations within a system.*

ACCT -HVACR2-2 Students will demonstrate the purpose and installation of chimneys, vents, and flues.

- a. Explain complete and incomplete combustion.
- b. Demonstrate understanding of how to select and install venting for different kinds of furnaces.
- c. Perform the adjustments necessary to achieve proper combustion in a gas furnace.

Academic Standard(s):

SPS7 Students will relate transformations and flow of energy within a system.

- a. *Identify energy transformations within a system (e.g. lighting of a match).*

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

- b. *Uses content vocabulary in writing and speaking.*

ACCT -HVACR2-3 Students will demonstrate an understanding of alternating current.

- a. Explain hoe alternating current is developed and draw a sine wave.
- b. Describe the operation of the various types of three-phase and single-phase transformers.
- c. Describe the types of capacitors and their applications.
- d. Identify the various single-phase motors and their applications.
- e. Use test equipment, meters, and recorders.

Academic Standard(s):

SPS10 Students will investigate the properties of electricity and magnetism.

- 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*

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

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

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

- b. Solve problems that arise in mathematics and in other contexts .*
- d. Monitor and reflect on the process of mathematical problem solving .*

ACCT -HVACR2-4 Students will demonstrate an understanding of the operation and installation of electric furnaces.

- a. Describe and explain the basic operation of an electric furnace.
- b. Identify and describe the functions of electric furnace controls.
- c. Measure resistances and check components and controls for operation and safety.

Academic Standard(s):

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

- b. Uses content vocabulary in writing and speaking.*
- c. Explores understanding of new words found in subject area texts.*

SCSh3 Students will identify and investigate problems scientifically.

- c. Collect, organize and record appropriate data*

ACCT -HVACR2-5 Students will identify and explain the function of various HVACR controls.

- a. Describe different types of thermostats and explain how they are used.
- b. Demonstrate the correct installation and adjustment of a thermostat.
- c. Perform simulated troubleshooting of a typical HVACR control circuit.

Academic Standard(s):

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

- b. Uses content vocabulary in writing and speaking*
- c. Explores understanding of new words found in subject area texts.*

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

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- a. *Develop and use systematic procedures for recording and organizing information*

ACCT -HVACR2-6 Students will describe and explain the use of HVACR accessories and optional equipment.

- a. Recognize the various types of humidifiers used with HVACR systems and explain why each is used.
- b. Recognize the various kinds of air filters used with HVACR systems and explain why each is used.
- c. Demonstrate how to install and service humidifiers and filters used in HVACR systems.

Academic Standard(s):

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

- b. *Uses content vocabulary in writing and speaking.*
- c. *Explores understanding of new words found in subject area texts*

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

- a. *Develop and use systematic procedures for recording and organizing information.*

ACCT -HVACR2-7 Students will demonstrate an understanding of compressors.

- a. Identify and explain the operation of the different kinds of compressors.
- b. Demonstrate the common procedures for servicing and maintenance of both hermetic and semi-hermetic compressors.
- c. Demonstrate or describe the procedures used to clean up a system after a compressor burnout.

Academic Standard(s):

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

- b. *Uses content vocabulary in writing and speaking.*
- c. *Explores understanding of new words found in subject area texts*

ACCT -HVACR2-8 Students will demonstrate an understanding of heat pumps.

- a. Describe the principles of reverse-cycle heating.
- b. List the major components of a heat pump system.
- c. Demonstrate heat pump service and installation procedures.

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Academic Standard(s):

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

b. Uses content vocabulary in writing and speaking.

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

a. Develop and use systematic procedures for recording and organizing information.

ACCT -HVACR2-9 Students will demonstrate how and why refrigerants must be handled properly.

- a. Identify the common types of leak detectors and explain how each is used.
- b. Explain and demonstrate a system evacuation.
- c. Explain and demonstrate refrigerant recovery.
- d. Explain and demonstrate charging refrigerant into a system.

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

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

a. Develop and use systematic procedures for recording and organizing information.

ACCT -HVACR2-10 Students will demonstrate an understanding of metering devices.

- a. Describe the types of metering devices and explain their function.
- b. Describe the procedure for installing and adjusting a TXV.

Academic Standard(s):

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

a. Develop and use systematic procedures for recording and organizing information

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

- a. Demonstrates an understanding of contextual vocabulary in various subjects.*

ACCT -HVACR2-11 Students will demonstrate an understanding of troubleshooting an HVACR system.

- a. Describe a systematic approach for troubleshooting the electrical system of an HVACR system.
- b. Make electrical troubleshooting checks and measurements on circuits and components common to all HVACR equipment.
- c. Analyze circuit diagrams to determine the operating sequence of microprocessor-controlled systems.
- d. Demonstrate skill in using tools and instruments required for troubleshooting gas heating systems.

Academic Standard(s):

SCSh1 Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

- b. Recognize that different explanations often can be given for the same evidence.*
- c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.*

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

- a. Develop and use systematic procedures for recording and organizing information*

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.*

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

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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.

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.

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.*

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