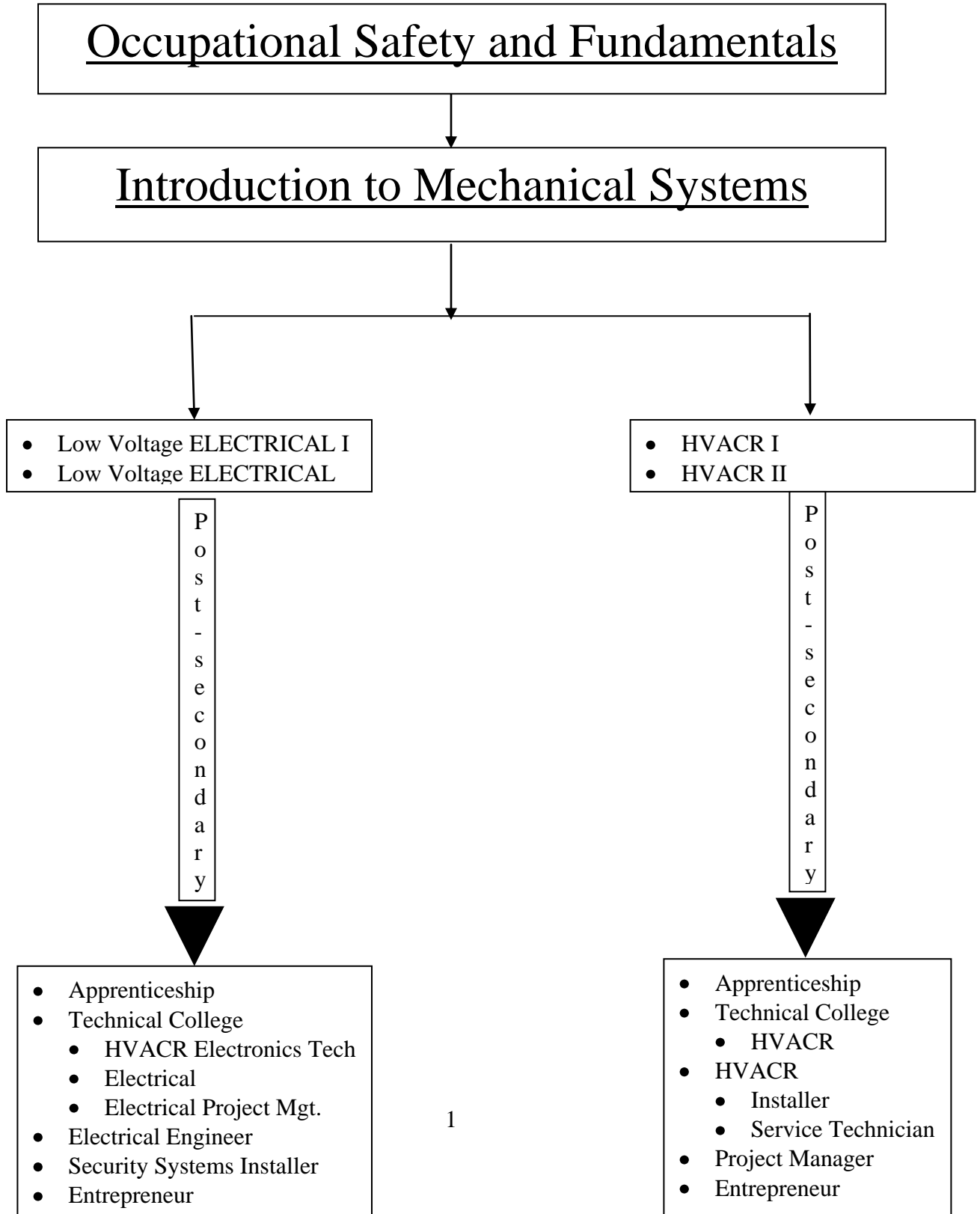


THE CLIMATE CONTROL SYSTEMS TECHNOLOGY MAP



Implementation date
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PROGRAM CONCENTRATION: Architecture, Construction,
Communications & Transportation
CAREER PATHWAY: CLIMATE CONTROL SYSTEMS TECHNOLOGY
COURSE TITLE: Occupational Safety and Fundamentals

This course is designed to prepare a student with foundational knowledge and skills for a career in one of two possible construction crafts. It also is a good course for a student to prepare for a variety of opportunities in addition to the craft areas such as; Mechanical Engineering and Construction Management to name a few.

As the student progresses through the course they are given the opportunity to explore two construction craft areas on an introductory level. Once they have completed the foundational and introductory levels they are then given the option to “major” in at least one of the two craft areas. These areas are HVACR and Low Voltage Electrical Upon successful completion of four units within this pathway, in an Industry Accredited Program, the student will earn at least two industry credentials with the possibility of others.

Occupational Safety and Fundamentals:

This course is the foundational course that prepares students for a pursuit of any career in the field of construction. It prepares the trainee for the basic knowledge to function safely on or around a construction site and in the industry in general. It provides the trainee with the option for an Industry Certification in the Construction Core.

This course explains the safety obligations of workers, supervisors, and managers to ensure a safe workplace. Course content discusses the causes and results of accidents and the dangers of rationalizing risks. It includes the basic content of OSHA 10-hour safety standards. It also includes the basic knowledge and skills needed in the following areas: construction math, hand and power tools used in the field, general blueprints, and basics of rigging safety.

ACCT -OS-1 Students will understand and practice construction safety.

- a. Demonstrate knowledge of use and care of PPE.
- b. Demonstrate a basic knowledge of OSHA and its regulations.
- c. Demonstrate a basic knowledge of safety as related to aerial work, electricity, and fire.

Academic Standards:

MA1P4. 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*

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produce a coherent whole.

c. Recognize and apply mathematics in contexts outside of mathematics.

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.

ELA9RC3. 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.

ACCT -OS-2 Students will understand and apply math concepts as applied to construction.

a. Demonstrate knowledge and application of measuring.

b. Demonstrate ability to apply basic math computations to construction settings.

c. Apply basic geometric calculations including the 3-4-5 rule.

d. Demonstrate knowledge and application of area and volume calculations.

Academic Standards:

MA1G1. 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.

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.

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MM1P3. Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.*
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- c. Analyze and evaluate the mathematical thinking and strategies of others.*
- d. Use the language of mathematics to express mathematical ideas precisely.*

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.*

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.*

MM2G2. Students will define and apply sine, cosine, and tangent ratios to right triangles.

- a. Discover the relationship of the trigonometric ratios for similar triangles.*
- b. Explain the relationship between the trigonometric ratios of complementary angles.*
- c. Solve application problems using the trigonometric ratios.*

MM2A4. Students will solve quadratic equations and inequalities in one variable.

- c. Analyze the nature of roots using technology and using the discriminant.*

MM2G3. Students will understand the properties of circles.

- d. Justify measurements and relationships in circles using geometric and algebraic properties.*

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.*

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- d. *Understand the distance formula as an application of the Pythagorean theorem.*

ELA9W3. The student uses research and technology to support writing.

- b. *Uses supporting evidence from multiple sources to develop the main ideas within the body of an essay, composition, or technical document.*
- c. *Synthesizes information from multiple sources and identifies complexities and discrepancies in the information and the different perspectives found in each medium (i.e., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, or technical documents).*

ACCT -OS-3 Students will use basic hand and power tools in a professional and safe manner.

- a. Demonstrate knowledge of rules and regulations regarding the safe use of hand and power tools.
- b. Demonstrate knowledge of the care and maintenance of hand and power tools.
- c. Demonstrate the knowledge of proper usage techniques of hand and power tools.

Academic Standards:

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.*

ELA9LSV1. The student participates in student-to-teacher, student-to-student, and group verbal interactions.

- b. *Asks relevant questions.*
- c. *Responds to questions with appropriate information.*
- d. *Actively solicits another person's comments or opinions.*
- f. *Volunteers contributions and responds when directly solicited by teacher or discussion leader.*
- g. *Gives reasons in support of opinions expressed.*
- i. *Employs group decision-making techniques such as brainstorming or a problem-solving sequence (i.e., recognizes problem, defines problem, identifies possible solutions, selects optimal solution, implements solution, and evaluates solution).*
- j. *Divides labor to achieve the overall group goal efficiently.*

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ACCT -OS-4 Students will be introduced to blueprint terms, components, and symbols.

- a. Demonstrate knowledge of blueprint terms.
- b. Demonstrate knowledge of blueprint components.
- c. Demonstrate knowledge of blueprint symbols.

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.*

MM1P3. Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.*
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- c. Analyze and evaluate the mathematical thinking and strategies of others.*
- d. Use the language of mathematics to express mathematical ideas precisely.*

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.*

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. Examine the powers of state and local government.*
- c. Analyze the services provided by state and local government.*

ELA9RL5. Student understands and acquires new vocabulary and uses it correctly in reading and writing.

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- a. *Uses general dictionaries, specialized dictionaries, thesauruses, or related references as needed to increase learning.*

ELA9RC3. 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.*

ELA9W3. The student uses research and technology to support writing.

- b. *Uses supporting evidence from multiple sources to develop the main ideas within the body of an essay, composition, or technical document.*
- c. *Synthesizes information from multiple sources and identifies complexities and discrepancies in the information and the different perspectives found in each medium (i.e., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, or technical documents).*

ACCT -OS-5 Students will explain and implement safe rigging procedures.

- a. *Demonstrate the knowledge of basic rigging equipment.*
- b. *Demonstrate the knowledge of basic rigging communication.*
- c. *Demonstrate the knowledge of basic rigging safety.*

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.*

MM1P3. Students will communicate mathematically.

- a. *Organize and consolidate their mathematical thinking through communication.*
- b. *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- c. *Analyze and evaluate the mathematical thinking and strategies of others.*

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- d. Use the language of mathematics to express mathematical ideas precisely.*

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- a. Recognize and use connections among mathematical ideas.*
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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.*

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. Examine the powers of state and local government.*
- c. Analyze the services provided by state and local government.*

ELA9RL5. Student understands and acquires new vocabulary and uses it correctly in reading and writing.

- c. Uses general dictionaries, specialized dictionaries, thesauruses, or related references as needed to increase learning.*

ELA9C1. The student demonstrates understanding and control of the rules of the English language, realizing that the usage involves appropriate applications of conventions and grammar in both written and spoken formats.

- a. Demonstrates an understanding of proper English usage and control of grammar, sentence and paragraph structure, diction, and syntax.*
- c. Demonstrates an understanding of sentence construction (i.e., subordination, proper placement of modifiers) and proper English usage (i.e., consistency of verb tenses).*

SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects.

- e. Measure and calculate the magnitude of gravitational forces.*

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- h. Determine the conditions required to maintain a body in a state of static equilibrium.*

ACCT -OS-6 Students will explore career pathways in the construction industry.

- a. Demonstrate knowledge of the job opportunities that are available to entry level employees.
- b. Demonstrate knowledge of the post-secondary training opportunities that are available.
- c. Demonstrate knowledge of the industry licenses and certifications available.

Academic Standards:

SSEF3. The student will explain how specialization and voluntary exchange between buyers and sellers increase the satisfaction of both parties.

- a. Give examples of how individuals and businesses specialize.*
- b. Explain that both parties gain as a result of voluntary, non-fraudulent exchange.*

SSEM13. The student will explain how markets, prices and competition influence economic behavior.

- c. Define price elasticity of demand and supply.*

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.

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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.

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

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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.

PROGRAM CONCENTRATION:

CAREER PATHWAY:

**Architecture, Construction,
Communications & Transportation
CLIMATE CONTROL SYSTEMS TECHNOLOGY**

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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.*

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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.

a. Describe the transformation of mechanical energy into electrical energy and

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- 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.

- a. Investigate the basic theory of electronics and semiconductors.

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- 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.
- b. Identify different types of gaskets, seals, and seal parts.
- c. Align and properly adjust V-belts.

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- 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.*

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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.

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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:

- c. 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.
- d. 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.
- e. 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.
- f. 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.

FOUNDATION SKILLS

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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-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

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academic-career plans and employment relations.

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

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 Introduction to Mechanical Systems. The course is the second of three courses that provides the trainee a solid foundation in HVACR skills and knowledge and the concepts involved with conditioning air within a given space. It is the third step in gaining a Level One Industry Certification in HVAC.

This course builds on the concepts of math concepts introduced in Occupational Safety. It provides knowledge of the hardware and systems used by an HVACR technician and the basic skills to install them. It provides a general knowledge of refrigeration and heating processes including the electronic circuitry. It also shows the integration between the electrical and HVACR fields. It provides an understanding of joining and piping practices in HVACR systems. It provides an introduction to the skills and knowledge of conduit bending and installation.

ACCT -HVACR1-1 Students will understand and apply math concepts as applied to HVACR.

- a. Solve algebraic equations that relate to the HVACR trade.
- b. Calculate volume, weight, pressure, vacuum, and temperature.
- c. Construct simple geometric figures and solve basic geometry problems that relate to the HVACR trade.

Academic Standard(s):

MC2A2. Students will solve simple equations

- a. *Solve quadratic equations in the form $ax^2 + bx + c = 0$, where $a = 1$, by using factorization and finding square roots where applicable*

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

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- b. *Use the coordinate plane to investigate properties of and verify conjectures related to triangles and quadrilaterals.*

MM1P3. Students will communicate mathematically.

- c. *Use the language of mathematics to express mathematical ideas precisely*

ACCT -HVACR1-2 Students will use hand and power tools associated with the HVACR trade in a professional and safe manner.

- a. Demonstrate the ability to correctly use the following: pipe wrenches, torque wrenches, hammers and mallets, tin snips, hand and power hacksaws, drills, and measuring instruments.
- b. Describe the general procedures for maintenance of hand and power tools.
- c. Describe or demonstrate the safety precautions that must be followed when using hand and power tools.

Academic Standard(s):

MM1P3. Students will communicate mathematically

- b. *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*

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

- d. *Compare and contrast the organization and responsibilities of independent regulatory agencies, government corporations, and executive agencies.*

ACCT -HVACR1-3 Students will understand the selection, handling, methods of joining, installation, and supporting of HVACR pipe and tubing.

- a. Describe procedures and precautions that must be taken when preparing and installing HVACR piping.
- b. Select, prepare, and join tubing and piping using various fittings.
- c. Braze and solder copper tubing and fittings in a safe and professional manner
- d. Demonstrate correct preparation and installation of PVC and Ferrous Metal Piping.

Academic Standard(s):

SSCG18 The student will demonstrate knowledge of the powers of Georgia's state and local governments

- a. *Analyze the services provided by state and local government.*

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

- b. Uses content vocabulary in writing and speaking*

ELAALRL5 The student understands and acquires new vocabulary and uses it correctly in reading and writing. The student

- a. Identifies and correctly uses idioms, cognates, words with literal and figurative meanings, and patterns of word changes that indicate different meanings or functions.*

ACCT -HVACR1-4 Students will understand electrical circuitry associated with the HVACR trade.

- a. Describe how voltage, current, resistance and power are related.
- b. Describe the differences between series and parallel circuits.
- c. Recognize and describe the purpose and operation of the various electrical components used in HVACR equipment.
- d. Make voltage, current, and resistance measurements using electrical test equipment.
- e. State and demonstrate safety precautions that must be followed when working on electrical equipment.

Academic Standard(s):

MM1P3. Students will communicate mathematically.

- d. Use the language of mathematics to express mathematical ideas precisely.*

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*

SPS10 Students will investigate the properties of electricity and magnetism

- c. Explain the flow of electrons in terms*

- *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*

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

ACCT -HVACR1-5 Students will demonstrate an understanding of how an HVACR system conditions and cools the air within a specified space.

- Demonstrate an understanding of the basic refrigeration cycle.
- Recognize the major components of a cooling system and explain how they operate.
- Identify refrigerants and demonstrate procedures for safe handling of them.
- Use temperature and pressure measuring instruments to evaluate the condition of the system.

Academic Standard(s):

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

- Compare and contrast the organization and responsibilities of independent regulatory agencies, government corporations, and executive agencies*

SPS5 Students will compare and contrast the phases of matter as they relate to atomic and molecular motion

- Relate temperature, pressure, and volume of gases to the behavior of gasses.*

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

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

ACCT -HVACR1-6 Students will demonstrate an understanding of how an HVACR system conditions and heats the air within a specified space.

- Explain the three methods of heat transfer.
- Recognize the major components of a forced air furnace (gas and electric) and explain their function.
- State the factors that must be considered when installing a furnace.
- Perform preventive maintenance procedures such as cleaning and filter replacement.

Academic Standard(s):

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

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- 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*
c. *Explores understanding of new words found in subject area texts*

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.

Students will enhance reading in all curriculum areas by:

- e. 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.
- f. Discussing books
- Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.

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- 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.
- g. 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.
- h. 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.

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.

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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.

PROGRAM CONCENTRATION:

**Architecture, Construction,
Communications & Transportation**

CAREER PATHWAY:

CLIMATE CONTROL SYSTEMS TECHNOLOGY

COURSE TITLE:

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

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.

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- a. Explain the gas laws (Dalton, Boyle, and Charles) used when dealing with air and its properties.
- b. Use a psychometric 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.*

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

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b. Uses content vocabulary in writing and speaking.

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

- a. Explain how 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

- *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

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- 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.

- 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*

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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.

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.

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- 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*

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.

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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 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

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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:

- g. 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.
- h. 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.
- i. 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.
- j. 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.

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

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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.

PROGRAM CONCENTRATION:

**Architecture, Construction,
Communications & Transportation**

CAREER PATHWAY:

CLIMATE CONTROL SYSTEMS TECHNOLOGY

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COURSE TITLE:

Low Voltage Electrical I

This course is preceded by Introduction to Mechanical Systems. The course is the second of three courses that provides the trainee a solid foundation in electrical skills and knowledge and how they integrate with the HVACR systems. It is the second step in gaining a Level One Industry Certification in Electrical.

This course builds on the concepts of electrical safety introduced in Occupational Safety. It provides knowledge of the hardware and systems used by an HVACR technician/electrician and the basic skills to install them. It provides a general knowledge of electrical systems including series, parallel, and series-parallel circuits. It also shows the integration between the electrical and HVACR fields. It provides the basic skills and knowledge to navigate and use the National Electrical Code. It provides an introduction to the skills and knowledge of conduit bending and installation.

ACCT -LVE1-1 Students will demonstrate an understanding of, and apply general construction and specific OSHA and EPA safety concepts and practices.

- a. Demonstrate safe working procedures in the electrical/electronic environment.
- b. Identify electrical hazards and how to minimize them in the workplace.
- c. Explain safety issue concerning lockout, tag out, PPE, assured grounding and isolation programs, confined spaces, breathing and fall protection.

Academic Standards:

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

- b. Compare and contrast the organization and responsibilities of independent regulatory agencies, government corporations, and executive agencies.*
- c. 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.*

SSEPF5. The student will describe how insurance and other risk-management strategies protect against financial loss.

- a. List various types of insurance such as automobile, health, life, disability and*

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property.

b. Explain the costs and benefits associated with different types of insurance.

SSEF5. The student will describe the roles of government in a market economy.

b. Give examples of government regulation and deregulation and their effects on consumers and producers.

ACCT -LVE1-2 Students will use tools, instruments, and equipment in a professional and safe manner.

a. Demonstrate 90 degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.

b. Demonstrate correct application of fasteners and anchors.

c. Demonstrate proper use of a multi-meter, clamp-on ammeter, and megohm-meter.

d. Demonstrate the knowledge of testing GFCI.

Academic Standards:

MM1D1. Students will determine the number of outcomes related to a given event.

a. Apply the addition and multiplication principles of counting.

b. Calculate and use simple permutations and combinations.

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.

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.

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

- *Compare and contrast the organization and responsibilities of independent regulatory agencies, government corporations, and executive agencies.*

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

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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.*

ACCT -LVE1-3 Students will demonstrate an understanding of the selection, handling, storage, and proper use of electrical/electronic materials.

- a. Recognize the correct fasteners and anchors.
- b. Demonstrate knowledge of proper handling and storage of capacitors, motors, transformers and other electronic and electrical equipment.
- c. Demonstrate proper handling of electronic circuitry.

Academic Standards:

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.*

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. *Examine the powers of state and local government.*
- b. *Examine sources of revenue received by each level of government.*
- c. *Analyze the services provided by state and local government.*

ELA9RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

- a. *Identifies and correctly uses idioms, cognates, words with literal and figurative meanings, and patterns of word changes that indicate different meanings or functions.*
- b. *Uses knowledge of Greek and Latin prefixes, suffixes, and roots to understand the meanings of new words.*
- c. *Uses general dictionaries, specialized dictionaries, thesauruses, or related references as needed to increase learning.*

ACCT -LVE1-4 Students will read, interpret, apply information and estimate costs from a variety of architectural and construction working drawings.

- a. Read and interpret electrical blueprints.

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- b. Read and interpret electrical diagrams.
- c. Estimate materials based on blueprints provided.

Academic Standards:

MM1D1. Students will determine the number of outcomes related to a given event.

- a. Apply the addition and multiplication principles of counting.*
- b. Calculate and use simple permutations and combinations.*

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.*

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.*

MM1P3. Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.*
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- c. Analyze and evaluate the mathematical thinking and strategies of others.*
- d. Use the language of mathematics to express mathematical ideas precisely.*

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.*

ELA9RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

- a. Identifies and correctly uses idioms, cognates, words with literal and figurative meanings, and patterns of word changes that indicate different*

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meanings or functions.

- b. Uses knowledge of Greek and Latin prefixes, suffixes, and roots to understand the meanings of new words.*
- c. Uses general dictionaries, specialized dictionaries, thesauruses, or related references as needed to increase learning.*

ACCT -LVE1-5 Students will demonstrate an understanding of electrical circuitry including raceways, boxes, and conduit.

- a. Recognize and accurately size electrical devices and boxes.
- b. Recognize and accurately size electrical conduit.
- c. Demonstrate knowledge of computing loads for various circuits.
- d. Demonstrate knowledge of connecting HVACR equipment to power supplies.

Academic Standards:

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.*

MM1D1. Students will determine the number of outcomes related to a given event.

- a. Apply the addition and multiplication principles of counting.*
- b. Calculate and use simple permutations and combinations.*

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*

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.*

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. Examine the powers of state and local government.*

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- b. Examine sources of revenue received by each level of government.
- c. Analyze the services provided by state and local government.

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.

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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.
- j. 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.
- k. Building vocabulary knowledge

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- 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.
- I. 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.

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PROGRAM CONCENTRATION: Architecture, Construction, Communications & Transportation
CAREER PATHWAY: CLIMATE CONTROL SYSTEMS TECHNOLOGY
COURSE TITLE: Low Voltage Electrical II

This course is preceded by Low Voltage Electrical I. The course is the third of three courses that provides the trainee a solid foundation in electrical skills and knowledge. It is the final step in gaining a Level One Industry Certification in Electrical.

This course focuses on proper selection, inspection, use, and maintenance of common electrical test equipment; introduces the types and applications of raceways, wire-ways, and ducts; focuses on the types and application of conductors and cover proper wiring techniques, electrical prints, drawings and symbols; covers the electrical devices and wiring techniques common to commercial and industrial construction, HVACR and maintenance, and covers the electrical devices and wiring techniques common to residential construction and maintenance.

ACCT -LVE2-1 Students will understand and explain the importance of the current **National Electrical Code (NEC), National Electrical Manufacturers Association Code (NEMA), National Fire Protection Association Code (NFPA), and Underwriters Laboratories (UL) Standards.**

- a. Demonstrate knowledge of the use of electrical codes and specifications.
- b. Demonstrate ability to apply codes to calculating loads.
- c. Recognize and apply code, specification and load knowledge to HVACR installation.

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Academic Standards:

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.*

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. Examine the powers of state and local government.*
- b. Examine sources of revenue received by each level of government.*
- c. Analyze the services provided by state and local government.*

ELA9RL5. The student understands and acquires new vocabulary and uses it correctly in reading and writing.

- a. Identifies and correctly uses idioms, cognates, words with literal and figurative meanings, and patterns of word changes that indicate different meanings or functions.*
- b. Uses knowledge of Greek and Latin prefixes, suffixes, and roots to understand the meanings of new words.*
- c. Uses general dictionaries, specialized dictionaries, thesauruses, or related references as needed to increase learning.*

ELA9W3 The student uses research and technology to support writing. The student

- a. Formulates clear research questions and utilizes appropriate research venues (e.g., library, electronic media, personal interview, survey) to locate and incorporate evidence from primary and secondary sources.*
- b. Uses supporting evidence from multiple sources to develop the main ideas within the body of an essay, composition, or technical document.*

ACCT -LVE2-2 Students will investigate the identification and installation of conductors according to NEC.

- a. Demonstrate the knowledge of NEC as related to conductors.
- b. Demonstrate knowledge of selecting proper conductors for a specified application.
- c. Demonstrate knowledge of proper installation of selected conductors.

Academic Standards:

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

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- a. *Examine the powers of state and local government.*
- b. *Examine sources of revenue received by each level of government.*
- c. *Analyze the services provided by state and local government.*

SP5 Students will evaluate relationships between electrical and magnetic forces.

- 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 -LVE2-3 Students demonstrate the ability to install a variety of fixtures.

- a. *Demonstrates knowledge of the selection of the proper fixture for the specified application.*
- b. *Demonstrate knowledge of the installation of various fixtures.*
- c. *Demonstrate knowledge of HVACR equipment tie in to electrical systems.*

Academic Standards:

SSCG18. The student will demonstrate knowledge of the powers of Georgia's state and local governments.

- a. *Examine the powers of state and local government.*
- b. *Examine sources of revenue received by each level of government.*
- c. *Analyze the services provided by state and local government.*

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.*

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.*

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.*

ACCT -LVE2-4 Students will explore voltage, resistance, current and how they relate.

- a. Demonstrate a working knowledge of Ohm's Law, Kirchhoff's Law and how they work in a circuit.
- b. Demonstrate the knowledge of the math needed to calculate voltage, wattage, amps and resistance.
- c. Demonstrate application of this knowledge in connecting HVACR equipment.

Academic Standards:

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.*

MM2A2. Students will explore exponential functions.

- d. *Solve simple exponential equations and inequalities analytically, graphically, and by using appropriate technology.*
- e. *Understand and use basic exponential functions as models of real phenomena.*

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*

SPS1 Students will investigate our current understanding of the atom.

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

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- *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.*

SP5 Students will evaluate relationships between electrical and magnetic forces.

- Describe the transformation of mechanical energy into electrical energy and the transmission of electrical energy.*
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ELAALRC3 The student acquires new vocabulary in each content area and uses it correctly.

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

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

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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:

- k. 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.
- l. 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.
- m. 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.
- n. 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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