Burlington County Institute of Technology

Medford Campus

Westampton Campus

Course Title: Heating, Air Conditioning, Ventilation, and Refrigeration
CAREER CLUSTER: Architecture and Construction
CIP CODE: 470201

Curriculum Area: CTE

Board Approved: August 2022

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HVAC Curriculum

I.Course of Study:

A. Introduction to HVAC 1	(9th)	S1 B4
B. Introduction to HVAC 2	(9th)	S2 B4
C. Fundamentals of Cooling and A/C System Troubleshooting	(10th)	S1 B1
D. Fundamentals of Heat and Troubleshooting	(10th)	S2 B1
E. EPA 608 Certification - Core and Type I	(10th)	S1 B2
F. Soft Skills	(11th)	S1 B3
G. Fundamentals of Heat Pumps, Hydronics, and HC/HFOs	(11th)	S2 B3
H. EPA 608 Certification - Type II and Type III	(11th)	S2 B2
I. Air Distribution, Sheet Metal Duct Systems, and IAQ	(12th)	S1 B3
J. Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems	(12th)	S2 B3
K. HVAC School to Work (optional)	(12th)	S1/2 B3/4

All courses are semester length courses

II.Program Descriptor:

This HVACR course involves equipment used for heating, cooling, and cleaning indoor air as well as equipment for preserving food and other perishable products. It covers furnaces and air conditioners used in homes and businesses, as well as the heating and cooling systems used in large buildings. It includes equipment used in retail, commercial, and industrial enterprises for the preservation and packaging of food and other perishables.

One of the most serious issues affecting the craft is the damage that can be done to Earth's ozone layer by the misuse of refrigerants. HVACR technicians form an important line of defense in the fight to improve energy efficiency and to reduce harmful chemical emissions into the atmosphere. Technicians will receive training in this course to obtain an EPA certification for safe and proper refrigerant usage.

Because of the widespread use of HVACR equipment, there are many career opportunities in the craft. Jobs are available with small local firms, commercial and industrial companies, and businesses that manufacture HVACR equipment. This course provides an opportunity to learn the trade through a combination of hands-on training and related classroom instruction.

III.Program Outcome:

Graduates of the HVAC program will possess the skills and competencies required for entry level employment as well as a foundation for pursuing post secondary education. Upon completion of the course, students can earn an EPA Universal certification for refrigerant purchasing and handling. In addition students can receive a certification for R-410a Safety and Handling, and Tracpipe flexible gas piping.

I**V.Course Descriptions:**

A. Introduction to HVAC 1 (9th)

This course includes Introduction to *Basic Safety, Hand Tools and Hardware, Basic Copper and Plastic Piping Practices, Soldering and Brazing, and Carbon Steel piping Practices*.This course instructs students in the identification, use, and care of hand tools. Developing the knowledge to properly choose and safely use hand tools and hardware such as screws, bolts, and anchors is an essential part of the HVAC industry as well as identifying and following safe work practices and procedures and how to properly inspect and use safety equipment . Students will be introduced to the various types of copper tubing and plastic piping and the various fittings that are used with them in the HVAC industry. This section explains soldering and brazing as the two methods used for joining copper tubing and fittings. It reviews the safety equipment, tools, and materials needed for soldering and brazing copper tubing in various applications. This section also includes the basic knowledge and skills needed to thread and install carbon steel piping systems.

B. Introduction to HVAC 2 (9th)

This course includes *Introduction to HVAC, and Basic Electricity.* It includes the most basic operating principles of HVAC systems along with a review of technician licensing and trade-governmenting regulations. This section also introduces the concepts of power generation and distribution, common electrical components, AC and DC circuits, and electrical safety as it relates to the HVAC field. It presents the basic concepts of alternating current generation and use. It also discusses how single and three phase altering current is used to power resistive and inductive circuits in HVAC equipment.

C. Fundamentals of Cooling and A/C System Troubleshooting (10th)

This course includes *Introduction to Cooling and Troubleshooting Cooling .* This section also introduces the fundamental concepts of the mechanical refrigeration cycle and examples of the primary components required to make it work. This section presents refrigerant compressors performance and reliability. It discusses common compressors failures and their causes, the various types of compressors used in the HVAC industry, and how to correctly identify problems that can affect compressor

operation. It discusses the refrigerant oils used in modern HVAC systems and reviews the new handling and service requirements that HVAC technicians must be familiar with. Students will be provided with guidance related to servicing the refrigerant circuit of HVAC systems. In addition information related to the US EPA's requirements for providing the necessary services in an environmentally sound manner. Students will also learn the metering devices used in the mechanical refrigeration cycle. The primary function of metering devices is presented, along with related components such as the distributor, and the process of selecting and installing thermal expansion valves.

D. Fundamentals of Heat and Troubleshooting (10th)

This course includes *Intro to Heat and Troubleshooting Furnaces.* Students will learn an overview of common residential heating systems. Fundamental concepts of heating and combustion systems are described with the emphasis on gas forced air systems. This section also provides students with the information and skills needed to troubleshoot gas fired furnaces and boilers. This section describes the construction and operation of oil fired heating systems and their components.

E. EPA 608 Certification - Core and Type I (10th)

The EPA Universal Certification requires all individuals who open a system or container holding a controlled refrigerant to be certified with the EPA Section 608 Certifications. Within Section 608 Certifications, there are four types of certifications that HVAC technicians will need before they can begin professionally servicing, repairing, or disposing of the appliances they will be trained to work with. Core Certification- is required as a fundamental knowledge test of basic safety and the dangers HVAC/R refrigerants can cause to the student and the environment. Type I Certification - A Type I certification is required for HVAC technicians primarily servicing small appliances such as domestic refrigerators, window air conditioners, and vending machines.The EPA Core/Type I Certification exam consists of 50 multiple-choice questions: 25 Core questions, 25 Type I questions.A score of 72% is required to pass each section, which means 18 of the 25 questions must be answered correctly in order to obtain each certification.

F. Soft Skills (11th)

This course includes *Employability Skills, Customer Relations, and Communication skills .* This section provides students with guidance related to finding and searching a position in the HVAC trade. It includes areas of problem solving and effective interaction with others to ensure their success in the HVAC industry. It shows the importance of establishing good relations with customers and provides guidance on how to achieve that goal. It focuses on good first impressions and describes how to communicate in a positive way with customers. This module provides students with the information and skills needed to communicate effectively and clearly in the HVAC industry.

G. Fundamentals of Heat Pumps, Hydronics, Oil Heat and HC/HFOs (11th)

This course includes *Heat Pumps, Introduction to Hydronic Systems, Troubleshooting Oil Heating, and HCs/ HFOs.* Students will learn an overview of common alternative residential heating systems. Students will be introduced to the operation of

heat pump systems in detail with the emphasis on the most common form of supplemental heat, electric resistance heating elements. Introduces hydronic heating systems operation, various pumps, various instruments and the fluids used with hydronic heating.This section describes the construction and operation of oil fired heating systems and their components. HydroCarbon and Hydrofluro-Olefins are becoming the new standard in refrigerants. Students will learn safety and standards for using HCs and HFOs.

H. EPA 608 Certification - Type II and Type III (11th)

The EPA Universal Certification requires all individuals who open a system or container holding a controlled refrigerant to be certified with the EPA Section 608 Certifications. Within Section 608 Certifications, there are four types of certifications that HVAC technicians will need before they can begin professionally servicing, repairing, or disposing of the appliances they will be trained to work with. Type II Certification - A Type II certification is required for HVAC technicians primarily servicing and disposing equipment using a high pressure refrigerant. Examples of such equipment include residential air conditioners and heat pumps, supermarket refrigeration and process refrigeration. Type III Certification - A Type III certification is required for HVAC technicians primarily servicing and disposing equipment using a low pressure refrigerant. These units are primarily chillers.The EPA Type II/Type III Certification exam consists of 50 multiple-choice questions: 25 Type II questions, 25 Type III questions.A score of 72% is required to pass each section, which means 18 of the 25 questions must be answered correctly in order to obtain each certification. If the student has passed all four section of the EPA test, a EPA Universal Certification will be granted - A Universal certification is required for HVAC technicians who service all types of equipment.

I. Air Distribution, Sheet Metal Duct Systems, and IAQ (12th)

This course includes *Air Distribution Systems, Basic Maintenances, Indoor Air Quality and Sheet Metal Duct Systems.* Students will be introduced to fundamental concepts of air movement and how these concepts form the basis for air distribution system design. This module reviews air distribution components and various air measurement devices with interpreting charts related to air distribution.This section introduces the student to the common tasks associated with basic maintenance activities. Reviewed in detail are proper procedures in lubrication of HVAC components and belt installation. Required tasks to complete a thorough maintenance inspection of a gas furnace and common cooling/Heat pump systems. This section covers sheet metal duct systems advantages, their low resistance to airflow, strength, durability, assembly methods, and how to properly seal and insulate to prevent heat loss or gain in the duct system.

J. Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems (12th)

This course includes *TracPipe, Manual J/D, Basic Maintenances, Green Systems.* Students will be introduced to the use of corrugated stainless steel tubing and best practices. This module describes the use of manual J and D and their importance when sizing systems.This section introduces the student to the common tasks associated with basic maintenance activities. Reviewed in detail is proper procedures in lubrication of HVAC components and belt installation. Becoming Green HVAC/R certified demonstrates to customers, peers, and potential employers that you are aware of and possess a basic understanding of the principles behind energy conservation and how it relates to the heating and cooling industry.

K. HVAC Program School to Work (optional)(12th)

This experience is available to qualified students that have the ability to demonstrate their skills and proficiencies in a hands-on setting. Students will earn credit and income during their school to work experiences in their field of study. Students must provide their own transportation to avail themselves for this opportunity. This experience is coordinated by the school to work coordinator and have the recommendation of the HVAC instructor

Course: Introduction to HVAC 1 S1 Grade 9
Unit: Safety and PPE Length: 1 week

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-MO.1 Recognize and employ universal construction signs and symbols to function safely in the workplace. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and	What are the career paths for this trade? Can you describe the basic safe installation and service techniques?	Students will consider the many areas that use refrigeration systems, heatings systems, and other professions that use HVAC skills Students will study the skills to safely install in new construction, service existing, and replace aging systems.	Discuss residential and commercial heating and cooling, refrigeration, and trade skills as they pertain to employment Demonstrate use of common safety principles and organizations.	Objective Questions Group Questioning Written Test

topics. CRP10. Plan education and career paths aligned to personal goals. 9.2.12.CAP.1: Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.				

Course: Introduction to HVAC 1 S1 Grade 9
Unit: Hand Tools and Hardware Length: 1 week

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.2 Use architecture and construction skills to create and manage a project. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues. CRP2. Apply appropriate academic and technical skills. Follow precisely a complex multistep procedure when	What are some of the daily hand tools and hardware used in the HVAC industry?	Students will learn proper use and the safety procedures for various hand tools and hardware used in the HVAC field.	Identify, explain, and demonstrate where appropriate various types of trade tools.	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Performance Tasks: Wood construction project as a team of 2

carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.				

Course: Introduction to HVAC 1 S1 Grade 9
Unit: Copper and Plastic pipe Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.2 Use architecture and construction skills to create and manage a project. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials,	What are some of the methods that we use in the HVAC industry to cut or connect various types of tubing? Why are there various types of pipe and what are their uses	Students will learn the two common methods of joining copper tubing, the preparations of copper tubing, and the safety equipment used in soldering and brazing Students will learn the uses and assembly methods of plastic pipe	Describe and demonstrate soldering and brazing copper using proper PPE. Describe and demonstrate using plastic pipe	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Performance Tasks: Brazing and soldering copper projects, gluing plastic project

components and assemblies in the project design. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.				

Course: Introduction to HVAC 2 **S2** **Grade 9**
Unit: Carbon Steel Pipe **Length: 4 weeks**

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.2 Use architecture and construction skills to create and manage a project. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of construction materials,	What are some of the methods that we use in the HVAC industry to cut or connect steel pipe? Why are there various types of steel pipe and what are their uses	Students will learn the common methods of joining steel pipes. Students will learn the uses of steel pipe and the various fittings.	Demonstrate proper assembly of steel pipe.	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Performance Tasks: Steel pipe project

components and assemblies in the project design. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.				

Course: Introduction to HVAC 2 S2 Grade 9
Unit: Basic Electricity Length: 8 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.2 Use architecture and construction skills to create and manage a project. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.	What is electricity and how is it measured? What are the risks associated with working with electricity? What are common electrical components? What math formulas are commonly used with electricity?	Students will learn how to test for electricity and install circuits safely. Students will learn the types of electricity, health hazards, and common formulas. Students will learn common electrical devices used in HVAC.	Describe the health effects of electrocution. Analyze circuits for voltage and amperage to properly design a circuit. Discuss the various components and materials used in circuits.	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Performance Tasks: Build a common light circuit Design and build a more complex circuit using a thermostat

9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects.				

Course: Introduction to HVAC 2 **S2** **Grade 9**
Unit: Intro to HVAC **Length: 3 weeks**

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.7 Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.2 Describe the approval procedures required for successful completion of a construction project. 9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design. CRP1. Act as a responsible and contributing citizen and employee.	What are common heating and air conditioning systems? How is air conditioning different from refrigeration? How do HVAC systems affect our health? Why is some HVAC work subject to inspection?	Students will learn and differentiate common heating and cooling systems. Students will learn how HVAC systems help to prevent sick building syndrome. Students will learn how HVAC systems can be designed to increase efficiency. Students will learn about HVAC licensing and inspection.	Describe types of heating systems. Compare and contrast air conditioning vs refrigeration. Discuss environmental health concerns in buildings and how HVAC systems can address these issues. Justify the needs for inspections and efficient systems.	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Create video of a household system

Course: Fundamentals of Cooling and A/C System Troubleshooting S1 Grade 10 Unit: Intro to Cooling Length: 8 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.8 Demonstrate the construction crafts required for each phase of a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals 9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design 9.3.12.AC-MO.3 Apply construction skills when repairing, restoring or renovating existing buildings	What is the refrigeration cycle? What are the 4 main components in the refrigeration cycle? What are the jobs of each of the 4 main components?	Students will learn how heat transfer is affected by saturation, vapor, and liquid states. Students will learn how refrigerant moves through a system absorbing and rejecting heat. Students will compare different compressor types. Students will compare and contrast different metering devices.	Compare heat absorption and temperature change of vapor, liquid, and saturation. Analyze the state of refrigerant moving through the 4 main components and how each component aids in the removal of heat. Describe how each type of compressor can compress vapor. Describe the pros and cons of fixed vs adjustable metering devices. Analyze how installation affects system performance.	Objective Questions Section and Chapter tests Trade Terms Diagram labeling Weekly Performance Rubric Performance task: Complete a copper brazing project Replace a condensing unit

CRP2. Apply appropriate academic and technical skills CRP6. Demonstrate creativity and innovation				

Course: Fundamentals of Cooling and A/C System Troubleshooting S1 Grade 10
Unit: Troubleshooting Cooling Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC-MO.2 Use troubleshooting procedures when solving a maintenance problem in buildings. 9.3.12.AC-MO.4 Determine work required to repair or renovate an existing building. 9.3.12.AC-MO.6 Maintain and inspect building systems to achieve safe and efficient operation of buildings. CRP1. Act as a responsible and contributing citizen and employee. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them 9.4.12.CT.2: Explain the potential benefits of	How can superheat and sub-cooling be used to evaluate system charge? What are the steps to analyze a system without power? What are the steps to analyze a running system? What are common compressor problems and their causes? What is the formula to test a PSC motor and capacitor?	Review refrigeration cycles and states of refrigerants working through the system. Students will learn about high and low vapor pressures and liquid pressures and what causes these issues. Students will learn the causes of various symptoms. Students will learn how to test a PSC motor and capacitor.	Justify the need for proper superheat and sub-cooling. Create a preliminary inspection list. Create a list to analyze a running system. Create a flowchart to analyze systems based on symptoms. Analyze a PSC motor and a capacitor using the correct tools and formula.	Objective Questions Section and Chapter tests Trade Terms Weekly Performance Rubric Performance task: Troubleshoot and replace components in an A/C system

collaborating to enhance critical thinking and problem solving CRP11. Use technology to enhance productivity.				

Course: Fundamentals of Heat and Gas Furnace Troubleshooting S2 Grade 10
Unit: Intro to Heating Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.8 Demonstrate the construction crafts required for each phase of a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals 9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design 9.3.12.AC-MO.3 Apply construction skills when repairing, restoring or renovating existing buildings	What is heat transfer? What are the components of a gas furnace? What is needed for proper combustion? What is gas furnace efficiency?	Students will review heat transfer and identify heating systems that use each method. Students will identify the components of a gas furnace. Students will learn combustion and combustion by products. Students will identify how furnace efficiency is rated.	Compare heat transfer of different heating systems. Analyze gas furnace combustion and common by products of complete and incomplete combustion. Differentiate the AFUE ratings of furnaces.	Objective Questions Section and Chapter tests Trade Terms System component labeling Weekly Performance Rubric Performance task: Complete a gas pipe and wiring project Replace a gas furnace

CRP2. Apply appropriate academic and technical skills CRP6. Demonstrate creativity and innovation				

Course: Fundamentals of Heat and Gas Furnace Troubleshooting S2 Grade 10
Unit: Troubleshooting Gas Furnaces Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC-MO.2 Use troubleshooting procedures when solving a maintenance problem in buildings. 9.3.12.AC-MO.4 Determine work required to repair or renovate an existing building. 9.3.12.AC-MO.6 Maintain and inspect building systems to achieve safe and efficient operation of buildings. CRP1. Act as a responsible and contributing citizen and employee. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them 9.4.12.CT.2: Explain the potential benefits of	What is the sequence of operation of a gas furnace? What tools are needed for troubleshooting and how to test each component? What are the safety recommendations for testing furnaces? Why is combustion analysis important?	Students will work through gas furnace schematics to identify both sequence of operation and system components. Students will identify the tools needed and how to safely test each component. Students will learn about the importance of combustion analysis from both a health and a financial standpoint.	Interpret electrical schematics to identify components and sequence of operation. Use tools and testing methods to test common gas furnace components. Analyze flue gasses for proper combustion.	Objective Questions Section tests Epa 608 Core exam Performance task: Manifold gauge maintenance Use a recovery machine Use a vacuum pump and micron gauge

collaborating to enhance critical thinking and problem solving CRP11. Use technology to enhance productivity.				

Course: EPA 608 Certification - Core and Type I S1 Grade 10
Unit: EPA Type 1 Length: 5 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of	What are the requirements to become an EPA 608 Type 1 technician? What are common Type 1 refrigerants? What are the best practices when working with Type 1 equipment?	Students will learn the work related to EPA Type 1 equipment. Students will learn why best practices are important to both the environment and health. Students will learn the various refrigerants common to type 1 equipment.	Describe the equipment Type 1 certification allows a technician to work on. Demonstrate the proper use of tools and equipment for working with refrigerants. Interpret charts to read pressures and temperatures of refrigerants. Identify the safety and health hazards associated with refrigerants.	Objective Questions Section tests Epa 608 Type 1 exam Performance task: Manifold gauge maintenance Use a recovery machine Use a vacuum pump and micron gauge

construction materials, components and assemblies in the project design. CRP1. Act as a responsible and contributing citizen and employee.				

Course: EPA 608 Certification - Core and Type I S1 Grade 10
Unit: EPA Core Length: 12 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of	What are the requirements to become an EPA 608 Universal technician? Why is EPA 608 important? What are the tools and PPE required to work with refrigerants? What are the types of refrigerants? What are the best practices for working with refrigerants?	Students will learn the work related to the 4 types of EPA 608 certifications. Students will learn why best practices are important to both the environment and health. Students will work with appropriate tools to recover and charge refrigerants. Students will learn the refrigerants and oils used in modern refrigeration and air conditioning systems and the handling/service requirements with which technicians must be familiar with. Students will learn the four essential service tasks—leak detection, evacuation, recovery, and charging.Information	Justify the need for EPA 608 certification. Describe the work EPA 608 certification allows a technician to do. Demonstrate the proper use of tools and equipment for working with refrigerants. Interpret charts to read pressures and temperatures of refrigerants.	Objective Questions Section tests Epa 608 Type 1 exam Performance task: Manifold gauge maintenance Use a recovery machine Use a vacuum pump and micron gauge

construction materials, components and assemblies in the project design. CRP1. Act as a responsible and contributing citizen and employee.		related to the US EPA's requirements for providing these services in an environ-mentally sound manner.		

Course: EPA 608 Certification - Type II and Type III S2 Grade 11
Unit: EPA Type 2 Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of	What are the requirements to become an EPA 608 Type 2 technician? What are common Type 2 refrigerants? What are the best practices when working with Type 2 equipment?	Students will learn the work related to EPA Type 2 equipment. Students will learn why best practices are important to both the environment and health. Students will learn the various refrigerants common to type 2 equipment.	Describe the equipment Type 2 certification allows a technician to work on. Demonstrate the proper use of tools and equipment for working with refrigerants. Interpret charts to read pressures and temperatures of refrigerants. Identify the safety and health hazards associated with refrigerants.	Objective Questions Section tests Epa 608 Type 2 exam Performance task: Use a recovery machine on Type 2 equipment Charge Type 2 equipment

construction materials, components and assemblies in the project design. CRP1. Act as a responsible and contributing citizen and employee.				

Course: EPA 608 Certification - Type II and Type III S2 Grade 11
Unit: EPA Type 3 Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project. 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. 9.3.12.AC-DES.8 Apply standards, applications and restrictions pertaining to the selection and use of	What are the requirements to become an EPA 608 Type 3 technician? What are common Type 3 refrigerants? What are the unique features of chillers compared to other refrigerant systems?	Students will learn the work related to EPA Type 2 equipment. Students will learn why best practices are important to both the environment and health. Students will learn the various refrigerants common to type 3 equipme..t Students will be able to identify chiller specific equipment.	Describe the equipment Type 3 certification allows a technician to work on. Demonstrate the proper use of tools and equipment for working with refrigerants. Interpret charts to read pressures and temperatures of refrigerants. Identify the safety and health hazards associated with refrigerants. Differentiate chiller systems vs other refrigeration systems.	Objective Questions Section tests Epa 608 Type 3 exam

construction materials, components and assemblies in the project design. CRP1. Act as a responsible and contributing citizen and employee.				

Course: Soft Skills S1 Grade 11
Unit: Employability Skills Length: 7 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
CRP3. Attend to personal health and financial well-being CRP9. Model integrity, ethical leadership and effective management. 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.9-10.5. Develop and strengthen writing as needed by planning,	What are the opportunities in the HVAC business and how to enter the HVAC workforce? What is the importance of social skills and identify ways good social skills are applied in the construction trade?	Students will be provided with guidance related to finding and securing a position in the con-struction trades. Students will learn problem-solving and effective interaction with others is offered to help ensure their success in the construction trades.	Create a resume to apply for employment in the desired content area. Demonstrate social skills and problem solving techniques for different levels of employment.	Objective Questions Section and chapter tests Create a resume Mock job interview

revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.				

Course: Soft Skills S1 Grade 11
Unit: Communication skills Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
CRP3. Attend to personal health and financial well-being CRP9. Model integrity, ethical leadership and effective management. 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.9-10.5. Develop and strengthen writing as needed by planning,	Why is proper communication essential to achieving an efficient workplace? What are some techniques used to better communicate goals and objectives?	Students will be provided with the information and skills needed to communicate effectively and clearly. Students will learn to develop good communications skills and how they enable the construction professional to become a confi- dent, reliable asset to their craft.	Use verbal and written communication skills to work with others in achieving goals and objectives.	Objective Questions Section and chapter tests Mock problem/ solution scenarios using communication skills

revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.				

Course: Soft Skills S1 Grade 11
Unit: Customer relations Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
CRP9. Model integrity, ethical leadership and effective management. 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.9-10.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is	How do personal habits, behaviors, and attitudes affect customer relations? What are the how to three phases of a service call?	Students will learn the importance of establishing good relations with customers and provides guidance on how to achieve that goal.	Justify the importance of and how to make a good first impression. Develop an approach to handle difficult situations with customers.	Objective Questions Section and chapter tests Participate in at least three different role-playing scenarios related to challenging customer situations.

most significant for a specific purpose and audience.				

Course: Fundamentals of Heat Pumps, Hydronics, and HC/HFOs S2 Grade 11
Unit: Heat Pumps Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP8. Utilize critical thinking to make sense of problems and persevere in solving	What is the difference with heat pumps and standard A/C systems? What is the operating cycle of a heat pump? How do you troubleshoot a heat pump?	Students will differentiate heat pump operating cycle to standard A/C systems. Students will be provided with guidance related to troubleshooting heat pump systems.	Justify the use of a heat pump over other heating systems. Identify heat pump testing procedures.	Objective Questions Section and chapter tests Performance task: Use a heat pump schematic to create a wiring project

them.				

Course: Fundamentals of Heat Pumps, Hydronics, and HC/HFOs S2 Grade 11
Unit: Intro to hydronics Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP8. Utilize critical thinking to make sense of problems and persevere in solving	What is a hydronic system? What are the various components in a hydronic system? What are normal pressures and temperatures in hydronic systems?	Students will be introduced to hydronic heating systems. In hydronic heating systems, fluids (typically water) are used to transfer heat. Fuels such as gas or oil are used to heat the water in a boiler. Pumps then cir- culate that heated water throughout the structure where terminal devices such as radiators release the heat into different areas.	Identify the components and functions of a hydronic system.	Objective Questions Section and chapter tests Performance task: Identify the components and take pressure and temperature readings of a boiler system

them.				

Course: Fundamentals of Heat Pumps, Hydronics, and HC/HFOs S2 Grade 11
Unit: Troubleshooting Oil Heating Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP8. Utilize critical thinking to make sense of problems and persevere in solving	What is the normal operation of an oil burner? What are the components of an oil burner?	Students will be introduced to the construction and operation of oil-fired heating systems and their components. Students will be instructed on servicing and testing of oil furnaces, as well as procedures for isolating and correcting oil furnace malfunctions.	Identify the components and functions of an oil burner system.	Objective Questions Section and chapter tests Performance task: Take apart and rebuild an oil furnace burner assembly

them.				

Course: Fundamentals of Heat Pumps, Hydronics, and HC/HFOs S2 Grade 11
Unit: Hydrocarbons and hydrofluoro-olefins Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP1. Act as a responsible and contributing citizen and employee. 9.3.12.AC-MO.1 Recognize and employ universal construction signs and symbols to function safely in the workplace. 9.3.12.AC-DES.4 Apply building codes, laws and rules in the project design. RST.9-10.3. Follow	What makes HC and HFO refrigerants more dangerous than other refrigerants?	Students will learn all aspects of techniques and regulations for the safe handling of flammable hydrocarbon and hydrofluoroolefin refrigerants. The HC/HFO provides training for the use of Low Global Warming Potential (Low-GWP) Refrigerants.	Demonstrate best practices when working with HC and HFO refrigerants.	Objective Questions Section and chapter tests Option of HC/HFO certification Performance task: Recover, vacuum, and charge an A/C system

precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.				

Course: Air Distribution, Sheet Metal Duct Systems, and IAQ S1 Grade 12
Unit:Sheet Metal Duct Systems Length: 10 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP8. Utilize critical thinking to make sense of problems and persevere in solving	What are common types of sheet metal? What are the various methods of joining sheet metal? Why does ductwork need to be installed properly?	Students will learn and work with various sheet metal duct systems. In addition to using time-tested assembly methods, modern sheet metal duct systems need to be sealed to prevent leakage of conditioned air, and insulated to prevent heat loss or heat gain through the walls of the duct.	Justify the use of various duct materials. Assemble duct projects using the associated tools and techniques.	Objective Questions Section and chapter tests Weekly Performance rubric Performance task: Sheet metal projects

them. 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities				

Course: Air Distribution, Sheet Metal Duct Systems, and IAQ S1 Grade 12
Unit: Air Distribution Systems Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-CST.9 Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals. CRP8. Utilize critical thinking to make sense of problems and persevere in solving	How is airflow measured? What is static pressure and how does it affect system performance?	Students will be introduced to the fundamental concepts of air movement and how these concepts form the basis for air distribution system design. With an understanding of these fundamentals, trainees are introduced to air measurement devices and the mechanical equipment used to initiate and maintain air move- ment.	Describe the process of measuring airflow. Analyze system airflow.	Objective Questions Section and chapter tests Weekly Performance rubric Performance task: Measure system static pressure

them. 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities				

Course: Air Distribution, Sheet Metal Duct Systems, and IAQ S1 Grade 12
Unit: IAQ Length: 3 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.	Why is Indoor Air Quality important in both residential and commercial applications? What is Sick Building Syndrome?	Students will learn the meaning of Indoor Air Quality and how it applies to healthy buildings. Students will learn about indoor air pollutants and how they can be addressed through the HVAC system.	Analyze air quality and make recommendations to correct any issues. Identify equipment and best practices to provide healthier air.	Objective Questions Section and chapter tests Option of testing to become certified

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities				

Course: Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems S2 Grade 12
Unit: TracPipe Length: 1 week

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them	What is corrugated stainless steel tubing? What are best practices when installing corrugated stainless steel tubing?	Students will work with corrugated stainless steel tubing and take an exam to become certified to work with TracPipe.	Design and size a system using corrugated stainless steel tubing. Create connections using corrugated stainless steel tubing.	Objective Questions TracPipe exam Performance task: corrugated stainless steel tubing project.

9.3.12.AC-CST.3 Implement testing and inspection procedures to ensure successful completion of a construction project.				

Course: Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems S2 Grade 12
Unit: System sizing (maula J and D) Length: 1 week

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.	What is Manual J and D?	Students will learn about using Manual J and D to size and design HVAC systems.	Design and size a system using Manual J.	Objective Questions Performance task: Create a floor plan of a home and input information to design the system size.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities				

Course: Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems S2 Grade 12
Unit: PM Tech/ Maintenance Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.	What is proactive vs reactive maintenance?	Students will learn all aspects of acid and moisture detection, acid removal, water removal, compressor maintenance, coil maintenance, proper refrigeration charging techniques, advanced diagnosis, and leak testing procedures.	Implement maintenance techniques to extend the life of HVAC equipment.	Objective Questions Option of testing for PM Tech Certification Performance task: Clean a condensing unit

Course: Corrugated Stainless Steel, System Sizing, Maintenance, and Green Systems S2 Grade 12
Unit: Green Systems Length: 4 weeks

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction 9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace. 9.3.12.AC-CST.7 Compare and contrast the building systems and components required for a construction project. 9.3.12.AC-DES.3 Describe the requirements of the integral systems that impact the design of buildings. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.	What does the term “Green Systems” mean? What are the benefits of installing green systems vs standard systems?	Students will learn the fundamentals behind current energy saving equipment options, energy auditing, effects of building infrastructure on efficiency, and energy saving preventative maintenance.	Justify the use of Green Systems.	Objective Questions Option of testing for PM Tech Certification

V. RESOURCES AND SUPPLEMENTAL MATERIALS

TEXTBOOKS:

A. NCCER- *Core Curriculum: Introductory Craft Skills* - Pearson Fifth edition ,2015.

B. NCCER- *Heating,Ventilating and Air Conditioning- Level 1* - Pearson Fourth edition ,2013.

C. NCCER- *Heating,Ventilating and Air Conditioning- Level 2* - Pearson Fourth edition ,2013.

D. NCCER- *Heating,Ventilating and Air Conditioning- Level 3* - Pearson Fourth edition ,2013.

E. NCCER- *Basic Math for the Construction Trades-* Pearson Fifth edition ,2015.

F. Mainstream Engineering EPA 608, HC/HFO, IAQ, Maintenance, Green Systems