

Burlington County Institute of Technology
Medford Campus

Career Major Programs

Course Title: Construction Technologies

Curriculum Area: CTE

Credits: 5

Board Approved: November, 2018

Prepared by: Richard Reed

Construction Technology

I. Course of Study (Proposed):

A. Introduction to Construction Technology 1	(9th)	S1 B4
B. Introduction to Construction Technology 2 S2 B4		(9th)
C. Blueprint Reading and framing	(10th)	S1 B1
D. Framing and Roofing	(10th)	S2 B1
E. Framing and roofing Practical	(10th)	S2 B2
F. Roofing , layout and windows	(11th)	S1 B1
G. Roofing ,layout and windows practical	(11th)	S1 B2
H. Exterior and interior finish and trim	(11th)	S2 B1
I. Interior finish work	(12th)	S1 B3
J. Practical interior finish work	(12th)	S1 B4
K. Interior finish and remodeling	(12th)	S2 B3
L. Interior finish and remodeling practical	(12th)	S2 B4

All courses are semester length courses

II. Program Descriptor:

The Construction Technology program covers many aspects of carpentry and masonry which are the building blocks of the construction industry. These cover many of the occupational titles and jobs of the construction industry. Building homes, offices and commercial buildings are an important part of the American economy. Each student in the class will be required to demonstrate proficiency in all areas required of the trade. The students will be taught basic hand and power tool use and safety. They will then be required to reach proficiency in Blueprint reading. The students will then move on to framing, this will include floors, wall and roof framing, both wood and metal stud framing. When the students are finished with framing they will move on to roof shingling. The students will learn level and transit layout work, stair framing and installation, exterior door and window identification and installation. The students will continue the course by covering exterior siding installation and identification and interior trim. Next, the students will move onto interior wall finish insulation and cabinet making and installation. The students will finish out the course by reviewing for the NOCTI test and remodeling.

III. Program Outcome:

Graduates of the Construction Technology 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 will be prepared to enter the workforce as entry level carpenters or Carpenters Union Apprentices. In addition, students will receive a certification from the NOCTI testing center in Carpentry.

IV. Course Descriptions:

A. Introduction to Construction Technology 1 (9th)

This course includes *Basic Shop Safety. An Introduction to Hand and power tool use and safety.* This section explains the importance of safety in the construction field. Students will learn how to identify and follow safe work practices and procedures and how to properly inspect and use safety equipment. This section also includes the most basic operating principles of hand and power tools. This section reinforces and extends the skills needed to properly and safely use all tools of the construction trades. As hand and power tool use is essential to working in the Building Trades, the unit extensively covers the tools identification of parts, safety and safety in use under extremely difficult professional situations.

B. Introduction to Construction Technology 2 (9th)

This course includes *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 is an essential part of the HVAC industry. 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 course 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 course also includes the basic knowledge and skills needed to thread and install carbon steel piping systems.

C. Basic Electricity & Fundamentals of Cooling (10th)

This course includes *Basic Electricity, Alternating Current, Introduction to Power Tools, and Introduction to Cooling.* This class 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. Students will identify and describes some of the power tools used by HVAC workers. The construction of each tool is discussed, along with the information regarding the safe usage and typical maintenance requirements of power tools. This course also introduces the fundamental concepts of the mechanical refrigeration cycle and examples of the primary components required to make it work.

D. Air Conditioning and Refrigeration Components (10th)

This course includes *Compressors, Refrigerants and Oils, Leak Detection, Evacuation, Refrigerant Handling, and Metering Devices.* 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. This section provides the students with guidance related to servicing the refrigerant circuit of HVAC systems. In addition information related to the US EPA's requirements for providing the necessities services in an environmentally sound manner. This section also includes 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 a thermal expansion valves.

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 the appliances they will be trained to work with. Core Certification- is required as a fundamental knowledge test of basic safety and the dangers of dealing with HVAC/R refrigerant 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. Fundamentals of Heating (11th)

This course includes *Introduction to Heating, Heat Pumps, Introduction to Hydronic Systems, and Chimneys, Vents and Flues*. This section provides HVAC students with 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 introduces 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.

G. Heating Applications and Indoor Air Quality (11th)

This course includes *Troubleshooting Gas Heating, Troubleshooting Oil Heating, Communication skills, and Air Quality Equipment*. This section provides students with the information and skills needed to troubleshoot gas fired furnaces and boilers. This course describes the construction and operation of oil fired heating systems and their components. It contains instructions for servicing and testing of oil furnaces as well as procedures for isolating and correcting oil furnace malfunctions. This module provides students with the information and skills needed to communicate effectively and clearly in the HVAC industry. This section also introduces the factors related to indoor air quality and human comfort. It describes the common comfort factors for all building types, equipment used to control humidity and air filtration materials used in the industry.

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 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, an EPA Universal Certification will be granted - A Universal certification is required for HVAC technicians who service all types of equipment.

I. HVAC Troubleshooting and Air Distribution Components (12th)

This course includes *Air Distribution Systems, Basic Maintenances, Customer Relations, and Troubleshooting Cooling*. This course introduces the fundamental concepts of air movement and explains 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 is 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. It shows the importance of establishing good relations with customers and provides guidance on how to achieve that goal. It focus on good first impressions and describes how to communicate in a positive way with customers. This also includes guidance related to troubleshooting cooling systems in the HVAC industry.

J. Performance Testing and Sustainability (12th)

This course includes *Employability Skills, Sheet Metal Duct Systems, and Troubleshooting Accessories*. 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. This class 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. This section also includes the information and skills needed to troubleshoot various air treatment accessories used with modern heating and cooling equipment.

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. Student 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: HVAC

S1

Grade 9

Unit: Introduction to HVAC 1

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
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<p>9.3.MN.3</p> <p>9.3.MN.4</p> <p>9.3.MN.5</p> <p>9.3.MN- HSE.2</p> <p>RST.9-10.1</p> <p>RST.9-10.3</p> <p>RST.9-10.7.</p> <p>CRP 1-12</p>	<p>What are the basic principles of HVACR?</p> <p>Can you describe the basic safe installation and service techniques?</p> <p>What are the career paths for this trade?</p> <p>Can students describe basic math skills used in this career?</p>	<p>Virtually all homes and businesses have an HVACR system.</p> <p>Students will study the skills to safely install in new construction, service existing, and replace aging systems.</p>	<p>Explain the principles of heating, ventilation, air conditioning, and refrigeration.</p> <p>Identify the common safety principles and organizations.</p> <p>Describe trade licensing and certification requirements.</p> <p>Identify the responsibilities and characteristics needed to be a successful HVACR technician.</p>	<p>Performance Tasks</p> <p>Graphic Organizers</p> <p>Review Questions</p> <p>Trade Terms</p> <p>Chapter Exam</p>
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Course: HVAC

S2

Grade 9

Unit: Introduction to HVAC 2

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
<p>9.3.MN.3</p> <p>9.3.MN.4</p> <p>9.3.MN.5</p> <p>9.3.MN- HSE.2</p> <p>RST.9-10.7.</p> <p>WHST.9-10.1</p> <p>CRP 1-12</p>	<p>What are some of the methods that we use in the HVAC industry to cut or connect various types of tubing?</p> <p>What are some of the daily hand tools used in the HVAC industry?</p> <p>What are the some of the safety equipment needed for proper soldering and brazing methods?</p>	<p>Students will learn the methods of cutting and joining various HVAC tubing.</p> <p>Students will learn proper use and the safety procedures for various hand tools used in the HVAC field.</p> <p>Student will learn the two common methods of joining copper tubing, the</p>	<p>Identify, explain, and demonstrate where appropriate various types of trade tools.</p> <p>Recognize, describe, and safely demonstrate basic copper and plastic piping skills.</p> <p>Describe and demonstrate soldering and brazing copper using proper PPE.</p> <p>Explain the methods of joining steel pipe, describe the various tools and fittings used.</p>	<p>Performance Tasks</p> <p>Graphic Organizers</p> <p>Review Questions</p> <p>Trade Terms</p> <p>Chapter Exam</p>

		preparations of copper tubing, and the safety equipment used in soldering and brazing.		
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Course: HVAC

S1

Grade 10

Unit: Basic Electricity & Fundamentals of Cooling

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 RST.9-10.1 RST.9-10.3 RST.9-10.7. CRP 1-12	<p>Have you ever thought of where the power of a light bulb comes from and what paths it took it get there?</p> <p>What are some of the ways we can measure electric in the HVAC field?</p> <p>What are some of the power tools we can use in the HVAC field, and what are some of the safety precautions we should take when using power tools?</p> <p>What are some of</p>	<p>Students will understand the concepts of power generation and distribution, common electrical components, AC and DC circuits and electrical safety as it relates to the HVAC field.</p> <p>Students will learn single- and three-phase alternating current is used to power resistive and inductive circuits in HVAC/R equipment.</p> <p>Students will learn to how power tools work and how to use them, the proper maintenance of different power</p>	<p>Describe the basic fundamentals of electricity and identify the components and tools used to safely work with it.</p> <p>Explain electric motor theory and describe how to test various electrical components.</p> <p>Identify common power tools and explain their uses.</p> <p>Explain the fundamental concepts of the refrigeration cycle and identify the components used in cooling systems today.</p>	<p>Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam</p>

	the methods of heat transfer in the refrigeration cycle?	tools, and proper safety guidelines when using power tools. Students will learn the fundamental concepts of the mechanical refrigeration cycle and examples of the primary components required in HVAC equipment.		
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Course: HVAC S2 Grade 10 Unit: Air Conditioning and Refrigeration Components

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5	What are some of the various types of compressors used in the HVAC industry?	Students will be able to correctly diagnose and correct problems that can affect compressor operation to avoid a costly compressor replacement.	Identify and describe operating characteristics and construction styles of compressors including common failures.	Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam
9.3.MN- HSE.2 9.3.MN- PRO.4 9.3.MN- PRO.5 9.3.MN- QA.5	What are some of the safety procedures when handling or servicing new refrigerants and their oils?	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.	Explain and demonstrate the PT chart and its use in industry.	
RST.9-10.4 RST.9-10.5 RST.9-10.7. CRP 1-12	What are some of the laws the HVAC technician must follow when handling refrigerant in the HVAC industry?	Students will learn the four essential service tasks—leak detection, evacuation, recovery, and charging. Information related to the US EPA's requirements for	Describe the refrigerant management protocols used in detection, repair, and charging while following EPA 608 guidelines.	
	What are some of the metering devices used in the HVAC industry and where would you most likely see them used at?		Explain and identify types of metering devices used and describe common problems associated with them. Calculate superheat and sub	

		<p>providing these services in an environmentally sound manner.</p> <p>Students will learn the primary function of metering devices along with related components such as the distributor. The operation of capillary tube, fixed-orifice, and expansion-type metering devices are explored in detail.</p>	cooling accurately.	
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Course: HVAC/R

S2 Grade 10

Unit: EPA 608 Certification - Core and Type I

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 9.3.MN- PRO.4 9.3.MN- PRO.5 9.3.MN- QA.5 RST.9-10.4 RST.9-10.5 RST.9-10.7. WHST.9-10.6 CRP 1-12	<p>What are the requirements to pass the EPA Core & Type I certification exam?</p> <p>What study techniques will you incorporate to help you pass this exam?</p>	<p>Required to Pass before completion of Senior Year</p> <p>EPA 608 Certification - Core and Type I</p>	<p>Students will become nationally Certified by Environmental Protection Agency upon passing the Exam.</p>	<p>Written Test</p> <p>Practical Test</p>

Course: HVAC

S1

Grade 11

Unit: Fundamentals of Heating

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
<p>9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- PRO.5 9.3.MN- QA.6 9.3.MN- QA.7 9.3.MN- HSE.2 RST.9-10.4 RST.9-10.5 RST.9-10.7. WHST.9-10.6 CRP 1-12</p>	<p>What are some of the ways to cause combustion and what are the side effects if not done correctly?</p> <p>What are some of the similarities and differences between an air conditioning unit and a heat pump system?</p> <p>What are the advantages and disadvantages of hydronic heating systems?</p> <p>Why is it important to properly vent out combustion gas from our HVAC equipment?</p>	<p>Students will understand the fundamental concepts of heating and combustion systems are described with an emphasis on gas forced-air heating systems. Hydronic heating systems and different types of electric forced-air heating systems are also covered.</p> <p>Student will understand the operation of heat pump systems in detail with additional emphasis on the most common form of supplemental heat, electric resistance heating elements. The installation considerations of both split and packaged heat pumps systems.</p> <p>Students will understand the 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 circulate that heated water throughout the structure where terminal devices such as radiators release the heat into different areas.</p> <p>Students will learn</p>	<p>Describe heat transfer and combustion. Perform proper measurements. Identify components in basic furnaces and be able to perform maintenance tasks including filter replacement and temp. measurements.</p> <p>Install a heat pump and perform the proper set up.</p> <p>Identify common components of hydronic systems.</p> <p>Practice combustion efficiency measurements and identify standard chimney design.</p>	<p>Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam</p>

		the different types of chimneys, vents, and flues that are used with fuel-burning furnaces and boilers.		
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Course: HVAC S2 Grade 11 Unit: Heating Applications and Indoor Air Quality

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 RST.11-12.1 RST.11-12.8 CRP 1-12	<p>What are some of the HVAC test and safety equipment we may need to diagnose a gas fired furnace?</p> <p>What are some of the HVAC test and safety equipment we may need to diagnose an oil fired furnace?</p> <p>Why is it important for the professional HVAC technician to be able to communicate properly with the customer and his/her co-workers?</p> <p>Why does the human body feel uncomfortable, What can we do as HVAC technicians to help relieve this discomfort?</p>	<p>Student will understand the information and skills needed to troubleshoot gas-fired furnaces and boilers.</p> <p>Students will learn the construction and operation of oil-fired heating systems and their components. The instructions for servicing and testing of oil furnaces, as well as procedures for isolating and correcting oil furnace malfunctions.</p> <p>Student will learn the ability to communicate skillfully to make them a better worker and a more effective leader. Student will be provide guidance in listening to understand, and speaking with clarity.</p> <p>Students will understand the factors related to</p>	<p>Using the proper tools and test instruments, students will be able to isolate and repair malfunctions in a gas furnace.</p> <p>Students will correctly assemble a gun type oil burner. Conduct an efficiency test and make adjustments for proper operation.</p> <p>Students will practice giving directions and following them for specific tasks.</p> <p>Explain the importance of indoor air quality. Students will demonstrate correct tools and measuring devices to monitor and correct air problems.</p>	<p>Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam</p>

		indoor air quality and human comfort, the equipment used to control humidity, and the air filtration materials and the introduction of outside air into the indoor environment.		
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Course: HVAC/R

S2 Grade 11

Unit: EPA 608 Certification - Type II and Type III

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 9.3.MN- PRO.4 9.3.MN- PRO.5 9.3.MN- QA.5 RST.11-12.9 RST.11-12.1. CRP 1-12	What are the requirements to pass the EPA Core & Type I certification exam? What study techniques will you incorporate to help you pass this exam?	Required to Pass before completion of Senior Year EPA 608 Certification - Type II and Type III	Students will become nationally Certified by Environmental Protection Agency upon passing the Exam.	Written Test Practical Test

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
<p>9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 RST.11-12.2 RST.11-12.3 WHST.9-10.1 CRP 1-12</p>	<p>How does air movement affect the temperature in the room, What happens if it is not done correctly?</p> <p>What happens if proper maintenance is done every year?</p> <p>What are some of the attributes needed when dealing with HVAC customers?</p> <p>What are some of the problems that can occur in the operation of the refrigerant cycle?</p>	<p>Students will learn the fundamental concepts of air movement and explains how these concepts form the basis for air distribution system design. Air measurement devices and the mechanical equipment used to initiate and maintain air movement. The air measurement devices and interpret charts related to air distribution system sizing.</p> <p>Students will learn the common tasks associated with basic maintenance activities. Specific tasks, such as lubrication and belt installation.</p> <p>Students will learn the importance of establishing good relations with customers and provides guidance on how to achieve that goal. The module focuses on the ways that a technician can make a good first impression and</p>	<p>Students will demonstrate specific air measuring tools. They will describe various blower styles and duct systems.</p> <p>Students will demonstrate proper blower maintenance. They will identify water leaks and discuss repair options.</p> <p>Students will model correct service protocol in dealing with customers who are happy and unhappy.</p> <p>Students will be able to isolate and determine the correct solution for various types of malfunctions.</p>	<p>Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam</p>

		<p>describes how to communicate in a positive way with customers.</p> <p>Students will develop the necessary skills to provide troubleshooting services which are vital to the future success of trainees in the HVAC/R trades.</p>		
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Course: HVAC

S2

Grade 12

Unit: Performance Testing and Sustainability

CTE Proficiencies	Essential Questions	Content	Skills	Assessments
9.3.MN.3 9.3.MN.4 9.3.MN.5 9.3.MN- HSE.2 RST.11-12.6 RST.11-12.5 WHST.9-10.6 CRP 1-12	<p>Describe the opportunities in the HVAC business and how to enter the HVAC workforce?</p> <p>How has duct systems changed over the past 2,000 years? From the roman times to present day ductwork?</p> <p>What are some of the ways to troubleshoot various HVAC system</p>	<p>Students will be provided with guidance related to finding and securing a position in the HVAC trade. In addition, guidance in the areas of problem-solving and effective interaction with others is offered to help ensure their success in the HVAC trade.</p> <p>Students will learn the major advantages of sheet metal ducts systems include low resistance to airflow, strength, and durability. In addition to using time-tested</p>	<p>Students will describe the opportunities offered in the construction trades. Develop a personal plan for their success in this field.</p> <p>Students will describe and demonstrate common sheet metal construction, insulation, and installation methods. Flexible ductwork installation practices will be demonstrated as well.</p> <p>Students will demonstrate while under supervision of</p>	<p>Performance Tasks Graphic Organizers Review Questions Trade Terms Chapter Exam</p>

	accessories?	<p>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.</p> <p>Students will be provided with information and skills needed to troubleshoot various air treatment accessories used with heating and cooling equipment. Developing troubleshooting skills for accessories is vital to the future success of trainees in the HVAC/R trade.</p>	the instructor the use of correct tools and circuit diagrams to isolate and correct accessory malfunctions.	
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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.