

**HVAC TECHNOLOGY 1, 2**  
**(Effective 2025-26 HVAC/R TECHNOLOGY 1, 2**  
**Course Codes: 6003, 6004**

**PROGRAM DESCRIPTION:** The HVAC/R Technology program offers student's specialized training related to the design, installation, and repair of heating, ventilation, air conditioning and refrigeration systems for residential and commercial use.

These courses emphasize the theory and design of electrical, electronic, mechanical, and pneumatic control systems used in air conditioning systems. Additionally, students focus on procedures used in troubleshooting, servicing, and installing components of heating, ventilation, air conditioning and refrigeration systems.

Provided a student takes Introduction to Construction and scores 70% on all assessments (00101-8-15), he or she does not have to repeat these modules in HVAC/R.

**OBJECTIVE:** Given the necessary equipment, supplies, and facilities, the student will complete all of the following core standards successfully.

**CREDITS:** 1 (120 hours), 2 (240 hours) units per course code

**PREREQUISITE(S):** None

**RECOMMENDED GRADE LEVEL:** 9 - 12

**COMPUTER ACCESS REQUIRED:** 1 Computer per student with Internet access

**RECOMMENDED MAXIMUM ENROLLMENT:** 16

**RESOURCES:** [Instructional Materials](#)

**PREREQUISITE:** NCCER® Core Modules

**A. NCCER® CORE MODULES**

**MODULE A: SAFETY**

**Proficient construction professionals demonstrate basic safety knowledge. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Identify the responsibilities and personal characteristics of a professional craftsman.
2. Describe the safe work requirements for elevated work.
3. Identify and explain how to avoid struck-by and caught-in-between hazards.
4. Explain the appropriate safety precautions around common job-site hazards.
5. Demonstrate the use and care of appropriate personal protective equipment (PPE).
6. Identify and describe other specific job-site safety hazards.

7. Follow safe procedures for lifting heavy objects.
8. Describe safe behavior on and around ladders and scaffolds.
9. Explain the importance of the Hazard Communication Standard (HazCom) requirement and Safety Data Sheets (SDS)
10. Describe fire prevention and firefighting techniques.
11. Define safe work procedures around electrical hazards.
12. Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement)
13. Complete Performance Tasks

## **MODULE B: CONSTRUCTION MATH (OPTIONAL)**

**Proficient construction professionals demonstrate basic math skills. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler and a metric ruler to measure.
3. Add, subtract, multiply, and divide fractions.
4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percent and percent to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

## **MODULE C: INTRODUCTION TO HAND TOOLS (OPTIONAL)**

**Proficient construction professionals demonstrate how to safely use various hand tools. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Recognize and identify various types of basic hand tools used in the construction trade.
2. Identify and describe how to use various types of measurement and layout tools.
3. Identify and explain how to use various types of cutting and shaping tools.
4. Use these tools safely.
5. Describe the basic procedures for taking care of these tools.
6. Complete Performance Tasks

## **MODULE D: INTRODUCTION TO POWER TOOLS (OPTIONAL)**

**Proficient construction professionals demonstrate how to safely use power tools. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Identify and explain how to use various types of power drills and impact wrenches used in the construction trade.
2. Identify and explain how to use various types of power saws.
3. Identify and explain how to use various grinders and grinder attachments.
4. Identify and explain how to use miscellaneous power tools. Use power tools safely.
5. Explain how to maintain power tools properly.
6. Complete Performance Tasks

## **MODULE E: INTRODUCTION TO CONSTRUCTION DRAWINGS/RECOMMEND BLUEPRINT READING (OPTIONAL)**

**Proficient construction professionals demonstrate knowledge and the use of blueprints/construction drawings. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Identify and describe various types of construction drawings, including their fundamental components and features.
2. Recognize and identify basic blueprint terms, components, and symbols.
3. Relate information on blueprints to actual locations on the print.
4. Recognize different classifications of drawings.
5. Interpret and use drawing dimensions.
6. Complete Performance Tasks

## **MODULE F: BASIC RIGGING (OPTIONAL)**

**Proficient construction professionals demonstrate how to use basic rigging. The following accountability criteria are considered essential for students in all the Construction programs of study.**

1. Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site.
2. Describe inspection techniques and load-handling safety practices.
3. Explain the American National Standards Institute (ANSI) hand signals.
4. Complete Performance Tasks

## **MODULE G: BASIC COMMUNICATION SKILLS (SDE Requirement)**

**Proficient construction professionals demonstrate appropriate communication skills. The following accountability criteria are considered essential for students in all of the Construction programs of study.**

1. Describe the communication, listening and speaking processes and their relationship to job performance.
2. Describe good reading and writing skills and their relationship to job performance
3. Demonstrate telephone and e-communication skills necessary in the workplace.
4. Complete Performance Tasks.

## **MODULE H: BASIC EMPLOYABILITY SKILLS (SDE Requirement)**

**Proficient construction professionals demonstrate appropriate workplace behavior. The following accountability criteria are considered essential for students in all of the Construction programs of study.**

1. Describe the opportunities in the construction business and how an individual enters the construction workforce.
2. Explain the importance of critical thinking and how to solve problems in the workplace.
3. Explain the importance of social skills and identify ways good social skills are applied in the construction trade.
4. Describe computer systems and their industry applications.
5. Explain interpersonal relationship skills, self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

## **MODULE I: MATERIALS HANDLING (OPTIONAL)**

**Proficient construction professionals demonstrate appropriate skills handling materials. The following accountability criteria are considered essential for students in all of the Construction programs of study.**

1. Describe the hazards associated with handling materials and provides techniques to avoid both injury and property damage.

## **HVAC/R TECHNOLOGY LEVEL 1 (240 HOURS)**

### **B. INTRODUCTION TO HVAC/R**

**HVAC/R professionals demonstrate knowledge of the HVAC/R industry and relevant professional development. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Explain the basic principles of heating, ventilation, and air conditioning.
2. Identify career opportunities available to people in the HVAC/R trade.
3. Explain the purpose and objectives of an apprentice training program.
4. Describe how certified apprentice training can start in high school.
5. Identify related HVAC/R certifications.
6. Describe what the Clean Air Act means to the HVAC/R trade.

### **C. TRADE MATHEMATICS (OPTIONAL)**

**HVAC/R professionals demonstrate appropriate mathematical skills. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Identify similar units of measurement in both the inch-pound (English) and metric systems and know which units are larger.
2. Convert measured values in the inch-pound system to equivalent metric values and vice versa.
3. Express numbers as powers of ten.
4. Determine the powers and roots of numbers.
5. Solve basic algebraic equations.
6. Recognize various geometric figures.
7. Use the Pythagorean Theorem to make calculations involving right triangles.
8. Convert decimal feet to feet and inches and vice versa.

### **D. BASIC ELECTRICITY**

**HVAC/R professionals demonstrate appropriate skills when working with electricity. The following accountability criteria are considered essential for students in all of the HVAC/R program of study.**

1. State how electrical power is generated and distributed.
2. Describe how the voltage, current, resistance, and power are related.
3. Use Ohm's law to calculate the current, voltage, and resistance in a circuit.
4. Use the power formula to calculate how much power is consumed by a circuit.
5. Describe the differences between series and parallel.
6. Recognize and describe the purpose and operation of the various electrical components used in HVAC/R equipment.
7. State and demonstrate the safety precautions that must be followed when working on electrical equipment.

8. Make voltage, current, and resistance measurements using electrical test equipment.
9. Wire a relay.
10. Wire a contactor and/or starter.
11. Demonstrate performance tasks.

## **E. INTRODUCTION TO HEATING**

**HVAC/R professionals demonstrate appropriate knowledge of heating systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Explain the three methods by which heat is transferred and give an example of each.
2. Describe how combustion occurs and identify the byproducts of combustion.
3. Identify the various types of fuels used in heating.
4. Identify the major components and accessories of a forced-air furnace and explain the function of each component.
5. State the factors that must be considered when installing a furnace.
6. Identify the major components of a gas furnace and describe how each works.
7. With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.
8. Identify the major components of an oil furnace and describe how each works.
9. Describe how an electric furnace works.
10. With supervision, perform basic furnace preventative maintenance procedures such as cleaning and filter replacement.
11. Demonstrate performance tasks.

## **F. INTRODUCTION TO COOLING**

**HVAC/R professionals demonstrate appropriate knowledge of cooling systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.
2. Calculate the temperature and pressure relationships at key points in the refrigeration cycle.
3. Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.
4. Identify commonly used refrigerants and demonstrate the procedures for handling these refrigerants.
5. Identify and draw the major components of a cooling system and explain how each type works.
6. Identify the major accessories available for cooling systems and explain how each type works.
7. Identify the control devices used in cooling systems and explain how each

- type works.
8. State the correct methods to be used when piping a refrigeration or cooling systems.
  9. Seat the front Seat, mid position, and back seat service valves.
  10. Install filter dryer.
  11. Install capillary tube.
  12. Install liquid line indicator.
  13. Install an access core type service valve.
  14. Demonstrate performance tasks.

## **G. INTRODUCTION TO AIR DISTRIBUTION SYSTEMS**

**HVAC/R professionals demonstrate appropriate knowledge of air distribution systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Describe the airflow and pressures in a basic forced-air distribution system.
2. Explain the differences between propeller and centrifugal fans and blowers.
3. Identify and explain various types of motors used in HVAC/R (e.g., shaded pole, psc, x13 and ECM).
4. Identify the various types of duct systems and explain why and where each type is used.
5. Demonstrate or explain the installation of metal, fiberboard, and flexible duct.
6. Demonstrate or explain the installation of fittings and transitions used in duct systems.
7. Demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.
8. Demonstrate or explain the use and installation of dampers used in duct systems.
9. Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.
10. Identify the instruments used to make measurements in air systems and explain the use of each instrument.
11. Make basic temperature, air pressure, and velocity measurements in an air distribution system.
12. Demonstrate performance tasks.

## **H. BASIC COPPER AND PLASTIC PIPING PRACTICES**

**HVAC/R professionals demonstrate appropriate knowledge of basic copper and plastic piping practices. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. State the precautions that must be taken when installing refrigerant piping.
2. Select the right tubing for the job.
3. Cut and bend tubing.
4. Safely join tubing by using flare and compression fittings.
5. Determine the kinds of hangers and supports needed for refrigerant piping.
6. State the basic requirements for pressure-testing a system once it has

been installed.

7. Demonstrate performance tasks.

## **I. SOLDERING AND BRAZING**

**HVAC/R professionals demonstrate appropriate soldering and brazing skills. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Assemble and operate the tools used for soldering.
2. Prepare tubing and fittings for soldering.
3. Identify the purposes and uses of solder and solder fluxes.
4. Solder copper/brass/steel tubing and fittings.
5. Assemble and operate the tools used for brazing.
6. Prepare tubing and fittings for brazing.
7. Identify the purposes and uses of filler metals and fluxes used for brazing.
8. Brace copper tubing and fittings.
9. Identify inert gases that can safely be used to purge tubing when brazing.
10. Construct a swage joint.
11. Braze saddle valve on suction line.
12. Demonstrate performance tasks.

## **J. BASIC CARBON STEEL PIPING PRACTICES**

**HVAC/R professionals demonstrate appropriate knowledge of basic carbon steel piping practices. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Identify the types of ferrous metal pipes.
2. Measure the sizes of ferrous metal pipes.
3. Identify the common malleable iron fittings.
4. Cut, ream, and thread ferrous metal pipe.
5. Join lengths of threaded pipe together and install fittings.
6. Describe the main points to consider when installing pipe runs.
7. Describe the method used to join grooved piping.
8. Demonstrate performance tasks.

## **K. LEAK DETECTION, EVACUATION, RECOVERY, AND CHARGING**

**HVAC/R professionals demonstrate appropriate knowledge and skills leak detection, evacuation, recovery, and charging in refrigerant systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Identify the common types of leak detectors and explain how each is used.
2. Demonstrate skill in performing leak detection tests.
3. Identify the service equipment used for evacuating a system and explain why each item of equipment is used.



4. Demonstrate skill in performing system evacuation and dehydration.
5. Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant, and explain why each item of equipment is used.
6. Demonstrate skill in performing refrigerant recovery.
7. Demonstrate or explain how to use a recycle unit.
8. Identify the service equipment used for charging.
9. Demonstrate performance tasks.

## **L. FIBERGLASS AND FLEXIBLE DUCT SYSTEMS**

**HVAC/R professionals demonstrate appropriate knowledge and skills when working with fiberglass and flexible duct systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Identify the standards related to fiberglass duct.
2. Identify application considerations related to fiberglass duct.
3. Describe how to close and join fiberglass duct using various methods.
4. Describe how to repair both minor and major fiberglass duct damage.
5. Describe methods used to suspend and support fiberglass duct.
6. Describe methods used to suspend and support fiberglass duct fittings and risers.
7. Identify various types and designs of fabric-based air distribution products.
8. Describe the various methods of installing and suspending fabric-based air distribution products.
9. Identify different types of flexible duct.
10. Explain how flexible duct is connected and supported.
11. Demonstrate performance tasks.

## **M. SHEET METAL DUCT SYSTEMS**

**HVAC/R professionals demonstrate appropriate knowledge and skills when working with sheet metal duct systems. The following accountability criteria are considered essential for students in the HVAC/R program of study.**

1. Identify various types of steel sheet metals.
2. Identify various types of duct seams.
3. Identify various methods of duct component connection.
4. Describe methods used to suspend sheet metal duct.
5. Describe methods used to support sheet metal duct.
6. Describe the selection and installation of duct lining products.
7. Describe the selection and installation of external duct wraps.
8. Identify and describe the installation of various types of dampers.
9. Identify and describe the installation of duct takeoffs and access doors.
10. Demonstrate performance tasks.

*Student Organizations, Technology Knowledge, Personal Qualities and Employability Skills, and Professional Knowledge are to be embedded in Standards A-M.*

## **STUDENT ORGANIZATIONS**

**Proficient professionals know the academic subject matter, including professional development. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

## **TECHNOLOGY KNOWLEDGE**

**Proficient professionals know the academic subject matter, including the ethical use of technology. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; cyberbullying, illegal downloading; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, fair use laws, and ethics pertaining to downloading of images, photographs, documents, video, sounds, music, trademarks, Creative Commons, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

## **PERSONAL QUALITIES AND EMPLOYABILITY SKILLS**

**Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate creativity and innovation.
2. Demonstrate critical thinking and problem-solving skills.

3. Demonstrate initiative and self-direction.
4. Demonstrate integrity.
5. Demonstrate work ethic.
6. Demonstrate conflict resolution skills.
7. Demonstrate listening and speaking skills.
8. Demonstrate respect for diversity.
9. Demonstrate customer service orientation.
10. Demonstrate teamwork.

## **PROFESSIONAL KNOWLEDGE**

**Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate global or “big picture” thinking.
2. Demonstrate career and life management skills and goal-making.
3. Demonstrate continuous learning and adaptability skills to changing job requirements.
4. Demonstrate time and resource management skills.
5. Demonstrates information literacy skills.
6. Demonstrates information security skills.
7. Demonstrates information technology skills.
8. Demonstrates knowledge and use of job-specific tools and technologies.
9. Demonstrate job-specific mathematics skills.
10. Demonstrates professionalism in the workplace.
11. Demonstrates reading and writing skills.
12. Demonstrates workplace safety.

Additional Course Materials and Resources and Academic Standards and Indicators are found in the Instruction Hub.