

HVAC TECHNOLOGY 3, 4
(Effective 2025-26 HVAC/R TECHNOLOGY 2, 3
Course Codes: 6005, 6006

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): HVAC/R Technology 1, 2

RECOMMENDED GRADE LEVEL: 9 - 12

COMPUTER ACCESS REQUIRED: 1 Computer per student with Internet access

RECOMMENDED MAXIMUM ENROLLMENT: 16

RESOURCES: [Instructional Materials](#)

HVAC/R TECHNOLOGY LEVEL 3, 4 (240 HOURS)

A. ALTERNATING / DIRECT CURRENT

HVAC/R professionals demonstrate appropriate practices when working with alternating current. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Describe the operation of various types of transformers.
2. Explain how alternating current is developed and draw a sine wave.
3. Identify single-phase and three-phase wiring arrangements.
4. Explain how phase shift occurs in inductors and capacitors.
5. Describe the types of capacitors and their applications.
6. Explain the operation of single-phase and three-phase induction motors.
7. Identify the various types of single-phase motors and their applications.
8. Use a wattmeter, megger, capacitor analyzer, and chart recorder.

9. Test inductors and capacitors using an ohmmeter.
10. State and demonstrate the safety precautions that must be followed when working with electrical equipment.
11. Demonstrate performance tasks.

B. COMPRESSORS

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

1. Identify the different kinds of compressors.
2. Demonstrate or describe the mechanical operation for each type of compressor.
3. Demonstrate or explain compressor lubrication methods.
4. Demonstrate or explain methods used to control compressor capacity.
5. Demonstrate or describe how compressor protection devices operate.
6. Perform the common procedures used when field servicing open and semi-hermetic compressors, i.e., valve plat removal and installation, and unloader adjustment.
7. Demonstrate the procedures used to identify system problems that cause compressor failures.
8. Demonstrate the system checkout procedure performed following a compressor failure.
9. Demonstrate or describe the procedures used to remove and install a compressor.
10. Demonstrate or describe the procedures used to clean up a system after a compressor burnout.
11. Install a start capacitor with different types of relays.
12. Demonstrate performance tasks.

C. REFRIGERANTS AND OILS

HVAC/R professionals demonstrate appropriate knowledge and skills when working with refrigerants and oils. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Describe the desirable characteristics of refrigerants and the various applications that require these characteristics.
2. Identify the primary chemical classifications of common refrigerants.
3. Describe the environmental concerns associated with refrigerants.
4. Identify and describe compounded and blended azeotrope, near-azeotropic, and zeotropic refrigerants.
5. Identify various refrigerant classifications and cylinder colors.
6. Explain how to use pressure-temperature (PT) charts to calculate superheat and subcooling for compounds, azeotropic, and near-azeotropic, and zeotropic refrigerants.
7. Identify important characteristics of refrigerant oils.
8. Compare mineral-based and synthetic oils.
9. Describe the movement of oil through the refrigerant circuit.
10. Describe oil contamination and its sources.
11. Describe common practices associated with handling, charging, and removing oils.

12. Identify and describe issues of concern and common practices related to refrigerant conversions.
13. Demonstrate performance tasks.

D. METERING DEVICES

HVAC/R professionals demonstrate appropriate knowledge and skills when working with metering devices. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Explain the function of metering devices.
2. Describe the operation of selected metering devices and expansion valves.
3. Identify types of thermal expansion (TXVs) and electronic expansion valves (EXVs).
4. Describe the procedure for installing and adjusting selected TXVs.
5. Demonstrate performance tasks.

E. HEAT PUMPS

HVAC/R professionals demonstrate appropriate knowledge and skills when working with heat pumps. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Describe the principles of reverse-cycle heating.
2. Identify heat pumps by type and general classification.
3. List the components of heat pump systems.
4. Demonstrate heat pump installation and service procedures.
5. Identify and install refrigerant circuit accessories commonly associated with heat pumps.
6. Analyze a heat pump control circuit.
7. Demonstrate performance tasks.

F. DUCTED AND DUCTLESS MINI-SPLITS

HVAC/R professionals demonstrate appropriate knowledge and skills when working with ducted and ductless mini-splits. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Describe the principles of a mini-split system.
2. Identify mini-splits types and general classifications.
3. List the components of a mini-split.
4. Demonstrate mini-split installation and service procedures.
5. Identify and install refrigerant circuit accessories commonly associated with mini-splits.
6. Analyze a mini-split control circuit.
7. Demonstrate performance tasks.

G. BASIC MAINTENANCE

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

1. Perform basic preventive maintenance inspection and cleaning procedures.
2. Identify common environmental health hazards associated with HVACR maintenance activities.
3. Describe common inspection and maintenance procedures for gas heating equipment.
4. Describe common inspection and maintenance procedures for DX cooling and heat pump systems.
5. Describe common inspection and maintenance procedures for various system accessories.
6. Describe how to complete common HVACR service reports.
7. Demonstrate performance tasks.

H. CHIMNEYS, VENTS, AND FLUES

HVAC/R professionals demonstrate appropriate knowledge and skills when working with chimneys, vents, and flues. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Describe the principles of combustion and explain complete and incomplete combustion.
2. Describe the content of flue gas and explain how it is vented.
3. Identify the components of a furnace vent system.
4. Describe how to select and install a vent system.
5. Perform the adjustments necessary to achieve proper combustion in a gas furnace.
6. Describe the techniques for venting different types of furnaces.
7. Explain the various draft control devices used with natural-draft furnaces.
8. Demonstrate performance tasks.

I. COMMERCIAL AIRSIDE SYSTEMS

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

1. Describe the typical operating characteristics of a commercial airside system.
2. Describe the purpose and function of ventilation and exhaust systems.
3. Describe single-zone constant volume system operation.
4. Describe multi-zone constant volume system operation.
5. Describe variable volume, variable temperature (VVT) system operation.
6. Describe variable air volume (VAV) system operation.
7. Explain the basic operation of VVT and single-duct VAV terminal devices.
8. Explain the basic operation of fan-powered VAV terminals.
9. Identify various styles of commercial grilles and registers.
10. Describe the various forms and components of packaged systems.

11. Describe the various forms and components of air handling units.
12. Describe common accessories used with commercial airside systems.
13. Demonstrate performance tasks.

J. AIR QUALITY EQUIPMENT

HVAC/R professionals demonstrate appropriate knowledge and skills when working with air quality equipment. The following accountability criteria are considered essential for students in the HVAC/R program of study.

1. Identify the factors related to the quality of indoor air.
2. Describe the elements of human comfort and their relationship to air properties.
3. Explain the relationship between air and moisture content.
4. Describe the processes and equipment used to humidify and dehumidify air.
5. Identify various types of media-based air filters.
6. Describe the operation of non-media based air filtration and purification equipment.
7. Explain how dampers and economizers are used to control the introduction of fresh air.
8. Describe the function and operation of energy and heat recovery ventilation systems.
9. Demonstrate performance tasks.

K. INTRODUCTION TO HYDRONIC SYSTEM (OPTIONAL)

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

1. Describe the basic properties of water and the significance of its contents.
2. Describe the relationship between water flow and system pressures.
3. Identify gravity and forced hydronic systems.
4. Describe the different types of boilers used.
5. Identify primary boiler components.
6. Identify common components related air and water control.
7. Describe the characteristics of one- and two-pipe systems.
8. Describe the function of hot-water zoning systems.
9. Identify various hot-water heating system terminal devices.
10. Identify the devices used to measure and control water flow in hydronic systems.
11. Describe how circulating pumps are selected based on required flow rates.
12. Explain how to measure pump pressures and system flow rates in operating system.
13. Demonstrate performance tasks.

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

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.