Indiana Department of Education
Academic Standards Course Framework

CONSTRUCTION TRADES: HVAC I

Construction Technology: HVAC I incorporates classroom theory and hands-on laboratory experiences in trade related areas such as heat generation, ventilation, air conditioning and refrigeration systems. It also presents a history of building construction with a focus on the Heating and Cooling industry including present-day applications emphasizing future trends and construction / H.V.A.C.R. as a career. It provides practice in the operation, maintenance and safe operation of various tools including an incline manometer and refrigeration gauge manifold along with other HVACR trade specific tools. Personal and jobsite safety in all areas of HVACR will be covered. Students will learn the basic sequence of operations for gas, oil and electric furnaces and other HVAC equipment. The proper installation of duct systems will be covered as well as an introduction to compression systems used in mechanical refrigeration including the refrigeration cycle, thermodynamic principles, and system components. Students will also Identify and interpret health, safety, and welfare standards and codes as dictated by local, state, or Federal agencies. Students will use mathematical principles to perform heating and cooling installation tasks and system charging procedures.

- DOE Code: 5497
- Recommended Grade Levels: 11
- Recommended Prerequisites: Introduction to Construction
- Credits: 2 semester course, 2 semesters required, 1-3 credits per semester, maximum of 6 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

Career and Technical Student Organizations (CTSOs)

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in SkillsUSA, the CTSO for this area.

Content Standards

Domain 1 – Safety

Core Standard 1 Students integrate shop and workplace safety concepts into projects to ensure compliance with professional and governmental regulations.

Standards

HVACI-1.1 Demonstrate safe practices and procedures with power and hand tools.
HVACI-1.2 Explain the characteristics of pressurized cylinders and gases used in brazing, soldering, leak testing, and refrigeration systems
HVACI-1.3 Discuss the characteristics and concerns of heating fuels
HVACI-1.4 Demonstrate an understanding of basic shop and workplace safety in compliance with OSHA standards
HVACI-1.5 Demonstrate basic first aid procedures
HVACI-1.6 Interpret health, safety, and welfare standards as dictated by local, state, or federal agencies
HVACI-1.7 Discuss and demonstrate safe industry related procedures when working with electrical circuits

Domain 2 – Duct Systems
Core Standard 2 Students fabricate duct systems and fittings to install, maintain, and repair systems.
Standards
HVACI-2.1 Develop layout drawings to scale
HVACI-2.2 Interpret schedules, drawings, and specifications shown on construction drawings to formulate a material list
HVACI-2.3 Layout and calculate measurements for ductwork used in HVAC mechanical drawings
HVACI-2.4 Use hand tools and shop equipment used to fabricate sheet metal duct and fittings
HVACI-2.5 Layout and fabricate sheet metal and fiberglass duct fittings such as plenums, transitions, and elbows
HVACI-2.6 Demonstrate proper installation techniques of sheet metal, fiberglass, and flexible duct systems

Domain 3 – Piping
Core Standard 3 Students apply and adapt the appropriate techniques to design and layout various piping systems
Standards
HVACI 3.1 Demonstrate refrigeration and gas piping connections including flaring, swaging, soldering, brazing, and NPT threading
HVACI-3.2 Design and layout natural gas and propane piping schematics for use with rigid and flexible fuel delivery systems
HVACI-3.3 Demonstrate ability to design, dry fit layout, and connect PVC Drain lines for condensate removal

Domain 4 – Electricity
Core Standard 4 Students analyze principles of electricity to repair, maintain, and troubleshoot HVAC systems.
Standards
HVACI-4.1 Understand the principles and applications of voltage, amperage, resistance, and power
HVACI-4.2 Identify the applications of transformers and low voltage circuits

HVACI-4.3 Explain the concepts of low voltage switches, relays, thermostatic and pressure controls
HVACI-4.4 Identify common electrical schematic symbols used in furnace and refrigeration electrical diagrams
HVACI-4.5 Understand the basic principles of the National Electric Code (NEC), it's use, and application in the Heating and Cooling industry

Domain 5 – Heating Fundamentals
Core Standard 5 Students evaluate various fuels, procedures, and controls to maintain and service heating appliances
Standards
HVACI-5.1 Demonstrate the use of the tools, test equipment and materials used in heating equipment installation and service
HVACI-5.2 Explain the combustion and heating process of a fossil fuel furnace
HVACI-5.3 Explain the operation of safety devices and components
HVACI-5.4 Describe the sequence of operation for all levels of furnace efficiencies
HVACI-5.5 Identify various ignition systems and flame proving devices
HVACI-5.6 Explain and measure fuel pressure readings and scales
HVACI-5.7 Discuss operational parameters of hot water and steam boiler systems
HVACI-5.8 Describe different venting requirements from atmospheric to induced draft heating appliances
HVACI-5.9 List basic code requirements pertaining to furnace installation
HVACI-5.10 Measure and perform start-up procedures for new heating equipment
HVACI- 5.11 Check for the proper airflow range using an airflow calculator taking the return air dry bulb and wet bulb temperatures for proper supply air dry bulb temperature.

Domain 6 – Refrigeration Fundamentals
Core Standard 6 Students analyze refrigeration principles to repair, install, and troubleshoot air conditioning systems
Standards
HVACI-6.1 Demonstrate the use of the tools, test equipment and materials used in refrigeration equipment installation and service
HVACI-6.2 Define and understand pressure and vacuum scales and measurement
HVACI-6.3 Define key terms and components associated with refrigeration systems
HVACI-6.4 Explain the basic principles of heat transfer and thermodynamics
HVACI-6.5 Identify refrigerant pressure and temperature relationship
HVACI-6.6 Identify refrigerant states throughout a refrigeration system such as superheated, subcooled, and saturated conditions
HVACI-6.7 Explain the principles and importance of proper system evacuation and dehydration
HVACI-6.8 Identify the steps and procedures necessary to perform new equipment start-up in accordance with manufacturers recommendations

HVACI-6.9 Analyze refrigeration systems based on superheat, subcooling, compressor amps, evaporator temperature drop, and loads
HVACI-6.10 Explain the basics of ozone depletion and refrigerant conservation as outlined by Section 608 of the Clean Air Act

Domain 7 – Employability Skills, Career Development and Exploration
Core Standard 7 Students will explore, evaluate and prepare for their future careers in the HVACR field
Standards
HVACI-7.1 Explore HVACR career options through research, career presentations, field trips, job shadowing, and post secondary visits.
HVACI-7.2 Develop an understanding of how a technician's appearance and attitude affects employment and the expected HVAC industry standards for appearance in the work place.
HVACI-7.3 Develop career resume to expected industry standards
HVACI-7.4 Develop career readiness portfolio of acquired HVAC industry certifications, training certificates, and accomplishments
HVACI-7.5 Participate in and complete mock HVAC interview training and debriefing conference