

CONSTRUCTION TRADES: HVAC II

Construction Trades HVAC II provides students with classroom theory and hands-on laboratory experiences relating to the maintenance, service, and troubleshooting of Heating, Air Conditioning and Refrigeration systems. Curriculum emphasizes reading blueprints, floor plans, elevations, section, detail and mechanical plans. The course covers the sequence of operations for various HVACR components. Safety and primary controls, combustion testing, venting requirements, and electrical schematic diagrams are also covered. Students will learn the procedures used to analyze mechanical and electrical problems that are encountered when servicing systems. The course will focus on using the manufacturer's approved methods as well as applicable E.P.A. section 608 procedures. New equipment installation and system start-up procedures will also be covered. This includes an introduction to troubleshooting procedures for electrical, mechanical and refrigeration problems. Students will analyze how a single problem affects the rest of the system and how system air flow is crucial to proper system operation. This course introduces electrical control systems and electrical motor basics as they apply to air conditioning, heating, and refrigeration including motor types, starting components, and motor troubleshooting basics. Students will also identify and interpret health, safety, and welfare standards and codes as dictated by local, state and Federal agencies. They will use mathematical principles and formulas to solve heating and cooling problems and to troubleshoot HVAC issues.

- DOE Code: 5498
- Recommended Grade Level: Grade 12
- Recommended Prerequisites: Construction Trades: HVAC I
- Credits: 2 semester course, 2 semesters required, 2-3 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 – Advanced Safety

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

Standards

HVACII-1.1 Demonstrate safe industry practices when working with pressurized cylinders, gases used in brazing & soldering, and refrigeration systems.

HVACII-1.2 Demonstrate industry standards when working with Mechanical and Electrical equipment.

HVACII-1.3 Demonstrate industry standards when working with fossil fuel heating equipment.

HVACII-1.4 Demonstrate an understanding of the OSHA standards as they pertain to the Industry.

HVACII-1.5 Demonstrate basic first aid procedures

HVACII-1.6 Interpret health, safety, and welfare standards as dictated by local, state, or federal agencies

HVACII-1.7 Discuss and demonstrate safe industry related procedures when working with electrical circuits.

Domain 2 – Indoor Air Quality

Core Standard 2 Students evaluate procedures, equipment, and concepts that effect indoor air quality.

Standards

HVACII-2.1 Develop a familiarity with the different types and styles of air filtration devices.

HVACII-2.2 Understand the need for ventilation in today's tighter homes.

HVACII-2.3 Identify the different types of indoor air pollution that HVAC professionals need to control.

HVACII-2.4 Analyze new clean air technologies such as UV air purification and Energy / Heat Recovery Ventilators.

HVACII-2.5 Explain the concept of Psychometrics as it applies to indoor air quality

Domain 3 – Heating Service

Core Standard 3 Students analyze heating systems to evaluate and maintain natural gas, propane, fuel oil, and electric heating appliances.

Standards

HVACII-3.1 Develop familiarity with manufacturer's literature pertaining to service and product data.

HVACII-3.2 Verify manufacturer's specifications pertaining to temperature, electrical, and pressure data

HVACII-3.3 Analyze the electrical schematic of heating appliances and demonstrate logic of operation

HVACII-3.4 Measure temperature rise across heat exchangers and measure / calculate system air flow.

HVACII-3.5 Perform a "clean and check" preventative maintenance procedure on fossil fuel fired heating appliances

HVACII-3.6 Troubleshoot furnace malfunctions

HVACII-3.7 Check for the proper input/ output voltages of the controls and amp draw of the electrical components

Domain 4 – Advanced Refrigeration

Core Standard 4 Students analyze refrigeration principles to accurately evaluate, assess, and troubleshoot maintenance problems.

Standards

HVACII-4.1 Locate air conditioning, heat pump, and refrigeration system components normally found in residential and light commercial systems

HVACII-4.2 Analyze common types of component failure and the effects each has on the performance of the system

HVACII-4.3 Apply fundamentals of the refrigeration cycle to interpret and troubleshoot air conditioning, heat pump, and light commercial refrigeration systems

- HVACII-4.4** Outline the basics of residential and light commercial electrical systems including controls used in temperature, humidity, and zoning
- HVACII-4.5** Describe motor starting components, their applications, functions, and troubleshooting
- HVACII-4.6** Analyze compressor failures and preventative measures to avoid compressor failures
- HVACII-4.7** Describe and analyze the effects of evaporator and condense loads and how they affect system performance
- HVACII-4.8** Develop familiarity with manufacturer’s literature pertaining to service and product data.
- HVACII-4.9** Verify manufacturer’s specifications pertaining to temperature, electrical, and pressure data
- HVACII-4.10** Analyze the electrical schematic of cooling appliances and demonstrate logic of operation
- HVACII-4.11** Formulate and Perform a “clean and check” preventative maintenance procedure for all on cooling appliances.
- HVACII-4.12** List basic code requirements pertaining to air conditioning, heat pump, and refrigeration installations
- HVACII-4.13** Demonstrate the process of Refrigerant recovery, system evacuation and system charging in accordance with E.P.A. Section 608 regulations.
- HVACII- 4.14** Check for the proper input/ output voltages and amp draw of the system’s electrical components and understand the sequence of operations for air conditioning and heat pump systems

Domain 5 – Alternative Heating and Cooling

Core Standard 5 Students evaluate alternative and green energy methods to perform maintenance, repair, and troubleshooting procedures on heating and cooling systems.

Standards

- HVACII-5.1** Describe alternatives to residential heat sources including geothermal, solar, and outdoor fuel furnaces such as corn pellets and wood burners
- HVACII-5.2** Describe applications of geothermal ground loops including horizontal, vertical, and pond loops
- HVACII-5.3** Discuss applications of commercial and industrial cooling systems including process cooling systems and their applications
- HVACII-5.4** Describe alternative cooling methods such as ice storage and cryogenics

Domain 6 – Customer Relations

Core Standard 6 Students practice methods used in dealing with customers while performing maintenance, repair, and troubleshooting procedures on heating and cooling systems.

Standards

- HVACII-6.1** Describe the methods used to properly deal with dis-satisfied customers.
- HVACII-6.2** Discuss how appearance and attitude affect employment and customer relations.
- HVACII-6.3** Discuss customer relations as it pertains to the Heating and Air Conditioning industry.

Domain 7 – Career Development and Exploration

Core Standard 7 Students investigate career opportunities and experience to explore career options in the industry through research, career presentations, field trips, extended lab opportunity, and post-secondary visits.

Standards

- HVACII-7.1** Update and refine career readiness portfolio of acquired HVAC industry certifications, training certificates, and accomplishments.
- HVACII-7.2** Participate in and complete career readiness training.
- HVACII-7.3** Update and refine student career resume to reflect all training and skills.

