2026 – 2027

CONSTRUCTION EDUCATION COURSES

KENTUCKY CTE
EMPOWERED
Today's Career and Technical Education

CONSTRUCTION EDUCATION COURSES
2026 – 2027

Table of Contents

AIR CONDITIONING TECHNOLOGY COURSES

460801 Heat Pump Application

This course explains reverse cycle heating systems, defrost cycles, reversing valves, and auxiliary heating. This course will also concentrate on the line and control voltage circuitry pertaining to these units. ARI Controls; Subtopic E; Heat Pump Systems: Subtopics A and B; System Installation and Start-Up: Subtopic C; System servicing and troubleshooting: Subtopic E.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice and observe safety procedures and techniques.
2. Explain the basic theory of heat pump operations.
3. Compare heat pump systems based on performance rating information: COP, SEER, balance points, economics.
4. Analyze and explain the refrigerant cycle in both heating and cooling modes.
5. Identify and describe different types of heat pump systems: air to air, water to air, water to air, water to water, air to water, air to ground, open loop, and closed-loop.
6. Analyze and compare the operation and performance of the different types of heat pump systems.
7. Explain the operation and function of a reversing valve.
8. Identify the main types of defrost controls.
9. Explain the operation of each defrost control.
10. Describe the purpose and function of the outdoor thermostats.
11. Describe the sequence and purpose of emergency heat controls.
12. Describe the purpose and function of metering devices.
13. Install or replace a heat-sequencing relay.
14. Identify and explain the operation and function of the electrical and mechanical components of the heat pump.
15. Explain the importance of manufacturers' installation and operation requirements.
16. Determine equipment electrical requirements.
17. Verify equipment airflow and distribution.
18. Check the operation of all electrical components.
19. Check system operation in the heating and cooling modes while following safety procedures.
20. Follow local codes and ordinances during installation and repair.
21. Read and demonstrate an understanding of electrical wiring diagrams.
22. Develop systematic ways to diagnose system problems and demonstrate methods in class.
23. Identify and describe all possible causes of failure and how to eliminate causes.
24. Use appropriate tools and test equipment while following safety practices.
25. Verify system operation.

460804 Residential Energy Auditor Prep

This course will provide step-by-step instructions and best practices involved in performing a residential energy audit. Ethics and customer relations, energy consumption and quality control inspecting. Building shell diagnosing, shell leakage, and evaluating heating systems. The course will include the evaluation of base-load measures, windows, doors, and exterior insulation. Mobile homes and safety issues are also covered.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Safety and Health:
    a. Receive safety training applied to energy auditing.
    b. Discuss safety considerations for air leakage.
    c. Discuss combustion safety.
    d. Evaluate chimneys and liners and safety.
    e. Discuss and evaluate health and safety issues, pollutant sources, and CO.
    f. Inform students about lead-safe weatherization.
    g. Practice electrical safety.
2. Energy Auditor Prep:
    a. Discuss the purpose of an energy audit.
    b. Explore the energy auditing process, visual inspection, diagnostics testing, and numerical analysis.
    c. Examine differences in work inspections, in-progress inspections, final inspections, quality assurance, and energy auditing gas and ethics.
    d. Evaluate attic and roof insulation, story-and-a-half homes, and closed-roof cavities.
    e. Evaluate walk-up stairways and doors and retractable attic stairways.
    f. Evaluate wall insulation.
3. Ethics and Consumer Relations:
    a. Practice customer relations, communication skills, customer interviews, and best sales practices.
    b. Practice customer education, reducing heating consumption, hot water and laundry, and cooling consumption.
    c. Use infrared and thermal scanning.
4. Building Shell Diagnosing and Shel Leakage:
    a. Discuss safety considerations for air leakage.
    b. Observe and learn about air leakage problems and solutions.
    c. Discuss goals of air leak testing and use of blower door.
    d. Discuss and practice air sealing approaches.
    e. Discuss crawl space moisture control.
    f. Describe heat sink methods.
    g. Evaluate moisture problems and mold.
    h. Evaluate shell leakage.
5. Evaluate Heating and Air Conditioning Systems:
    a. Evaluate heating system replacement.
    b. Perform inspection of gas and oil furnaces.
    c. Discuss wood stove safety and venting.
    d. Test draft and venting of combustion air.

e. Practice leak testing for gas piping.
f. Perform co-carbon monoxide testing pap.
g. Discuss ways of improving inadequate draft.
h. Evaluate duct air distribution.
i. Practice evaluating duct leakage.
j. Discuss duct insulation and type.
k. Discuss instructions and installation of programmable thermostats.
l. Perform electric heating inspections.
m. Perform heat pump inspections.
n. Practice evaluating central air conditioning system.
o. Check duct leakage and airflow.
p. Review ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 6.2.2-2007 ventilation standards.
q. Evaluate whole house ventilation systems.

6. Evaluate Water Heaters:
    a. Complete water heater inspection: gas, electric, tankless, and solar.
    b. Evaluate water heater energy savings.
7. Evaluation Base-Load Measures, Windows, Doors, and Exterior Insulation:
    a. Understand energy usage, base-load usage, seasonal usage, energy index, electrical peak load, and carbon footprint.
    b. Identify thermal bonding decisions and determine floor and foundation insulation.
    c. Discuss combustion safety.
    d. Evaluate chimneys and liners and safety.
    e. Practice air conditioning equipment sizing.
    f. Discuss lighting improvements.
    g. Explore different window shading/treatments interior and exterior.
    h. Observe and discuss landscaping for shade.
    i. Discuss exterior storm windows.
    j. Evaluate window replacement and weather stripping.
    k. Evaluate moisture problems and mold.
    l. Practice evaluating belly and side wall insulation.
    m. Discuss the evaluation of window and door replacements.
8. Mobile Homes:
    a. Evaluate moisture problems and mold.
    b. Discuss crawl space moisture control.
    c. Explore mobile home general auditing tasks.
    d. Practice evaluating mobile home insulation.
    e. Practice evaluating belly and side wall insulation.
    f. Evaluate shell leakage.
    g. Discuss the evaluation of window and door replacements.

460806 Green Awareness/Energy Management

This course will instruct students in the areas of energy management and analysis, green heating, ventilation, air conditioning and refrigeration. It will also cover electrical generation and consumption as well as green plumbing.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Safety:
    a. Review safety rules and student responsibilities.
2. Energy consumption:
    a. Discuss core renewable energy and sustainable energy.
    b. Discuss commercial building energy consumption surveys.
    c. Explain different energy conservation measures.
    d. Discuss the importance of energy audits.
    e. Explain energy consumption and demand analysis.
    f. Introduce heat load calculations.
    g. Discuss lighting fluorescence versus LED.
    h. Explain ghost loads.
    i. Review and discuss residential appliance energy usage.
    j. Introduce potable water conversation flow restriction faucets, showerheads, pre-rinse waterless urinals.
    k. Discuss high efficiency plumbing appliances: clothes washers, dishwashers, ice machines, garbage disposals.
    l. Explain first-hour rating system.
    m. Explain drain water heat recovery systems.
    n. All students will take the Green Mechanical Certification Exam.
3. HVAC (Heating, Ventilation, and Air Conditioning) Systems and Equipment:
    a. Explain life equipment, life cycle, and cost analysis.
    b. Cover HVAC (Heating, Ventilation, and Air Conditioning) energy efficiency ratio.
    c. Discuss HVAC (Heating, Ventilation, and Air Conditioning) seasonal energy efficiency ratio SEER.
    d. Discuss HVAC (Heating, Ventilation, and Air Conditioning) heating season performance factors.
    e. Explain HVAC (Heating, Ventilation, and Air Conditioning) coefficient of performance.
    f. Discuss and test HVAC (Heating, Ventilation, and Air Conditioning) ventilation and indoor air quality.
    g. Review mechanical HVAC (Heating, Ventilation, and Air Conditioning) equipment.
    h. Discuss evaporative cooling and passive cooling systems.
    i. Explain solar cooling and thermal storage systems.
    j. Review heating combustion analysis.
    k. Review forced air heating systems.
    l. Review condensing furnaces and modulating furnaces.
    m. Explain condensing boilers and instantaneous boilers.
    n. Review geothermal systems and air to air heat pumps.
    o. Review package terminal air conditioning.

p. Review mini-split AC systems.
q. Explain industrial fire protection systems and residential fire protection systems.

4. Refrigeration Equipment:
    a. Introduce commercial refrigeration and the U.S. EPA Green Chill Advanced Refrigeration Partnership.
    b. Discuss refrigeration replacement equipment.
5. Hot Water Systems and Equipment:
    a. Explain solar hot water and comfort heating systems.
    b. Discuss wastewater heat recovery.
    c. Discuss radiant panel systems and thermal mass.
    d. Explain optimized steam systems and steam traps.
    e. Introduce hot water distribution systems.
    f. Introduce hot water circulating systems.
    g. Explain different types of water heating systems: storage tank, tankless, heat pump water heaters, indirect, and solar.
    h. Explain rainwater harvesting.
    i. Explain green plumbing systems relevance to LEED.
6. Power Sources:
    a. Define and discuss electrical power and nuclear power.
    b. Explain fuel cells.
    c. Introduce photovoltaic and wind turbines as power sources.
    d. Explain tidal and ocean energy applications.

460817 HVAC Electricity

This course introduces students to the basic physics of electricity. Students apply Ohm's Law, measure resistance, voltage, ohms, watts and amps; construct various types of electrical circuits, select wire and fuse sizes; and learn to troubleshoot an electric motor and motor controls.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. HVAC (Heating, Ventilation, and Air Conditioning) Principles, Terminology, and Safety:
    a. Define basic terminology used in the HVAC (Heating, Ventilation, and Air Conditioning) industry.
    b. Describe the various types of tools and equipment used in HVAC (Heating, Ventilation, and Air Conditioning) and their proper use.
    c. Follow approved safety procedures.
    d. Explain the procedure for lockout/tagout system.
2. Electrical:
    a. Discuss electrical safety procedures and techniques.
    b. Explain the physics of electricity and electrical circuits.
    c. Identify the various types of single-phase and three-phase components.
    d. Explain how to use and read various instruments needed for checking and testing electrical circuits and components.
3. HVAC (Heating, Ventilation, and Air Conditioning) Electricity:
    a. Demonstrate electrical safety.
    b. Measure ohms with an ohmmeter.
    c. Measure voltage with a voltmeter.
    d. Measure amps with an ammeter.
    e. Measure watts with a wattmeter.
    f. Solve electrical circuit problems using Ohm's Law.
    g. Draw and interpret electrical symbols.
    h. Construct series circuits.
    i. Construct parallel circuits.
    j. Connect, operate, and identify the types of single-phase motors.
    k. Measure the resistance of windings in a split-phase motor and identify the start/run windings.
    l. Test capacitors.
    m. Select wire and fuse sizes.
    n. Test transformers.
    o. Locate faults in electrical circuits.
    p. Identify types of 3-phase power supplies.
    q. Troubleshoot magnetic motor starters and coils.

460820 Heating and Humidification

This course explains heating systems from simple fossil fuel furnaces through more complex systems. This course will also concentrate on the line and control voltage circuitry pertaining to these systems. ARI Controls; Subtopics A-C; Heating Systems: Subtopics A-C; System Installation and Start-Up: Subtopics A and B; System Servicing and Troubleshooting: Subtopic C; Tools and Equipment: Subtopic D.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. HVAC (Heating, Ventilation, and Air Conditioning) Principles, Terminology, and Safety:
    a. Define basic terminology used in the HVAC (Heating, Ventilation, and Air Conditioning) industry.
    b. Discuss the relationship between heat, humidity, and human comfort.
    c. Describe the various types of tools and equipment used in HVAC (Heating, Ventilation, and Air Conditioning) and their proper use.
    d. Follow approved safety procedures.
2. HVAC (Heating, Ventilation, and Air Conditioning) Installation Requirements:
    a. Explain the relationship between mechanical codes and proper installation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.
    b. Discuss installation requirements for duct systems, piping, and condensate disposal.
    c. Discuss techniques on the proper use of code books and reference manuals.
3. Gas Piping, Venting, Combustion Air:
    a. Explain the importance of the codes as they pertain to gas pipe safety.
    b. Explain how the codes affect the installation of piping and gas fired equipment.
    c. Identify the codes and standards applicable to proper venting techniques.
    d. Identify the life safety hazards of improper venting.
    e. Discuss and identify the codes related to determining proper combustion air.
4. Duct, Ventilation:
    a. Discuss the installation and safety considerations for the proper layout and construction of ducts and fittings.
    b. Evaluate air distribution systems to determine proper airflow and duct leakage.
    c. Analyze and explain the importance of balancing a whole building's ventilation system.
    d. Demonstrate knowledge of codes that relate to the installation of duct and ventilation systems.
5. Heating and Humidification Safety:
    a. Practice/observe safety procedures and techniques.
    b. Perform safety lockout procedures for burners.
    c. Test a fan/limit control to identify a set point of control.
    d. Test all safety controls.
    e. Check ignition systems while following all safety principles.
    f. Use tools and test equipment appropriately while following safety practices.
6. Values:
    a. Check the coil resistance of a valve coil.
    b. Test gas valve operation.

c. Check the voltage at the gas valve operator.
d. Check pressure at the inlet vs. the outlet of the gas valve.
e. Explain the operation of a solenoid valve.
f. Identify limited, non-adjustable and adjustable regulators.
g. Determine the application of gas valves.
h. Check the water-regulating valve operator.
i. Discuss TXV valves and their operation.

7. Pilot Devices:
    a. Differentiate between pilot proving devices.
    b. Explain the operation of the flame rod, mercury flame switch, bimetal, and millivolt flame sensors.
    c. Test and change a thermocouple flame sensor.
    d. Clean the pilot assembly.
8. Thermostats:
    a. Identify and install residential heating and cooling thermostats.
    b. Check and adjust the heat anticipator.
    c. Set aqua stat.
    d. Identify and design the difference between Communications and Non-Communications Thermostats.
    e. Set a Programmable Thermostat.
9. Furnace Gas System:
    a. Perform a regular conversion on a gas valve from natural gas to LP or reverse low, line voltage, redundant, two-stage, and modulating.
    b. Test and adjust the fuel system of the furnace.
    c. Measure gas pressure with a manometer.
    d. Adjust the burner system to the recommended efficiency.
    e. Perform pressure checks on the venting system.
    f. Adjust the regulator.
    g. Determine air velocity within a duct via Pilot tube/magnehelic.
    h. Determine air velocity at grills and diffusers via vane style anemometer, hot wire anemometer, pilot tube, and digital anemometer.
    i. Measure temperature difference across heating and cooling equipment.
    j. Verify equipment air flow and distribution requirements.
    k. Check the operation of gas train components and measurements.
    l. Check for correct heating input and adjust to manufacturers' specifications.
    m. Demonstrate an understanding of combustion theory.
    n. Determine combustion air requirements.
    o. Verify system operation.
10. Heating:
    a. Test spark ignition modules.
    b. Wire a complete heating system – line and low voltage.
    c. Identify controls for heating and cooling.
    d. Check the ignition system.
    e. De-rate or change over a gas burner.
    f. Check for proper temperature rise across the furnace.
    g. Set proper air distribution in-house.
    h. Remove, install, and adjust the blower motor and/or belt.
    i. Adjust individual register outlets to properly balance the system.
    j. Demonstrate good customer relations in a classroom simulation.
    k. Explain the importance of manufacturers' installation and operation requirements.
    l. Determine equipment electrical requirements.

m. Check the operation of all electrical control components.
n. Demonstrate the use of tools and instruments.
o. Test for proper combustion.
p. Check electrical components for operation and wiring connections.
q. Read electrical wiring diagrams and demonstrate an understanding of wiring diagrams.
r. Develop a systematic way to diagnose system problems and demonstrate them in class.
s. Determine the cause of failure in a heating system.
t. Identify and describe all possible causes of failure and how to eliminate causes.
u. Write a service report.
v. Demonstrate good customer relations.

11. Cooling and Heat Pump (Super-heat and Sub-Cooling):
    a. Determine what type of Freon is in the system.
    b. Hook up the refrigeration manifold to the system.
    c. Start the system and allow it to settle reading on gauges.
    d. Install line temperature measurement probes.
    e. Read gauge pressure and saturation temperature.
    f. Read the line temperature from the thermometer on the high and low sides.
    g. Determine superheat (suction) and sub-cooling liquid.
    h. Demonstrate proper shutdown.
    i. Remove testing equipment properly.
    j. Restart the equipment and put it in normal operation.
12. Humidification:
    a. Wire a humidistat into an electrical circuit.
    b. Determine the relative humidity using a sling psychrometer.
13. Fuel Oil:
    a. Measure the resistance of a cad cell during operation.
    b. Check safety control for proper timed operation on shut down.
    c. Check oil burner components and measurements.
    d. Evaluate fuel supply systems.
    e. Change the fuel oil filter.
    f. Clean oil pump strainer.
    g. Measure the chimney draft with a draft gauge.
    h. Determine the efficiency of an oil pump using a vacuum gauge and a pressure gauge.
    i. Check for proper oil pressure at the fuel pump.
    j. Remove drawer assembly, change nozzle, and adjust ignitors.
    k. Change oil pump coupler.
    l. Install delay fuel oil valve.
    m. Perform an efficiency test on an oil-gas burner: smoke test, CO_2 test, and O_2 test.
    n. Set over the fire draft.
    o. Set breech draft.
14. Boilers:
    a. Oil motors and bearings.
    b. Check the circulator for alignment and lubrication.
    c. Check the system for any gasket leaks at tankless and circulators.
    d. Remove air from the water system.
    e. Inspect/change zone valve operator.
    f. Wire a multizone/multi-pump hydronic system.
    g. Identify types of hydronic piping systems.

h. Observe proper draft conditions.
i. Test boiler efficiency and clean if necessary.
j. Set aqua stat.

15. Codes:
    a. Describe the reasons for codes.
    b. Discuss three model codes: Boca, standard, and uniform.
    c. Identify the codes and standards for the applicable area, locality, or state.
    d. Discuss the relationship between codes and manufacturers' installation instructions.
    e. Identify standards not covered by codes: AHRI (Air Conditioning, Heating, Refrigeration Institute), ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers), and SMACNA (Sheet Metal and Air Conditioning Contractors National Association).
    f. Explain the importance of local licensing codes.
    g. Explain how the codes affect the installation and operation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.
    h. Explain the relationship between manufacturers' suggested installation procedures and codes.
    i. Explain the importance of codes as they pertain to safety.
    j. Compare commercial codes and codes that pertain to residential applications.
    k. Demonstrate knowledge of codes that relate to the installation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.

460822 Commercial Refrigeration

This course develops techniques for servicing and troubleshooting mechanical and electromechanical refrigeration components. Electrical and refrigeration safety are emphasized. Proper tool use and environmentally sound refrigerant handling are taught.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Safety:
    a. Practice and observe safety practices and procedures.
2. Metering Devices:
    a. Define types of metering devices: capillary tubes, TXV, AEV, low side float, high side float, hand expansion valve, restrictor orifices.
    b. Evaluate system performance when using different types of flow control devices.
    c. Adjust and size devices when and where appropriate.
    d. Verify system operation.
3. Compressors and Compression:
    a. Identify types of compressors: hermetic, open type, and semi-hermetic.
    b. Identify methods of compression: centrifugal, rotary, screw, scroll, and reciprocating.
    c. Select the compressor based on cooling load.
    d. Explain the methods of compression.
    e. Explain methods of unloading cylinders (capacity control).
4. System Components and Accessories:
    a. Determine the system balance based on the selected components.
    b. Properly identify the location of all accessories in a refrigeration system.
    c. Determine appropriate accessories for systems application.
    d. Explain the operation of the accessories in a refrigeration system.
    e. Adjust EPR valve.
    f. Check the CPR valve.
5. Piping:
    a. Calculate pressure drop in liquid line risers.
    b. Size double risers.
    c. Size hot gas line.
    d. Size liquid line from condenser to receiver.
    e. Explain the multiplex system.
    f. Explain the cascade system.
    g. Determine capacities of refrigerant lines.
    h. Determine equivalent lengths of fittings.
    i. Calculate the total effective length of pipe runs.
6. Troubleshooting and Service:
    a. Explain how to set superheat on a multiplex system.
    b. Explain the heat reclaim cycle (three-way valve).
    c. Explain the head pressure control system (flooded condenser).
    d. Adjust EPR valve.
    e. Check control circuits according to manufacturer’s specifications.
    f. Check the system for full refrigerant charge.

g. Explain the difference between medium-temperature, low-temperature, and ultra-low-temperature storage systems.
h. Explain the operation of air screen freezer, glass door freezer, and coffin cases.
i. Explain the different methods of defrost: electric resistance, hot gas, and cool gas.
j. Replace anti-sweat heaters.
k. Replace fan motors and fans.
l. Check and/or replace the fan relay.
m. Verify airflow.
n. Demonstrate good customer relations.
o. Read electrical wiring diagrams and demonstrate an understanding of wiring diagrams.
p. Develop a systematic way to diagnose system problems and demonstrate them in class.
q. Determine the cause of failure in system components.
r. Identify and describe possible causes of failure and how to eliminate causes.
s. Demonstrate the use of tools and test equipment while following safety practices.
t. Verify system operation.
u. Write service report.

460824 Cooling and Dehumidification

This course will explain the working characteristics of air conditioning units with air- and water-cooled condensers. Line, low voltage, and pneumatic controls will also be covered. ARI – Air Conditioning Systems: Subtopics A-E; System Installation and Start-Up: Subtopic D; System Servicing and Troubleshooting: Subtopic D; and Controls: Subtopic will also be covered.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Safety:
    a. Practice and observe safety procedures and techniques.
    b. Explain the importance of manufacturers' installation and operation techniques.
    c. Check system operation while following all safety procedures.
    d. Follow local codes and ordinances during installation and repair.
    e. Demonstrate the use of tools and test equipment while following safety practices.
2. Air Conditioning:
    a. Describe air conditioning.
    b. List the benefits of conditioned air.
    c. Describe some of today's current issues regarding air conditioning – industry concerns and future ramifications.
    d. Describe the difference between split systems and package systems.
    e. Describe the sequence of the basic refrigeration cycle and operation of the air conditioning system.
    f. Use and read various tools and instrumentation needed for checking, testing and operating air conditioning systems and appropriately diagnose electrical and/or mechanical problems.
3. Cooling and Dehumidification:
    a. Define the types of condensers: air-cooled, water-cooled, and evaporative.
    b. Adjust the airflow for proper temperature difference.
    c. Describe the maintenance of a condenser and a cooling tower.
    d. Demonstrate good customer relations in a classroom simulation.
    e. Determine equipment electrical components, including control components.
    f. Verify equipment airflow and distribution requirements.
    g. Check the operation of all electrical components, including control components.
    h. Demonstrate the use of tools and test equipment.
    i. Read and demonstrate an understanding of electrical wiring diagrams.
    j. Develop a systemic way to diagnose system problems and demonstrate them in class.
    k. Determine the cause of failure in a system.
    l. Identify and describe possible causes of failure and how to eliminate.
    m. Verify system operation.
    n. Write a service report.
    o. Identify types of control systems: electromechanical, pneumatic, electronic, and programmable.
    p. Identify control system components.
    q. Describe the sequences of operation in all types of control systems.

r. Construct a schematic diagram using all components necessary to operate an air conditioner safely.
s. Program a programmable thermostat for heating, cooling, and heat pump operation, including set up and set back.
t. Plot and chart psychrometric terms.

460826 Electrical Components

This course defines the electrical components of an air conditioning system. Different types of line voltages, wiring diagrams, and solid-state devices are included. Safety is emphasized.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. HVAC (Heating, Ventilation, and Air Conditioning) Principles, Terminology, and Safety:
    a. Define basic terminology used in the HVAC (Heating, Ventilation, and Air Conditioning) industry.
    b. Describe the various types of tools and equipment used in HVAC (Heating, Ventilation, and Air Conditioning) and their proper use. Follow approved safety procedures.
    c. Explain the procedure for lockout/tagout system.
2. Electrical:
    a. Discuss electrical safety procedures and techniques.
    b. Explain the physics of electricity and electrical circuits.
    c. Identify the various types of single-phase and three-phase components.
    d. Explain how to use and read various instruments needed for checking and testing electrical circuits and components.
    e. Explain how to use and read various instruments needed for checking and testing electrical circuits and components.
3. Plan Analysis:
    a. Throughout the program, identify universal symbols used in equipment manuals and building and mechanical plans.
4. Electrical Components:
    a. Practice/Observe safety procedures/techniques.
    b. Measure voltage with digital and analog voltmeters.
    c. Measure AC current with a clamp-on ammeter.
    d. Check winding insulation with a megohmmeter.
    e. Define watts, ohms, volts, amps.
    f. Define and compare single and multi-phase voltage and current.
    g. Demonstrate proper use of an ohmmeter, ammeter, and voltmeter (voltage, ohms, capacitance, and micro amps).
    h. Calculate electrical circuit loads.
    i. Use appropriate meters to check fuses and breakers.
    j. Interpret tables and charts from the National Electrical Code (NEC).
    k. Figure wire sizes and voltage drop.
    l. Draw and identify power transformer types.
    m. Size and test fuses and breakers and safely replace them.
    n. Use NEC (National Electric Code) tables to size conduit.
    o. Define relays, sequencers, contactors, capacitors, defrost timers, crankcase heaters, water valves, damper actuators, thermostats, controllers, rheostats, zone valves, and solenoids.
    p. Explain the operation and application of split-phase motors, three-phase motors, variable-speed motors, shaded-pole motors, and permanent split capacitor motors.

q. Demonstrate proper use of testing equipment for motors.
r. Interpret detailed instructions for wiring circuits.
s. Draw electrical circuits in accordance with standard wiring procedures.
t. Wire actual electrical circuits from wiring diagrams.
u. Explain the use of various electrical components in HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration).
v. Interpret schematic wiring diagrams into a sequence of operations for HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) equipment.
w. Rewire an HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) unit using a schematic diagram.
x. Develop an approved routine for electrical troubleshooting.

460828 Refrigeration Fundamentals

This course introduces the fundamentals of refrigeration, refrigeration terms, and the basic refrigeration cycle. Proper use of tools, test equipment, and materials is stressed. Environmental issues, including refrigerant handling, are discussed. Refrigerant piping and methods used to join them are taught. General and specific safety is emphasized.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. HVAC (Heating, Ventilation, and Air Conditioning) Principles, Terminology, and Safety:
    a. Define basic terminology used in the HVAC (Heating, Ventilation, and Air Conditioning) industry.
    b. Explain physical laws that apply to refrigeration.
    c. Explain the principles of heat flow.
    d. Explain the relationship between pressure and temperature of a substance.
    e. Discuss the relationship between heat, humidity, and human comfort.
    f. Discuss EPA regulations regarding recovery, recycling, and proper handling of refrigerants.
    g. Describe the various types of tools and equipment used in HVAC (Heating, Ventilation, and Air Conditioning) and their proper use.
    h. Follow approved safety procedures.
2. HVAC (Heating, Ventilation, and Air Conditioning) Installation Requirements:
    a. Explain the relationship between mechanical codes and proper installation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.
    b. Discuss installation requirements for duct systems, piping, and condensate disposal.
    c. Discuss techniques on the proper use of code books and reference manuals.
3. Plan Analysis:
    a. Identify universal symbols used in equipment manuals and building and mechanical plans
4. Refrigeration Fundamentals – The Basic Refrigeration System:
    a. Explain the history of refrigeration.
    b. Identify and explain the operation of the four major components.
    c. Identify the high and low sides of the system.
    d. Explain the four parts of the refrigeration cycle.
    e. Draw a mechanical refrigeration system diagram (Plan Analysis).
    f. Explain the benefits of superheating and subcooling.
    g. Describe heat exchange techniques.
    h. Explain saturation temperature.
    i. Identify different types of evaporators.
    j. Identify different types of compressors.
    k. Identify different types of metering devices.
    l. Identify different types of condensers.
    m. Identify refrigeration system accessories.
5. Thermal Dynamics, Heat and Pressure:
    a. Define matter and heat.
    b. Distinguish between the three states of matter.

c. Explain the direction and rate of heat flow.
d. Describe the three methods of heat transfer.
e. Identify the reference points of temperature: boiling point, freezing point, critical temperature, and absolute zero.
f. Explain the difference between heat and temperature.
g. Explain the difference between latent and sensible heat.
h. Explain the relationship of pressures and fluids at different temperatures.
i. Calculate absolute and gauge pressures.
j. Compare temperature with pressure (T/P chart).
k. Explain why fluids flow.

6. Refrigerants:
    a. Define the properties of refrigerants.
    b. Explain the uses of different refrigerants.
    c. Identify color coding of refrigerant cylinders.
    d. Explain classifications of refrigerants.
    e. Transfer and store refrigerants properly.
    f. Identify the effects of improper refrigerant in a system.
7. Equipment Installation and Materials:
    a. Identify fasteners: bolts, screws, masonry anchors, various electrical connectors, conduit, pipe and cable clamps, and nails.
    b. Identify types of pipes and tubing used in refrigeration work.
    c. Identify various types of fittings.
    d. Describe methods of insulating pipe and tubing.
    e. Identify soldering and brazing alloys used in HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration).
    f. Explain applications of soldering and brazing alloys.
    g. Flare copper tubing.
    h. Swage copper tubing.
    i. Bend copper tubing.
    j. Identify types of torches.
8. Tools and Instrumentation:
    a. Measure absolute and gauge pressures.
    b. Identify basic tools and accessories: various screwdrivers, nut drivers, socket wrenches, Allen wrenches, open-end and box-end wrenches, and flare wrenches.
    c. Identify power tools: various drills, reciprocating saws, circular saws, portable band saws, and jig saws.
    d. Identify pipe and tubing tools: pipe cutters, tubing cutters, reamers, threaders, benders, flaring tools, swaging tools, and pipe vises.
    e. Describe lubrication methods utilizing grease guns, oilers, and sprays.
    f. Measure pressures with a refrigeration gauge manifold.
    g. Evacuate a system with a two-stage vacuum pump.
    h. Measure vacuums with an electronic vacuum gauge.
    i. Measure temperatures with various thermometers.
    j. Solder and braze copper piping/tubing.
    k. Cut, ream and thread black iron pipe.
9. System Operation, Service and Maintenance:
    a. Practice and observe safety practices and techniques.
    b. Charge a system with refrigerant using an electronic charging scale.
    c. Charge a system with refrigerant on the liquid side as well as the suction side.
    d. Check for refrigerant leaks using various methods.
    e. Repair refrigerant leaks.

f. Test and adjust all operating and safety controls.
g. Replace liquid line filter driers.
h. Inspect electrical circuits for defective connections and make repairs if needed.
i. Interpret electrical wiring diagrams.
j. Clean out condensate drain lines.
k. Check the voltage supply and amp draw of all electrical components.
l. Clean a condenser coil (air and water).
m. Clean an evaporator coil.
n. Perform all aspects of preventive HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) maintenance.

460845 Ice Machines

This course introduces students to the operation, checking, adjusting, and troubleshooting of commercial ice makers. The student will learn to adjust, check, clean, and troubleshoot commercial ice machines.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice and observe safety procedures and techniques.
2. Explain the operation of ice making.
3. Follow the manufacturer's instructions for cleaning the evaporator.
4. Clean the condenser.
5. Check the harvest cycle.
6. Adjust cube size.
7. Check for and repair leaks.
8. Inspect the electrical circuit.
9. Adjust the metering device for proper operation.
10. Measure grid heater current when applicable.
11. Clean ice storage bin.
12. Inspect and clean drains as necessary.
13. Replace bearings in flake-type machine.
14. Check and adjust the water level.
15. Check and adjust the water pressure.
16. Level machine.
17. Check the water pump.
18. Explain the water spray system for ice making.
19. Treat water properly.

460846 Journeyman Preparation

This course includes a series of lectures, discussions, and presentations pertaining to the proper application of HVAC (Heating, Ventilation, and Air Conditioning) codes. The class will help prepare the student to pass the Kentucky Journeyman HVAC (Heating, Ventilation, and Air Conditioning) licensing exam.

Recommended Grade Level: 10 – 12

Recommended Credit: .5

Students will:

1. Explain the importance of local licensing codes.
2. Explain how the codes affect the installation and operation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.
3. Explain the relationship between manufacturers' suggested installation procedures and codes.
4. Explain the importance of codes as they pertain to safety.
5. Compare commercial codes and codes that pertain to residential applications.
6. Demonstrate knowledge of codes that relate to the installation of HVAC (Heating, Ventilation, and Air Conditioning) equipment.

460847 Sheet Metal Fabrication

The student will learn to make patterns and layout and construct common sheet metal duct fittings.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Layout and construct common sheet metal duct fittings.
2. Construct duct connectors of all shapes and sizes.
3. Construct duct couplings of all shapes and sizes.
4. Construct three-way and four-way duct fittings of various sizes.
5. Layout a duct system for a residence or commercial building.
6. Install duct system in a residence or commercial building.

460877 Special Problems - Air Conditioning

This course is designed for the student who has demonstrated specific special needs.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Complete selected tasks and problems as determined by the instructor.

460880 Co-op* (Air Conditioning)

Co-op I provides supervised, on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Recommended Grade Level: 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance educational expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

460883 Internship (Air Conditioning)

An internship provides on-the-job work experience related to the student's educational objectives. Students participating in the internship do not receive compensation.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

460890 Special Topics - HVAC

Instruction related to Electrical Technology but not described in the other courses.

Recommended Grade Level: 9 – 12

Recommended Credit: .5 – 1

Students will:

1. Complete selected tasks and problems as determined by the instructor.

480812 Heat Load/Duct Design

Introduces the fundamentals needed to calculate heat gain and heat loss, thereby determining air conditioner/furnace size. This information will be used to calculate the correct duct size. Procedures to layout a duct system as outlined in ACCA MANUAL D are presented.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Terminology:
    a. Define “U” value.
    b. Define “R” value.
    c. Interpret heat transfer tables (“U,” “R”).
    d. Calculate the total heat transfer valve of any surface (R) - (U).
    e. Explain specific humidity, apparatus dew point, contact factor, relative humidity, dry-bulb, wet-bulb, dew point, and enthalpy.
2. Manual “J” Heat Loss Gain:
    a. Explain the heat load sources, conduction, infiltration, product, and miscellaneous loads (people, motors, and equipment).
    b. Explain the purpose of vapor barriers.
    c. Interpret tables of specific heat values, latent heat, and heat of respiration.
    d. Calculate refrigeration-sensible heat ratio, contact factor, latent heat, sensible heat, total heat, water removal, and mixed air conditions.
    e. Determine total resistance to heat flow (“R”), (“U”).
    f. Interpret structure design data.
    g. Interpret building prints.
    h. Calculate conduction loss for walls, roof, floors, windows, basement (walls, floor), and unconditioned space.
    i. Calculate infiltration: doors, windows.
    j. Calculate ventilation load.
    k. Calculate duct loss.
    l. Calculate “U” values for building materials.
    m. Calculate CLTD (Cooling Load Temperature Difference).
    n. Make corrections for CLTD.
    o. Calculate conduction loads for walls, roofs, windows, doors, non-conditioned space, and floors.
    p. Calculate lighting load.
    q. Determine the size of equipment needed.
    r. Calculate infiltration and ventilation.
    s. Calculate duct gain.
3. Manual “D” Duct Design:
    a. Draw the layout of return and supply runs.
    b. Calculate the equivalent length of trunk and branch ducts.
    c. Calculate the total effective length of duct runs.
    d. Calculate the total available static pressure.
    e. Size trunk and branch ducts by equal friction method.
    f. Use a duct calculator to find duct size, velocity, CFM, and friction loss.

g. Calculate air flow factors for heating and cooling.
h. Size registers, grills, and diffusers.

4. Air Filtration:
    a. Identify types of mechanical filters: disposable, permanent foam, mesh, fiber, and high efficiency.
    b. Describe the operation of electronic air cleaners.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

BUILDING CONSTRUCTION TECHNOLOGY COURSES

460112 Introductory Masonry

This course introduces various types of mortar and cement, along with the use of basic masonry tools. It emphasizes the different methods of spacing materials on a construction site, the 6-8-10 method, and the use of the transit level, brick spacing, and modular rule. It also focuses on laying straight and plumb brick to the line, bricking gables and building columns. It permits application techniques for setting up different types of masonry materials, marking off layout lines, and erecting batter boards, along with techniques employed in different types of weather and climates. The laboratory is part of the class.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Demonstrate a safe environment according to best practices in the Masonry industry and OSHA standards.
2. Proportion and mix mortars manually with a hoe and mortar box.
3. Set up and maintain a mortar mixer.
4. Proportion and mix mortar with electric and gasoline-powered mixers.
5. Set up and maintain masonry saws.
6. Stock a mortar board or pan.
7. Temper mortar.
8. Layout building lines using the 6-8-10 method.
9. Square corners with a framing square.
10. Determine coursing with a brick spacing rule and with a modular mason's rule.
11. Determine coursing with a modular mason's rule.
12. Drop jack lines.
13. Set corner poles for veneer.
14. Set freestanding corner poles.
15. Plumb and level with a mason's two (2') and four (4') foot levels.
16. Plumb with a plumb bob.
17. Chalk a line.
18. Set lines, pins, blocks, and twigs.
19. Inspect, assemble, and disassemble rigging and scaffolding.
20. Carry brick with tongs.
21. Cut masonry materials with hand tools.
22. Cut materials with a masonry saw.
23. Identify brick types.
24. Spread mortar for brick.
25. Make head joints for brick.
26. Lay inside and outside brick corner leads.
27. Gauge masonry walls with a mason's modular rule.
28. Dry bond brick.
29. Bond a brick wall for range with a rule.
30. Lay brick to a line while holding bond.
31. Tuck-point a wall.
32. Finish joints with a variety of tools.
33. Identify types of block.

34. Layout block corners and walls with a tape measure.
35. Bond corners for all widths of block.
36. Square corners with a 2’ framing Square.
37. Spread mortar for block.
38. Lay inside and outside block corner leads.
39. Lay a block wall to a line.
40. Lay closure block/brick.
41. Lay 4” partition block walls and cap block.
42. Install foundation vents.

460114 Residential Maintenance Masonry

This course covers the basic aspects of masonry as it relates to the residential structure. Emphasis is placed on proper handling, mixing, placing, and finishing of Portland cement products.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice safe masonry procedures.
2. Use masonry trowels, hammers, and chisels.
3. Proportion and mix concrete.
4. Install concrete.
5. Edge, joint, and finish concrete.
6. Measure and mix mortar with a hoe and mortar box.
7. Repair/replace bricks.
8. Repair/replace concrete blocks.
9. Tuck-point walls.
10. Cut masonry materials with hand tools.
11. Cut masonry materials with a circular saw.
12. Clean and maintain masonry tools.
13. Estimate masonry materials.
14. Store masonry tools, materials, and equipment.

460220 Residential Maintenance Carpentry

This course covers the basic aspects of framing, roofing, window, door, and stair maintenance. The student will receive training in the proper use of ladders and the handling and storage of building materials.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate safe carpentry practices.
2. Construct and/or install a partition wall.
3. Frame wall openings.
4. Install/repair roof flashing.
5. Install rolled roofing.
6. Install/replace composition shingles.
7. Weatherproof exterior siding.
8. Install/repair doors.
9. Install/repair door hardware.
10. Install/repair windows.
11. Construct concrete forms.
12. Install insulation.
13. Maintain gutters and downspouts.
14. Re-glaze a window sash.
15. Install/repair a window screen.
16. Knowledge of building and trade codes.
17. Safely and properly handle and store materials.
18. Calculate material costs.
19. Knowledge of ordering and reviewing materials.

460222 Residential Interior Maintenance

This course covers the basic aspects of drywall hanging, finishing, and repair; painting; window, door, and floor moldings; laying composition and vinyl flooring; and maintaining ceramic tile.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Safely perform drywall practices.
2. Use drywall hammers, knives, saws, and sanders.
3. Measure, cut, and hang drywall.
4. Repair/replace cornerbead.
5. Mix and prepare joint compound.
6. Finish drywall joints.
7. Mix texturing compound.
8. Apply texture to ceilings.
9. Repair/replace damaged drywall.
10. Clean and maintain drywall tools.
11. Estimate drywall materials.
12. Practice painting safety.
13. Select and use a variety of paints.
14. Prepare an area for painting.
15. Prepare surfaces for painting.
16. Caulk cracks and moldings.
17. Cut-in corners and trim with brushes.
18. Apply coatings with rollers and brushes.
19. Clean and maintain painting tools.
20. Estimate materials for painting.
21. Repair damaged wallpaper.
22. Use floor covering tools.
23. Install underlayment.
24. Repair/replace composition floor tiles.
25. Repair/replace vinyl flooring.
26. Estimate materials for floor coverings.
27. Re-grout and caulk ceramic tiles.

460229 Co-op* (Building Construction Technology)

Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

460232 Internship (Building Construction Technology)

An internship provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the internship do not receive compensation.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

460241 Introduction to Building Construction Technology

This course covers required safety practices in the shop and workplace, identification and use of hand tools used in the construction trades, identification of construction materials, interpretation of blueprints and/or drawings, and exposure to various mechanical and structural systems in a residential structure.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Safety:
    a. Demonstrate knowledge of safe shop practices and procedures.
    b. Demonstrate knowledge of fire safety equipment.
    c. Demonstrate knowledge of first aid procedures.
    d. Demonstrate safety with handling and positioning of ladders.
2. Measuring Instruments:
    a. Identify and understand how to use measuring instrument tools.
3. Hand Tools:
    a. Understand how to safely use hand tools.
    b. Identify and understand how to properly use a hammer.
    c. Identify and understand how to properly use screwdrivers.
    d. Identify and understand how to properly use a sledgehammer.
    e. Identify and understand how to properly use ripping bars and nail pullers.
    f. Identify and understand how to properly use a wrench.
    g. Identify and understand how to properly use pliers and wire cutters.
    h. Identify and understand how to properly use a level.
    i. Identify and understand how to properly use a square.
    j. Identify and understand how to properly use a bench vise.
    k. Identify and understand how to properly use a clamp.
    l. Identify and understand how to properly use a hand saw.
    m. Identify and understand how to properly use a file and rasp.
    n. Identify and understand how to properly use a chisel and punch.
    o. Identify and understand how to properly use a plumb bob.
    p. Identify and understand how to properly use a socket and ratchet
    q. Identify and understand how to properly use a torque wrench.
    r. Identify and understand how to properly use a wedge.
    s. Identify and understand how to properly use a chalk line.
    t. Identify and understand how to properly use a utility knife.
    u. Identify and understand how to properly use a chain fall and come along.
    v. Identify and understand how to properly use a wire brush.
    w. Identify and understand how to properly use a shovel.
    x. Identify and understand how to properly maintain hand tools.
4. Power Tools:
    a. Understand how to safely use power tools.
    b. Identify and understand how to properly use a power drill.
    c. Identify and understand how to properly use a circular saw.
    d. Identify and understand how to properly use a grinder and sander.
    e. Identify and understand how to properly use miscellaneous power tools.

    f. Identify and understand how to maintain power tools.
    g. Identify and understand how to use stationary tools.
5. Fastening and Anchoring Devices:
    a. Identify and understand how to use fastening devices.
    b. Identify and understand how to use anchoring devices.
6. Construction:
    a. Identify and understand basic framing components.
    b. Identify and understand basic construction materials.
    c. Identify and understand residential mechanical systems.
7. Basic Blueprint:
    a. Identify blueprints and drawings.
    b. Sketch a drawing.

460333 Residential Maintenance Wiring

This course covers the basic aspects of electric theory, wire and cables, fixtures and devices, and troubleshooting and maintenance wiring.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice safe electrical procedures.
2. Use the electrician's cutting, stripping, and connecting tools.
3. Demonstrate knowledge of electrical theory.
4. Use electrical test equipment.
5. Route, pull, and secure cables.
6. Remove cable sheathing.
7. Make electrical connections.
8. Remove and replace device boxes.
9. Remove and replace circuit breakers and fuses.
10. Identify and mark circuits in a service panel.
11. Check overloaded circuits.
12. Remove and replace lighting fixtures.
13. Remove and replace receptacles.
14. Remove and replace various types of switches.
15. Troubleshoot and repair lighting and receptacle circuits.
16. Repair doorbell/chime system.
17. Remove and replace photoelectric control.
18. Remove and replace phone outlets.
19. Maintain electrical tools.
20. Estimate electrical materials.

460516 Residential Maintenance Plumbing

This course covers the basic aspects of clearing blocked drains, repairing leaks, repairing and replacement of residential plumbing fixtures, and working with copper, plastic, and steel pipes.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice safe plumbing procedures.
2. Identify plumbing systems components.
3. Use a plumber's cutting, cleaning, and joining tools.
4. Remove obstructions from building drains.
5. Repair malfunctioning valves and faucets.
6. Measure, cut, ream, and join copper pipe.
7. Cut and join plastic pipe.
8. Bend copper pipe using spring benders.
9. Join steel pipe.
10. Join pipes of different types.
11. Secure pipes.
12. Repair and replace the water supply line for a plumbing fixture.
13. Repair leaks in pipes.
14. Insulate water pipes.
15. Repair and replace water closets.
16. Repair and replace lavatories.
17. Repair and replace kitchen sinks.
18. Test gas piping for leaks.
19. Maintain plumbing tools.
20. Estimate plumbing materials and supplies.

460804 Residential Energy Auditor Prep

This course will provide step-by-step instructions and best practices involved in performing a residential energy audit. Ethics and customer relations, energy consumption and quality control inspecting. Building shell diagnosing, shell leakage, and evaluating heating systems. Evaluation of base load measures, windows, doors, and exterior insulation evaluations. Mobile homes and health and safety issues are also covered.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Safety and Health:
    a. Students will receive safety training applied to energy auditing.
    b. Discuss safety considerations for air leakage.
    c. Discuss combustion safety.
    d. Evaluate chimneys and liners and safety.
    e. Discuss and evaluate health and safety issues, pollutant sources and CO.
    f. Inform students about lead-safe weatherization.
    g. Practice electrical safety.
2. Energy Auditor Prep:
    a. Discuss the purpose of an energy audit.
    b. Explore the energy auditing process, visual inspection, diagnostics testing, and numerical analysis.
    c. Examine differences in work inspections, in-progress inspections, final inspections, quality assurance, energy auditing gas, and ethics.
    d. Students will practice evaluating attic and roof insulation/story-and-a-half homes and closed roof cavities.
    e. Students will practice evaluating walk-up stairways and doors/retractable attic stairways.
    f. Students will evaluate wall insulation.
3. Ethics and Consumer Relations:
    a. Students will practice customer relations, communication skills, customer relations, and best sales practices.
    b. Students will practice customer education relating to reducing heating consumption, hot water and laundry, and cooling consumption.
    c. Students will receive instruction on using infrared and thermal scanning
4. Building Shell Diagnosing and Shell Leakage:
    a. Discuss safety considerations for air leakage.
    b. Students will observe and learn about air leakage problems and solutions.
    c. Discuss goals of air leak testing/use of blower door.
    d. Discuss and practice air sealing approaches.
    e. Discuss crawl space moisture control.
    f. Evaluate moisture problems and mold.
    g. Evaluate shell leakage.
5. Evaluate Heating and Air Conditioning Systems:
    a. Evaluate heating system replacement.
    b. Perform inspection of gas and oil furnaces.
    c. Discuss wood stove safety and venting.

d. Test draft and venting of combustion air.
e. Practice leak testing gas piping.
f. Perform co-carbon monoxide testing pap.
g. Discuss ways of improving inadequate draft.
h. Evaluate duct air distribution.
i. Practice evaluating duct leakage.
j. Discuss duct insulation and type.
k. Discuss instructions and installation of programmable thermostats.
l. Perform electric heating inspections.
m. Perform heat pump inspections.
n. Practice evaluating central air conditioning system.
o. Check duct leakage and air flow.
p. Review ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 6.2.2-2007 ventilation standards.
q. Evaluate whole house ventilation systems.

6. Evaluate Water Heaters:
    a. Complete water heater inspection for gas, electric, tankless, and solar
    b. Evaluate water heater energy savings.
7. Evaluation Base Load Measures, Windows, Doors, and Exterior Insulation:
    a. Students will be instructed on understanding energy usage, base load usage, seasonal usage, energy index, electrical peak load, and carbon footprint.
    b. Students will identify thermal bonding decisions and determine floor and foundation insulation.
    c. Discuss combustion safety.
    d. Evaluate chimneys and liners and safety.
    e. Practice air conditioning equipment sizing.
    f. Discuss lighting improvements.
    g. Explore different window shading and treatments interior and exterior.
    h. Observe and discuss landscaping for shade.
    i. Discuss exterior storm windows.
    j. Evaluate window replacement and weather stripping.
    k. Evaluate moisture problems and mold.
    l. Practice evaluating belly and side wall insulation.
    m. Discuss evaluation of windows and doors/replacement.
8. Mobile Homes:
    a. Evaluate moisture problems and mold.
    b. Discuss crawl space moisture control.
    c. Explore mobile home general auditing tasks.
    d. Practice evaluating mobile home insulation.
    e. Practice evaluating belly and side wall insulation.
    f. Evaluate shell leakage.
    g. Discuss evaluation of windows and doors/replacement.

460818 Residential HVAC Maintenance

This course covers the basic aspects of maintaining various heating, ventilating, and air conditioning systems in residential buildings.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Use safe HVAC (Heating, Ventilation, and Air Conditioning) procedures.
2. Explain the basic operation of furnaces.
3. Inspect a ventilation system.
4. Light and adjust a pilot light.
5. Adjust burners.
6. Inspect heat exchangers.
7. Adjust belts and pulleys.
8. Service fan motors.
9. Check air circulation around units.
10. Replace air filters.
11. Clean condensing and/or cooling coils.
12. Inspect flues.
13. Install thermostats.
14. Inspect and clean condensate lines.
15. Replace a thermocouple.
16. Install window air conditioning units.

460826 Electrical Components

This course defines the electrical components of an air conditioning system. Different types of line voltages, wiring diagrams, and solid-state devices are included. Safety is emphasized.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Practice and observe safety procedures and techniques.
2. Measure voltage with digital and analog voltmeters.
3. Measure AC current with a clamp-on ammeter.
4. Check winding insulation with a megohmmeter.
5. Define watts, ohms, volts, and amps.
6. Define and compare single and multi-phase voltage and current.
7. Demonstrate proper use of an ohmmeter, ammeter, and voltmeter (voltage, ohms, capacitance, and microamps).
8. Calculate electrical circuit loads.
9. Use appropriate meters to check fuses and breakers.
10. Interpret tables and charts from the National Electrical Code (NEC).
11. Figure wire sizes and voltage drop.
12. Draw and identify power transformer types.
13. Size and test fuses and breakers and safely replace them.
14. Use NEC tables to size conduit.
15. Define relays, sequencers, contactors, capacitors, defrost timers, crankcase heaters, water valves, damper actuators, thermostats, controllers, rheostats, zone valves, and solenoids.
16. Explain the operation and application of split-phase motors, three-phase motors, variable speed motors, shaded pole motors, and permanent split capacitor motors.
17. Demonstrate proper use of testing equipment for motors.
18. Interpret detailed instructions for wiring circuits.
19. Draw electrical circuits in accordance with standard wiring procedures.
20. Wire actual electrical circuits from wiring diagrams.
21. Explain the use of various electrical components in HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration).
22. Interpret schematic wiring diagrams into a sequence of operations for HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) equipment.
23. Rewire an HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) unit using a schematic diagram.
24. Develop an approved routine for electrical troubleshooting.

460828 Refrigeration Fundamentals

This course introduces the fundamentals of refrigeration, refrigeration terms, and the basic refrigeration cycle. Proper use of tools, test equipment, and materials is stressed. Environmental issues, including refrigerant handling, are discussed. Refrigerant piping and methods used to join them are taught. General and specific safety are emphasized.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. The Basic Refrigeration System:
    a. Explain the history of refrigeration.
    b. Identify and explain the operation of the four major components.
    c. Identify the high and low sides of the system.
    d. Explain the four parts of the refrigeration cycle.
    e. Draw a mechanical refrigeration system diagram.
    f. Explain the benefits of superheat and sub-cooling.
    g. Describe heat sink methods.
    h. Describe heat exchange techniques.
    i. Explain saturation temperature.
    j. Identify different types of evaporators.
    k. Identify different types of compressors.
    l. Identify different types of metering devices.
    m. Identify different types of condensers.
    n. Identify refrigeration system accessories.
2. Thermal Dynamics, Heat and Pressure:
    a. Define matter and heat.
    b. Distinguish between the three states of matter.
    c. Explain the direction and rate of heat flow.
    d. Describe the three methods of heat transfer.
    e. Identify the reference points of temperature: boiling point, freezing point, critical temperature, and absolute zero.
    f. Explain the difference between heat and temperature.
    g. Explain the difference between latent and sensible heat.
    h. Explain the relationship of pressures and fluids at different temperatures.
    i. Calculate absolute and gauge pressures.
    j. Compare temperature with pressure (T/P chart).
    k. Explain why fluids flow.
3. Refrigerants:
    a. Define the properties of refrigerants.
    b. Explain the uses of different refrigerants.
    c. Identify color coding of refrigerant cylinders.
    d. Explain classifications of refrigerants.
    e. Demonstrate proper transfer and storage of refrigerants.
    f. Identify the effects of improper refrigerant in a system.
4. Equipment Installation and Materials:
    a. Identify fasteners: bolts, screws, masonry anchors, various electrical connectors, conduit, pipe and cable clamps, and nails.

b. Identify types of pipes and tubing used in refrigeration work.
c. Identify various types of fittings.
d. Describe methods of insulating pipe and tubing.
e. Identify soldering and brazing alloys used in HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration).
f. Explain applications of soldering and brazing alloys.
g. Flare copper tubing.
h. Swage copper tubing.
i. Bend copper tubing.
j. Identify types of torches.

5. Tools and Instrumentation:
    a. Measure absolute and gauge pressures.
    b. Identify basic tools and accessories: various screwdrivers, nut drivers, socket wrenches, Allen wrenches, open-end and box-end wrenches, and flare wrenches.
    c. Identify power tools: various drills, reciprocating saws, circular saws, portable band saws, and jig saws.
    d. Identify pipe and tubing tools: pipe cutters, tubing cutters, reamers, threaders, benders, flaring tools, swaging tools, and pipe vises.
    e. Measure pressures with a refrigeration gauge manifold.
    f. Evacuate a system with a two-stage vacuum pump.
    g. Measure vacuums with an electronic vacuum gauge.
    h. Measure temperatures with various thermometers.
    i. Solder and braze copper piping/tubing.
    j. Cut, ream, and thread black iron pipe.
6. System Operation, Service and Maintenance:
    a. Practice and observe safety practices and techniques.
    b. Change a system with refrigerant using an electronic charging scale.
    c. Charge a system with refrigerant on the liquid side as well as the suction side.
    d. Check for refrigerant leaks using various methods.
    e. Repair refrigerant leaks.
    f. Test and adjust all operating and safety controls.
    g. Replace liquid line filter driers.
    h. Inspect electrical circuits for defective connections and make repairs if needed.
    i. Interpret electrical wiring diagrams.
    j. Clean out condensate drain lines.
    k. Check the voltage supply and amp draw of all electrical components.
    l. Clean a condenser coil (air and water).
    m. Clean an evaporator coil.
    n. Perform all aspects of preventive HVACR (Heating, Ventilation, Air Conditioning, and Refrigeration) maintenance.

460847 Sheet Metal Fabrication

The student will learn to make patterns and layout and construct common sheet metal duct fittings.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Layout and construct common sheet metal duct fittings.
2. Construct duct connectors of all shapes and sizes.
3. Construct duct couplings of all shapes and sizes.
4. Construct three-way and four-way duct fittings of various sizes.
5. Layout a duct system for a residential or commercial building.
6. Install duct system in a residential or commercial building.

499920 Basic Blueprint Reading

This course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Review math concepts (fractions and decimals).
5. Identify the alphabet of lines.
6. Identify multiple views.
7. Arrange multiple views.
8. Arrange two-view drawings.
9. Identify one-view drawings.
10. Arrange and identify auxiliary views.
11. Demonstrate and use the size and location dimensions.
12. Demonstrate proper dimensions of cylinders and arcs.
13. Size dimensions of holes and angles.
14. Locate dimensions for the centering of holes, points, and centers.
15. Interpret the baseline dimensions on drawings.
16. Identify half, full, and removed sections.
17. Identify electrical schematic and diagram symbols.
18. Identify welding symbols and equipment.
19. Interpret ordinate and tabular dimensions.
20. Set tolerances using geometric dimensioning techniques.
21. Sketch parts with irregular shapes.
22. Sketch oblique views of various parts.
23. Sketch and dimension shop drawings.
24. Dimension parts using shop notes.
25. Calculate tolerances.
26. Identify labeling of various screw threads.
27. Calculate tapers and machined surfaces.
28. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

CONSTRUCTION CARPENTRY TECHNOLOGY COURSES

460119 Concrete Finishing

The focus of this course is the composition of concrete, defining the advantages of air-entrained concrete, learning how concrete is tested for strength requirements, and the steps in preparing, placing, finishing, and curing concrete. The student will be able to describe how floors, steps, footers, and pads are laid out and constructed, become familiar with construction safety practices and learn the safe and proper use of hand, portable and stationary power tools. In addition, students will develop a working knowledge of construction procedures utilized in residential and commercial construction.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Prepare wood and steel forms.
2. Prepare for pouring.
3. Install expansion joints.
4. Pour concrete.
5. Screed concrete.
6. Finish concrete by hand.
7. Finish concrete by machine.
8. Estimate cubic yards.
9. Pour concrete footers and pads.
10. Set grade stakes for footers.
11. Identify different types of concrete finishes.
12. Run a power screed.
13. Set forms.
14. Saw expansion joints.
15. Identify joint materials.
16. Add color to concrete.
17. Stamp concrete.
18. Set grade stakes.
19. Texture concrete.
20. Run a bull float.
21. Run an edger.
22. Use a finish trowel.
23. Determine concrete placement.

460201 Introduction to Construction Technology

This course is an introduction to the construction carpentry industry. The class will emphasize safe and proper methods of operating hand tools, portable power tools, and stationary power tools in the construction industry. Content in the course should be aligned with the pathway being offered: Commercial and/or Residential.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Commercial and Residential
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety: Commercial and Residential
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Hand and Power Tools: Commercial and Residential
    a. Identify and demonstrate the safe and proper use of hand tools, including fastening devices, leveling devices, and edge-cutting devices.
    b. Identify and demonstrate the safe and proper use of power tools including electric portable, cordless, stationary, powder-actuated, and pneumatic.
4. Building Materials, Fasteners, and Adhesives: Residential
    a. Identify the use and application of building materials in construction work, including lumber, sheet materials, engineered wood products, structural concrete, and structural steel.
    b. Identify the use and application of fasteners and adhesives used in construction work.
5. Orientation to the Construction Trade: Residential
    a. Recognize the order of operation and responsibilities of construction trade professionals such as foremen, general contractors, and laborers.

460209 Cabinet Construction and Installation

Students will lay out and plan the construction of base and wall cabinets. They will prepare wood surfaces for finishing as well as install cabinets and special units.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades:
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety:
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Cabinet Construction and Installation:
    a. Study design layout of the different types of kitchen layouts.
    b. Identify standardized cabinet and appliance dimensions.
    c. Produce a kitchen cabinet layout.
    d. Identify components of the factory-built cabinets.
    e. Lay out custom-built cabinets.
    f. Construct cabinet frames.
    g. Construct cabinet boxes.
    h. Construct and install drawers.
    i. Construct and install cabinet doors.
    j. Sand, prepare, and finish wood surfaces.
    k. Install shelf-supporting devices.
    l. Install cabinets.
    m. Install plastic laminates.
    n. Install countertops.
    o. Install cabinet hardware.
    p. Construct and install special units such as bookcases, medicine cabinets and window seats.

460212 Floor and Wall Framing

The student will practice floor framing, layout, and construction of floor frames. Cutting and installing floor and wall framing members according to plans and specifications will also be practiced. Content in the course should be aligned with the pathway being offered: Commercial and/or Residential.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Commercial and Residential
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety: Commercial and Residential
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Hand and Power Tools: Commercial and Residential
    a. Identify and demonstrate the safe and proper use of hand tools, including fastening devices, leveling devices, and edge-cutting devices.
    b. Identify and demonstrate the safe and proper use of power tools including electric portable, cordless, stationary, powder-actuated, and pneumatic.
4. Wood and Metal Framing: Commercial
    a. Understand the applications of wood and metal framing, including workability, varied sizes and shapes, ease of operation, fire resistance, and sound transmission.
    b. Identify wood and metal framing components and their sizes: gauges of metal; types and shapes of beams, columns, and pilasters; and various trims and fasteners used for interior partition work.
    c. Read prints and specifications to determine the type of partition and its location, layout, and related requirements.
    d. Identify, estimate, and describe the installation of floor, ceiling, and wall covering, including suspended ceiling, drywall, drywall finishing, door and door hardware, paneling, and trim.
5. Wood Framing: Residential
    a. Read prints and specifications to determine the type of partition and its location, layout, and related requirements.
    b. Utilize techniques for installing and squaring sill plates.

c. Demonstrate applications of wood and metal framing, including workability, varied sizes and shapes, ease of operation, fire resistance, and sound transmission.
d. Identify wood and metal framing components and code requirements such as gauges of metal, types and shapes of beams, columns, pilasters, various trims, and fasteners used for interior partition work.
e. Identify, estimate material and describe the installation of floor, ceiling, and wall covering, including suspended ceiling, drywall, drywall finishing, door and door hardware, trim, and paneling.
f. Identify and install basic stair systems per code requirements.

6. Energy Efficiency Codes: Residential
    a. Demonstrate awareness of the International Energy Conservation Code (IECC).
    b. Demonstrate awareness of installation requirements for various types of insulation.
    c. Recognize construction practices that allow the full depth/thickness of the insulation without compression, including insulated headers, open corners, and open tees.

460213 Ceiling and Roof Framing

This course covers roof types and combinations of roof types used in the construction industry. The emphasis of this course is on layout. Cutting and installing ceiling joists, rafters, roof sheathing, and roof coverings for both commercial and residential construction. Content in the course should be aligned with the pathway being offered-- Commercial and/or Residential.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Commercial and Residential
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety: Commercial and Residential
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Wood and Metal Framing: Commercial
    a. Understand the applications of wood and metal framing, including workability, varied sizes and shapes, ease of operation, fire resistance, and sound transmission.
    b. Identify the tools and fasteners used in ceiling and roof framing, including fasteners, hand tools, and power tools.
    c. Identify wood and metal framing components, their sizes, gauges of metal, and types used for ceiling and roof framing.
    d. Read construction drawings and specifications, including architectural, structural, mechanical, electrical, and plumbing, to determine the type, location, and layout of various roof framing components.
    e. Identify different roofing systems and their associated materials.
    f. Estimate the amount of materials to complete a specified steel framing roof project.
    g. Calculate, layout, cut, and erect ceiling joists and rafters.
    h. Frame roof openings and install roof sheathing.
    i. Install drip edge, flashing, and roof ventilation.
    j. Explain the purpose of underlayment and waterproof membrane.
    k. Discuss and demonstrate how to properly prepare a roof deck for various types of roofing materials.

l. Identify, estimate, and describe the installation of various roof coverings, including composition shingles, metal roofing, single-ply membrane, built-up, and tile or slate.
m. Identify, estimate, and describe the installation of ceiling, suspended ceiling, drywall, and drywall finishing.
n. Review the different types of low-slope and steep-slope roof systems available.
o. Identify the basic components of vertical and horizontal flashing systems and accessories for low- and steep-slope flashing systems.
p. Describe the estimating procedures for low-slope and steep-slope roofing projects.

4. Hand and Power Tools: Commercial and Residential
    a. Identify and demonstrate the safe and proper use of hand tools, including fastening devices, leveling devices, and edge-cutting devices.
    b. Identify and demonstrate the safe and proper use of power tools including electric portable, cordless, stationary, powder-actuated, and pneumatic.
5. Wood Framing: Residential
    a. Identify and construct basic roof types such as gable, gambrel, shed, and hip.
    b. Calculate, layout, cut, and erect rafters and ceiling joists to basic roof types such as gable, gambrel, shed, and hip.
    c. Frame roof openings and roof saddles.
    d. Identify the installation practices and prefabricated trusses.
    e. Cut, construct, and install trusses.
    f. Frame dormers.
    g. Install roof sheathing.
    h. Identify and install various roof coverings such as 3-tab, architectural/dimensional, metal, wood shakes, tile, and roll.
    i. Install roof underlayment.
    j. Install roof flashing and drip edge.
    k. Install various types of attic vents.

460214 Site Layout and Foundations

Students will prepare materials, calculate the cost for a building site, and layout a site with a transit, locating property lines and corners. Students calculate the amount of concrete needed for footing and foundation walls and construct different types of foundations and forms. Content in the course should be aligned with the pathway being offered: Commercial and/or Residential.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Commercial
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety: Commercial
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Building Layout: Commercial
    a. Demonstrate an understanding of the building layout process, including safety procedures, tools, materials, survey equipment points of beginning, and benchmarks.
    b. Identify and read relevant sections of the building plan.
    c. Identify tools and materials required in the building layout process.
4. Formwork/Foundations: Commercial
    a. Explain the properties of concrete and the purpose and specifications of formwork/foundations.
    b. Identify types and components of forms, including footers, wall forms, bridge forms, and slabs.
    c. Identify basic measures and materials used in formwork, such as form material, concrete, concrete block, and reinforcement.
    d. Identify important structural components that can be fabricated from formwork/foundation and concrete, including piers, columns, and pile caps.

460217 Construction Prints

This course will provide a series of lectures, demonstrations, and practice exercises in the study of symbols, views, sections, details, and material lists found on architectural working drawings, building materials and specifications lists, and construction dimensioning systems and charts/schedules.

Recommended Grade Level: 10 – 12

Recommended Credit: .5

Students will:

1. Math for the Trades:
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety:
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Construction Prints:
    a. Demonstrate view projection techniques as applicable to the construction trades.
    b. Identify different architectural line types.
    c. Identify standard listings on construction working drawings and details.
    d. Interpret a list of architectural terms associated with planning, including various symbols and uses.
    e. Identify procedural construction requirements from notations on working drawings, details and specifications.
    f. Specify duty-specific uses of contour and grade notes.
    g. Determine overall measurements such as lengths, heights, and depths.
    h. Describe various materials’ usage in sectioned drawings.
    i. Describe assembly techniques used in various sectioned drawings.
    j. Complete various sectioned views.
    k. Identify various prefabricated materials from vendor catalogs.
    l. Display an understanding of estimating procedures.
    m. Construct a materials control chart for a construction project.
    n. Display an understanding of door and window schedules.
    o. Determine structural calculations.
    p. Identify plumbing, air conditioning, electrical, concrete construction, and building procedures and techniques from various related details and drawings.
    q. Compile a duty-specific hardware list for a construction project.

r. Demonstrate duty-specific fire prevention techniques.
s. Identify and list duty-specific problems in a multi-story dwelling.
t. Identify all construction documents required in the completed building process.

4. Metal Framing:
    a. Read prints and specifications to determine the type of partition and its location, layout, and related requirements.
5. Building Layout:
    a. Identify and read relevant sections of the building plan.

460218 Construction Forms

This course will introduce the student to heavy commercial construction. The student will receive information about rigging, wall forms, vertical piers and columns, grade curb forms, horizontal beam forms, above-grade slab systems, fireproof encasement forms, stair forms, and bridge deck forms.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades:
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety:
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Construction Forms:
    a. Discuss the basic properties of concrete.
    b. Identify different soil conditions and the effects on footing design.
    c. Identify important structural components that can be fabricated from formwork and concrete.
    d. Describe and/or build various types of foundation systems.
    e. Identify form systems and components used to construct wall forms.
    f. Identify form systems and components used to construct vertical piers and columns.
    g. Describe the construction of horizontal beam forms.
    h. Explain the construction of above-grade forms such as piles, piers, columns, caps, and forming.
    i. Describe the construction of fire-proofing encasement forms.
    j. Layout and estimate materials for concrete stair forms.
    k. Calculate the quantity of concrete blocks and common face bricks needed for a concrete block wall.
    l. Calculate the amount of concrete needed for footings and foundation walls.

460219 Exterior and Interior Finish

This course presents basic concepts of building trim, gypsum wallboard, paneling, base, ceiling and wall molding with instruction on acoustical ceilings and insulation, wood floors, tile, inlaid adhesive and tools of the flooring trade. This course will continue to refine the techniques and skills taught in the previous carpentry courses. In this course, cost control, speed, and precision are emphasized. In addition, students will demonstrate the skills associated with the exterior finishing of a house.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Residential
2. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
3. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
4. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
5. Use and understand how to read measuring tools.
6. Construct layouts using lines, circles, and angles.
7. Explain square roots, square numbers, and the Pythagorean Theorem.
8. Use area measure to find the area of rectangles, squares, and circles.
9. Use volume measure to calculate the volume of three-dimensional objects.
10. Health and Safety: Residential
11. Assume responsibility for the safety of self and others.
12. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
13. Identify safety standards and procedures based on “OSHA 1926 Standards”.
14. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
15. Hand and Power Tools: Residential
16. Identify and demonstrate the safe and proper use of hand tools, including fastening devices, leveling devices, and edge-cutting devices.
17. Identify and demonstrate the safe and proper use of power tools including electric portable, cordless, stationary, powder-actuated, and pneumatic.
18. Exterior and Interior Finish: Residential
19. Install windows, interior/exterior doors, hardware and trim.
20. Estimate material quantities, install, and finish various types of drywall.
21. Demonstrate safe and proper use of elevated surfaces such as scaffolding and ladders.
22. Estimate material quantities and cut and install floor, wall, and ceiling molding.
23. Build and install cornices using different types of materials.
24. Install soffit, gable, and ridge vents.
25. Install various types of floor covering (optional task).
26. Layout and construct cabinets (optional task).
27. Layout and install cabinets (optional task).

460242 Co-op* (Carpentry)

Co-op provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Co-op Education program receive compensation for their work.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom/lab studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance educational expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

460245 Internship (Carpentry)

An internship includes various Construction Carpentry Technology topics, issues, and trends. Topics may vary from semester to semester at the discretion of the instructor; the course may be repeated with different topics to a maximum of six (6) credit hours.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom/lab studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Demonstrate a working knowledge of the topic chosen for the class.

460298 Special Topics - Construction Carpentry

This course provides instruction related to Carpentry Technology but is not described in the other courses.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Selected tasks and problems as determined by the instructor and approved by the Program Consultant.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

ELECTRICAL TECHNOLOGY COURSES

460305 Transformers

This course focuses on the operation, installation and application of AC single-phase and three-phase transformers. Testing and maintaining transformer equipment are emphasized, with safety integrated as a core component of the study.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (Safety Data Sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Transformers:
    a. Connect a dual voltage transformer for its highest input and output voltages.
    b. Connect a dual voltage transformer for the low voltage input and output.
    c. Connect an ammeter to a high-voltage line using a current transformer.
    d. Connect an autotransformer to give a variety of voltages.
    e. Connect transformers to supply 3-phase power, 4-2 configuration.
    f. Connect transformers to supply 3-phase power, delta configuration.
    g. Connect transformers to supply 3-phase power, Y configuration.
    h. Connect the secondary of a 3-phase bank to give a 4-wire delta system.
    i. Connect 3 single-phase transformers to form a delta-delta configuration.
    j. Connect 3 single-phase transformers to form a delta-star configuration.
    k. Connect 3 single-phase transformers to form a star-delta 3-phase bank.
    l. Connect 3 single-phase transformers to form a star-star 3-phase bank.
    m. Connect 2 single-phase transformers in an open-delta configuration.
    n. Connect 2 single-phase transformers in parallel.
    o. Connect a voltmeter using a potential transformer to determine voltage.
    p. Test transformer for output and performance under resistive, capacitive, and inductive loads.
    q. Connect the buck-boost transformer to increase voltage.
    r. Connect the buck-boost transformer to decrease voltage.

460312 Electrical Construction I

This course involves the study of materials and procedures used in construction wiring.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge for construction and industrial.
2. Identify equipment and materials of the trade.
3. Identify safe and proper use of tools of the trade.
4. Identify the characteristics of a safe worksite.
5. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
6. Identify and use personal protective equipment.
7. Demonstrate ladder safety.
8. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
9. Identify different types of chemical, biological, and physical hazards.
10. Interpret hazardous chemical communication, including SDS (Safety Data Sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
11. Demonstrate knowledge and understanding of blood-borne pathogens.
12. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
13. Demonstrate knowledge and understanding of schematics and line diagrams.
14. Demonstrate the following math and science concepts of electricity for construction and industrial.
15. Demonstrate an understanding of Ohm's Law.
16. Demonstrate an understanding of DC circuits.
17. Demonstrate an understanding of AC circuits.
18. Demonstrate an understanding of transformers.
19. General – National Electrical Code Articles 100-110: Construction and Industrial:
20. Exhibits previously learned material by recalling facts, terms, and basic concepts related to the National Electrical Code.
21. Locate information using electrical installation regulations.
22. Demonstrate an understanding of electrical installation regulations.
23. Wiring and Protection – National Electrical Code Articles 200-285: Construction and Industrial:
24. Exhibits use and identification of grounded conductors.
25. Interpret code regulations of branch circuits.
26. Interpret code regulations of feeders.
27. Apply branch circuit, feeder, and service calculations.
28. Interpret code regulations of services.
29. Calculate overcurrent protection.
30. Interpret code regulations of grounding and bonding.
31. Wiring Methods and Materials – National Electrical Code Articles 300-399: Construction and Industrial:
32. Exhibits previously learned knowledge of general wiring methods and materials.

33. Locate information using conductors for general wiring.
34. Demonstrate an understanding of conductors for general wiring.
35. Apply knowledge of outlet, device, pull, and junction boxes, conduit bodies, fittings, and handhole enclosures.
36. Apply knowledge of cables according to the National Electrical Code (Articles 320- 340).
37. Apply knowledge of raceways according to the National Electrical Code (Articles 342-399).
38. Equipment for General Use – National Electrical Code Articles 400-490: Construction and Industrial:
39. Interpret code regulations of equipment for general use, such as cords, switches, and fixtures.
40. Apply knowledge of luminaires, lamp holders, and lamps.
41. Apply knowledge of appliances and equipment.
42. Electrical Construction I:
43. Draw wiring diagrams to specifications.
44. Compile a bill of materials from wiring diagrams drawn to specifications.
45. Estimate the total cost of a specific installation.
46. Install temporary service (Article 590).
47. Perform an inventory of equipment, materials, and supplies.
48. Mark the location of switches and outlets on studding.
49. Use paper, wire, and pencil to perform layout calculations for ninety's offset and 3-point saddle.
50. Locate the room center for ceiling outlets.
51. Mark the location of single system components.
52. Layout and install single and ganged boxes, both flush and surface mounted (new construction) (Article 314).
53. Layout and install ganged boxes, both flush and surface mounted (old construction) (Article 314).
54. Install line and low-voltage thermostats (Article 424).
55. Install communication outlets (Articles 314, 720).
56. Introduce underground and overhead service entrances (Article 230).
57. Install the main distribution panel (Articles 110, 408).
58. Install circuits using non-metallic sheathed cables (Article 334).
59. Install and connect branch circuit grounding (Articles 210, 250).
60. Install power feeder wiring system to equipment (Articles 215, 220, 225).
61. Introduce non-metallic conduits for above and below-ground installation (Article 352).
62. Introduce conductors in conduit or raceway and terminate (Articles 310, 314).
63. Introduce underground cable (Article 340) (300.5 Table).
64. Install wire terminals and lugs (Article 110).
65. Make splices using approved methods (Article 110).
66. Install flexible and liquid-tight conduit (Articles 348-350).
67. Install, identify, and label circuit breakers, fuses, and fuse adapters in distribution panels (including AFCI (Arc Fault Circuit Interrupter) breakers).
68. Test circuits for proper operation.
69. Install lighting dimmer systems (Article 404).
70. Install switches - single pole, three-way, and four-way (Article 404).
    a. Install duplex and special purpose receptacles, including GFCI (Ground Fault Circuit Interrupter) (Articles 210, 406).
    b. Install lighting fixtures including incandescent, fluorescent, LED, recessed, and surfaced (Article 410).
    c. Install door chimes, switches, and transformers (Articles 404, 450, 720).

d. Install overhead fan or fanlight with controls (Article 314).
e. Connect or troubleshoot water heaters (Article 422).
f. Install single-phase dual voltage motors (Article 430).
g. Test emergency lighting system.
h. Complete an accident or incident report.
i. Apply National Electrical Code (NEC (National Electric Code)) terms and concepts (Article 100).
j. Summarize the NEC (National Electric Code) style (Article 90).
k. Use formal methods in finding code requirements.
l. Determine the purpose, scope, and enforcement of the NEC (National Electric Code) (Article 90).
m. Examine the mandatory rules and formal interpretation of the NEC (National Electric Code).
n. Apply definitions for proper understanding and application of the NEC (National Electric Code) rules (Article 100).
o. Examine working space and working space entrances for electrical equipment (Article 110).

460313 Electrical Construction II

This course expands the knowledge and skills needed to work in commercial and industrial construction wiring.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge for construction and industrial.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Demonstrate the following math and science concepts of electricity for construction and industrial.
    a. Demonstrate an understanding of Ohm's Law.
    b. Demonstrate an understanding of DC Circuits.
    c. Demonstrate an understanding of AC Circuits.
    d. Demonstrate an understanding of transformers.
3. General – National Electrical Code Articles 100-110: Construction and Industrial
    a. Exhibit previously learned material by recalling facts, terms, and basic concepts related to the National Electrical Code.
    b. Locate information using electrical installation regulations.
    c. Demonstrate an understanding of electrical installation regulations.
4. Wiring and Protection – National Electrical Code Articles 200 – 285: Construction and Industrial
    a. Exhibits use and identification of grounded conductors.
    b. Interpret code regulations of branch circuits.
    c. Interpret code regulations of feeders.
    d. Apply branch circuit, feeder, and service calculations.
    e. Interpret code regulations of services.
    f. Calculate overcurrent protection.
    g. Interpret code regulations of grounding and bonding.
5. Wiring Methods and Materials – National Electrical Code Articles 300 – 399: Construction and Industrial

a. Exhibits previously learned knowledge of general wiring methods and materials.
b. Locate information using conductors for general wiring.
c. Demonstrate an understanding of conductors for general wiring.
d. Apply knowledge of outlet, device, pull, and junction boxes, conduit bodies, fittings, and handhole enclosures.
e. Apply knowledge of cables according to the National Electrical Code (Articles 320 – 340).
f. Apply knowledge of raceways according to the National Electrical Code (Articles 342 – 399).

6. Equipment for General Use – National Electrical Code Articles 400 – 490: Construction and Industrial
    a. Interpret code regulations of equipment for general use, such as cords, switches, and fixtures.
    b. Apply knowledge of luminaires, lamp holders, and lamps.
    c. Apply knowledge of appliances and equipment.
7. Electrical Construction II
    a. Using paper, wire, and pencil to perform layout calculations for ninety's offset and 3-point saddle.
    b. Perform combination bends using EMT.
    c. Install rigid conduit (Article 344).
    d. Ground service to metallic bonding systems (Article 250).
    e. Draw external power diagrams.
    f. Install multi-conductor cable (Article 250).
    g. Install low-voltage lighting controls (Article 411).
    h. Lace cable and wires in open raceways and control panels (Articles 300, 336, 409).
    i. Install photo-electric control (Article 404).
    j. Install dynamic, switching, and resistive sensing devices.
    k. Draw control panel diagrams.
    l. Apply National Electrical Code (NEC (National Electric Code)) terms and concepts (Article 100).
    m. Summarize the NEC (National Electric Code) style (Article 90).
    n. Use formal methods in finding code requirements.
    o. Determine the purpose, scope, and enforcement of the NEC (National Electric Code) (Article 90).
    p. Examine the mandatory rules and formal interpretation of the NEC (National Electric Code).
    q. Apply definitions for proper understanding and application of the NEC (National Electric Code) rules (Article 100).
    r. Examine working space and working space entrances for electrical equipment (Article 110).
8. Additional tasks if provisions allow:
    a. Introduce electrical metallic tubing (Article 358).
    b. Introduce under-floor raceways (Article 390).
    c. Introduce lay-in duct work (wire ways) (Articles 376, 378).
    d. Introduce fiber optic cables in raceways (Article 770).
    e. Introduce explosion-proof fixtures and devices (Article 501).
    f. Introduce feeder busways (Article 368).
    g. Introduce plug-in busways (Article 368).
    h. Introduce intercom and public address systems (Articles 800, 170, 110).
    i. Introduce snow and ice melting equipment (Article 426).
    j. Introduce emergency backup systems (rotary and solid-state types) (Article 700).

k. Introduce cable and wires in open raceways and control panels (Articles 300, 336, 409).
l. Introduce PC-based climate control equipment (Articles 440, 750).

460316 Circuits I

This course provides an introduction to the basic theory of DC and AC circuits, including circuit analysis techniques, introductory magnetism, and transformer principles.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge for construction and industrial.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Demonstrate the following math and science concepts of electricity for construction and industrial.
    a. Demonstrate an understanding of Ohm's Law.
    b. Demonstrate an understanding of DC circuits.
    c. Demonstrate an understanding of AC circuits.
    d. Demonstrate an understanding of transformers.
3. Wiring Methods and Materials – National Electrical Code Articles 300-399: Construction and Industrial
    a. Exhibit previously learned knowledge of general wiring methods and materials.
    b. Locate information using conductors for general wiring.
    c. Demonstrate an understanding of conductors for general wiring.
    d. Apply knowledge of outlet, device, pull, and junction boxes, conduit bodies, fittings, and hand-hole enclosures.
    e. Apply knowledge of cables according to the National Electrical Code (Articles 320-340).
    f. Apply knowledge of raceways according to the National Electrical Code (Articles 342-399).
4. Circuits I:
    a. Demonstrate an understanding of resistance, capacitance, and inductance.
    b. Explain simple DC voltage and current divider circuits.
    c. Demonstrate an understanding of Ohm's Law and be able to perform a basic calculation.

d. Solve simple time-constant circuits, both R-C and R-L.
e. Solve series and parallel DC circuits.
f. Understand the basic theory of and applications to electric circuits for series circuits, parallel circuits, and series-parallel circuits.
g. Demonstrate an understanding of basic transformers.
h. Demonstrate basic soldering skills.
i. Demonstrate verbal and written communication skills through teamwork and technical reports.
j. Demonstrate an understanding of basic electrical measuring instruments such as those used for voltage measurement, current measurement, and resistance measurement.
k. Demonstrate proficiency in the use of common electrical laboratory instrumentation.
l. Demonstrate an understanding of electrical safety principles.
m. Describe the use of hand tools and basic test equipment.
n. Demonstrate an understanding of basic magnetism and AC principles.

460319 Circuits II

This course covers complex alternating current and direct current circuits. Emphasis is on impedance, reactance, power and electrical energy, electrical measurement instruments, and circuit analysis.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge for construction.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (Safety Data Sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Demonstrate the following math and science concepts of electricity for construction.
    a. Demonstrate an understanding of Ohm's Law.
    b. Demonstrate an understanding of DC circuits.
    c. Demonstrate an understanding of AC circuits.
    d. Demonstrate an understanding of transformers.
3. Explain the design of complex DC and AC series, parallel, and series/parallel circuits.
4. Use Kirchhoff's Laws, Thevenin, Norton, Loop, and Mesh analysis and superposition to solve AC and DC circuits.
5. Demonstrate an understanding of AC power, electrical energy, and power factor correction.
6. Demonstrate an understanding of transformers, single and 3-phase.
7. Exhibit a working knowledge of phasors and complex numbers (polar and rectangular forms).
8. Explain the design of simple low-pass, high-pass, and band-pass passive filter circuits.
9. Demonstrate a working knowledge of 3-phase AC.
10. Demonstrate verbal and written communication skills through teamwork and technical reports.
11. Demonstrate an understanding of Resonance in AC circuits.

460323 Rotating Machinery

This course focuses on the underlying principles of rotating electrical equipment including DC and AC motors and generating equipment construction, operating applications, and the maintenance of DC and AC motors and generating equipment.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Describe the installation and measurement of DC series motor speed/torque characteristics.
3. Describe the installation and measurement of DC shunt motor speed/torque characteristics.
4. Describe the installation and measurement of DC compound motor speed/torque characteristics.
5. Describe the installation and measurement of DC series generator counter torque/voltage/speed characteristics.
6. Describe the installation and measurement of DC shunt generator counter torque/voltage/speed characteristics.
7. Describe the installation and measurement of DC compound generator counter torque/voltage/speed characteristics.
8. Explain how to change the output voltage of DC generators.
9. Explain how to vary the output voltage on AC alternators through field excitation.
10. Describe the connection of instrumentation to measure frequency in AC alternators.
11. Describe how to parallel-connect two three-phase AC alternators so their voltages and frequencies are synchronized.
12. Use the National Electrical Code to size and install AC alternators.
13. Use electrical control equipment to vary the speed of single-phase AC motors.
14. Use mechanical and electrical instruments to measure the start and run torque of motors.
15. Explain how to vary the input voltage and measure the speed/torque characteristics of

single-phase AC motors.
16. Describe how to measure the speed/torque characteristics of capacitor-start, single-phase AC motors.
17. Use the National Electrical Code to size and install AC alternators.
18. Use electrical control equipment to vary the speed of single-phase AC motors.
19. Use mechanical and electrical instruments to measure the start and run torque of motors.
20. Explain how to vary the input voltage and measure the speed/torque characteristics of single-phase AC motors.
21. Describe how to measure the speed/torque characteristics of capacitor-start, single-phase AC motors.
22. Describe how to measure the speed/torque characteristics of capacitor-run, single-phase AC motors.
23. Describe how to measure the speed/torque characteristics of repulsion-induction, single-phase AC motors.
24. Describe how to measure the speed/torque characteristics of shaded-pole, single-phase AC motors.
25. Describe how to measure the speed/torque characteristics of split-phase, single-phase AC motors.
26. Use manual and automatic means to change the direction of three-phase AC motors.
27. Utilize electrical control equipment to vary the speed of three-phase AC motors.
28. Configure three-phase AC motor stators to operate in delta.
29. Configure three-phase AC motor stators to operate in wye.
30. Explain how to measure the speed/torque characteristics of three-phase synchronous AC motors.
31. Explain how to measure the speed/torque characteristics of three-phase squirrel-cage AC motors.
32. Explain how to measure the speed/torque characteristics of three-phase wound-rotor AC motors.
33. Describe the preventative and permanent maintenance of AC and DC electrical rotary equipment.
34. Size feeder conductors and overcurrent protection for AC and DC rotating equipment according to the standards summarized in the National Electrical Code.

460325 Rotating Machinery Electrical Motor Controls

This course focuses on the construction, operation and maintenance of DC motors and generators and AC motors and alternators. This course addresses the diversity of control devices and applications used in industry today. Safety and electrical lockouts are also included.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge of the industry.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Equipment for General Use – National Electrical Code Articles 400-490: Industrial
    a. Interpret code regulations of equipment for general use, such as cords, switches, and fixtures.
    b. Apply knowledge of luminaires, lamp holders, and lamps.
    c. Apply knowledge of appliances and equipment.
3. Rotating Machinery Electrical Motor Controls: Industrial
    a. Change the output voltage of alternators.
    b. Measure the frequency of alternators.
    c. Install two three-phase alternators in parallels.
    d. Install alternators.
    e. Change the speed of single-phase motors.
    f. Measure the torque of motors.
    g. Connect the single-phase motor to run on different voltages.
    h. Connect and test capacitor start motors.
    i. Connect and test capacitor run motors.
    j. Connect and test the repulsion-induction motor.
    k. Connect and test shaded pole motors.
    l. Replace split-phase motors.
    m. Change the direction of rotation of electrical motors.
    n. Connect three-phase motors to run on different voltages.
    o. Connect three-phase motor stator for delta operations.

p. Connect three-phase motor stator for star operations.
q. Connect and test synchronous motors.
r. Connect and test three-phase induction motors.
s. Connect and test wound rotor motors.
t. Install and test DC series motors for serviceability.
u. Install and test DC shunt motors for serviceability.
v. Install and test DC compound motors for serviceability.
w. Install and test DC series generators for serviceability.
x. Install and test DC shunt generators for serviceability.
y. Install and test DC compound generators for serviceability.
z. Change output voltages of DC generators.
aa. Connect control relay systems.
bb. Connect dynamic braking circuit for AC motors.
cc. Connect dynamic braking circuit for DC motors.
dd. Test magnetic starters.
ee. Connect overload relays into starting control circuits.
ff. Connect potential type motor starting relays.
gg. Connect reduced voltage starters.
hh. Connect time delay relays.
ii. Connect the motor for automatic controls.
jj. Connect automatic reduced voltage starter for DC motor control.
kk. Connect control relay systems.
ll. Connect limit switches.
mm. Connect motor control circuits for plugging.
nn. Connect point starters for DC motors.
oo. Connect push button stations.
pp. Connect selector switches.
qq. Connect sensing devices (non-electric).
rr. Connect magnetic starters.

460331 Electrical Motor Controls

This course addresses the diversity of control devices and applications used in industry today. Safety and electrical lockouts are also included.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge for construction and industrial.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Equipment for General Use – National Electrical Code Articles 400-490: Construction and Industrial
    a. Interpret code regulations of equipment for general use, such as cords, switches, and fixtures.
    b. Apply knowledge of luminaires, lamp holders, and lamps.
    c. Apply knowledge of appliances and equipment.
3. Electrical Motor Controls: Construction and Industrial
    a. Connect pushbutton stations.
    b. Demonstrate an understanding of schematics (wiring diagrams and ladder diagrams).
    c. Connect control relay systems.
    d. Connect potential type motor-starting relays.
    e. Connect magnetic starters.
    f. Connect selector switches.
    g. Connect time delay relays.
    h. Connect sensing devices (non-electric).
    i. Connect overload relays into starting control circuits.
    j. Connect motor for automatic controls.
    k. Test magnetic starters.
    l. Connect reduced voltage starters.
    m. Connect motor control circuits for plugging.
    n. Connect automatic reduced voltage starter for DC motor control.

o. Connect limit switches.

4. Additional tasks if provisions allow:
    a. Introduce point starters for DC motors.
    b. Introduce dynamic braking circuit for DC motors.
    c. Introduce dynamic braking circuit for AC motors.
    d. Introduce Programmable Logic Controls (PLC).

460339 National Electrical Code

This course emphasizes the importance of the National Electrical Code as it applies to electrical installations: electrical safety issues, prevention of fire due to the use of electrical energy, prevention of loss of life and property from the hazards that might arise from the use of electrical energy, and proper selection of electrical equipment for hazardous and non-hazardous environments. This course provides a learning resource in the preparation for electrical licensing examinations.

Recommended Grade Level: 10 – 12

Recommended Credit: .5

Students will:

1. Summarize the NEC (National Electric Code) style.
2. Use formal methods in finding code requirements.
3. Determine the purpose, scope, and enforcement of the NEC (National Electric Code).
4. Examine the mandatory rules and formal interpretation of the NEC (National Electric Code).
5. Determine guidelines for electrical equipment approval.
6. Apply National Electrical Code (NEC (National Electric Code)) terms and concepts.
7. Apply definitions for proper understanding and application of the NEC (National Electric Code) rules.
8. Utilize NEC (National Electric Code) rules for installing raceway systems and their associated wiring methods, including box size and conduit fill calculations.
9. Apply NEC (National Electric Code) tables to determine conductor size and de-rating factors for general wiring.
10. Apply NEC (National Electric Code) rules for conductor termination and splices.
11. Apply general code requirements for conductors, such as insulation markings, ampacity ratings, and their use.
12. Determine installation location and primary uses for a variety of cable and electrical raceways.
13. Determine the types and approval for the use of flexible cords and cables.
14. Determine the rules for multi-wire branch circuits.
15. Apply NEC (National Electric Code) rules for receptacles and lighting in dwelling units.
16. Protect circuits with overcurrent protection devices, such as fuses and circuit breakers, in a variety of locations and occupancies.
17. Utilize the NEC (National Electric Code) requirements for installing lighting fixtures, lamp holders, lamps and receptacles.
18. Size conductors and calculate overcurrent protection for a variety of appliances.
19. Calculate wire size for continuous and non-continuous loads.
20. Define feeder and how it relates to service and branch circuit conductors.
21. Calculate conductor and overcurrent protection size for feeder.
22. Demonstrate an understanding of the general requirements for all wiring methods by occupancy listed in the NEC (National Electric Code), including dwelling optional load calculations.
23. Examine working space and working space entrances for electrical equipment.
24. Utilize methods to identify disconnects and circuits.
25. Identify requirements for high-leg conductors.
26. Demonstrate an understanding of requirements for clearances, grounding, and raceways

for outside branch circuits and feeders.
27. Utilize code requirements for service disconnecting means.
28. Determine NEC (National Electric Code) rules for overhead and lateral services.
29. Determine the number and grouping of service disconnect means by occupancy.
30. Apply the rules for working space and dedicated space for switchboards and panel boards.
31. Associate the difference between a grounded and neutral conductor.
32. Determine the purpose of a grounded conductor.
33. Differentiate between a grounded and grounding conductor.
34. Use methods to identify the grounded and grounding conductor.
35. Apply grounding to equipment through permitted NEC (National Electric Code) bonding and measures.
36. Identify bonding methods for services and communication equipment.
37. Determine when equipment is considered effectively grounded.
38. Utilize the NEC (National Electric Code) to determine disconnecting means, overcurrent protection and conductor sizing of air conditioning and refrigeration equipment.
39. Bond separately derived electrical systems.
40. Calculate primary and secondary overcurrent protection for transformers.
41. Determine the rules for temporary wiring on construction sites.
42. Apply code requirements for installing transformers and transformer vaults.
43. Determine installation requirements for electrical space heating, motors, motor circuits and controllers.

460340 Sustainable Energy Systems

This course examines the sustainability of various energy resources. An overview of energy technology, energy resources, and emerging future energy technologies coupled with our energy use will bring into context the strengths and weaknesses of different energy methodologies in developing a working concept of sustainable energy.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe worksite.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Sustainable Energy Systems:
    a. Define sustainable energy.
    b. Define and convert various common energy sources to units of measurement in terms of BTUs of energy and power in terms of Watts.
    c. Demonstrate a basic understanding of the physics of heat.
    d. Explain how energy systems interact with local, regional and global environments.
    e. Analyze the basic operation of passive and active solar energy systems and associated sustainability issues.
    f. Describe the basic operation of tidal energy systems and associated sustainability issues.
    g. Explain the basic operation of wind energy systems and associated sustainability issues.
    h. Describe the basic operation of fossil fuel energy systems and associated sustainability issues.
    i. Describe the basic operation of nuclear power energy systems and associated sustainability issues.
    j. Explain how renewable energy systems contribute to the sustainability of energy sources.
    k. Describe the basic operation of biomass energy systems and associated sustainability issues.

l. Describe the basic operation of hydropower systems and associated sustainability issues.
m. Assess the basic operation of electrical power generation and associated sustainability issues.
n. Categorize the sustainability issues associated with residential and commercial building designs.

460342 Renewable Energy Systems

This course examines the need for alternative and renewable energy resources as a survey course providing citizens from all walks of life with an understanding of responsible stewardship of technologies that will contribute to the sustainability of energy in our present and future societies. The object of this course is to take a more in-depth look at renewable energy forms and the replacement of fossil fuels in our society. Through wind, solar, and biomass, this class will focus on live projects, scientific studies and comparisons of feasibility.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Define renewable energy.
2. Identify and describe different types of renewable energy.
3. Determine costs and tradeoffs of various renewable options.
4. Identify and describe sources of renewable energy and how they are delivered to customers.
5. Identify and describe the impact of renewable energy on the environment and the economy.
6. List and discuss overall issues associated with energy availability, effectiveness, distribution, and regulation.

460344 Renewable Energy Systems (Special Problems)

The object of this course is to take a more in-depth look at renewable energy forms and the replacement of fossil fuels in our society. Through scientific research methods, portfolios and presentations, students will focus on live projects, social energy issues, problems, and solutions using comparisons of feasibility.

Recommended Grade Level: 11 – 12

Recommended Credit: .5

Students will:

1. Complete selected tasks and problems as determined by the instructor.

460345 Co-op* (Electrical)

Co-op I (Electrical) provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance educational expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program.

460348 Internship (Electrical)

An internship provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Internship do not receive compensation.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability after graduation.

460377 Special Problems - Electrical Technology

This course is designed for the student who has demonstrated specific special needs.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Complete selected tasks and problems as determined by the instructor.

460399 Special Topics - Electrical Technology

Instruction related to Electrical Technology but not described in the other courses.

Recommended Grade Level: 10 – 12

Recommended Credit: .5 – 1

Students will:

1. Complete selected tasks and problems as determined by the instructor.

499920 Basic Blueprint Reading

This course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Review math concepts (fractions and decimals).
5. Identify the alphabet of lines.
6. Identify multiple views.
7. Arrange multiple views.
8. Arrange two-view drawings.
9. Identify one-view drawings.
10. Arrange and identify auxiliary views.
11. Demonstrate and use the size and location dimensions.
12. Demonstrate proper dimensions of cylinders and arcs.
13. Size dimensions of holes and angles.
14. Locate dimensions for the centering of holes, points, and centers.
15. Interpret the baseline dimensions on drawings.
16. Identify half, full, and removed sections.
17. Identify electrical schematic and diagram symbols.
18. Identify welding symbols and equipment.
19. Interpret ordinate and tabular dimensions.
20. Set tolerances using geometric dimensioning techniques.
21. Sketch parts with irregular shapes.
22. Sketch oblique views of various parts.
23. Sketch and dimension shop drawings.
24. Dimension parts using shop notes.
25. Calculate tolerances.
26. Identify labeling of various screw threads.
27. Calculate tapers and machined surfaces.
28. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams.

499925 Basic Troubleshooting

This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the how's and why's of planned maintenance.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Demonstrate workplace safety and knowledge.
    a. Identify equipment and materials of the trade.
    b. Identify safe and proper use of tools of the trade.
    c. Identify the characteristics of a safe work site.
    d. Identify OSHA (Occupational Safety and Health Administration)'s 1926.10 Construction Standards and who enforces OSHA (Occupational Safety and Health Administration) Rules and Regulations in Kentucky.
    e. Identify and use personal protective equipment.
    f. Demonstrate ladder safety.
    g. Demonstrate electrical safety, including GFCI (Ground Fault Circuit Interrupter), cord use, and grounding.
    h. Identify different types of chemical, biological, and physical hazards.
    i. Interpret hazardous chemical communication such as SDS (safety data sheet) and HAZWOPER (Hazardous Waste Operations and Emergency Response).
    j. Demonstrate knowledge and understanding of blood-borne pathogens.
    k. Demonstrate knowledge and understanding of blueprints, including symbols, specifications, and layout.
    l. Demonstrate knowledge and understanding of schematics and line diagrams.
2. Demonstrate the following math and science concepts of Electricity.
    a. Demonstrate an understanding of Ohm's Law.
    b. Demonstrate an understanding of DC circuits.
    c. Demonstrate an understanding of AC circuits.
    d. Demonstrate an understanding of transformers.
3. Perform basic troubleshooting skills.
    a. Explain the reason efficient troubleshooting is important in a production plant.
    b. Demonstrate good communication skills when dealing with plant personnel.
    c. List the steps in troubleshooting a machine/system.
    d. List the questions that should be asked when a machine system fails.
    e. Identify a pictorial diagram, a blocking diagram, and a schematic diagram.
    f. Use schematics when troubleshooting.
    g. Identify differences in schematics when troubleshooting.
    h. Use a troubleshooting chart.
    i. Identify the current voltage characteristics of wire.
    j. Demonstrate how to troubleshoot an electrical problem.
    k. Identify bearing wear problems.
    l. Identify pump failure problems and solutions.

m. Identify types of hosing.
n. List the information that should be recorded in a machine equipment record.
o. Identify calibration standards.
p. Identify preventive maintenance procedures.
q. List the signs of a machine in need of service.
r. List the questions that should be asked when a machine/system fails.
s. Identify different troubleshooting test equipment.
t. Apply all safety rules when working with electrical equipment.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

HEAVY EQUIPMENT SCIENCES COURSES

460201 Introduction to Construction Technology

This course is an introduction to the construction carpentry industry. The class will emphasize safe and proper methods of operating hand tools, portable power tools, and stationary power tools in the construction industry. Content in the course should be aligned with the pathway being offered: Commercial and/or Residential.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Math for the Trades: Commercial and Residential
    a. Add, subtract, multiply, and divide single-, double-, and triple-digit numbers.
    b. Use mixed fractions to add, subtract, multiply, and divide parts of numbers.
    c. Convert fractions to decimals and decimals to fractions and use decimals to find percentages.
    d. Use and understand how to read measuring tools.
    e. Construct layouts using lines, circles, and angles.
    f. Explain square roots, square numbers, and the Pythagorean Theorem.
    g. Use area measure to find the area of rectangles, squares, and circles.
    h. Use volume measure to calculate the volume of three-dimensional objects.
2. Health and Safety: Commercial and Residential
    a. Assume responsibility for the safety of self and others.
    b. Identify personal protection equipment of the trade such as eye protection, harnesses, and footwear.
    c. Identify safety standards and procedures based on “OSHA 1926 Standards”.
    d. Manage personal health and wellness, including substance abuse, air pollutants, chemicals, and workplace toxins.
3. Hand and Power Tools: Commercial and Residential
    a. Identify and demonstrate the safe and proper use of hand tools, including fastening devices, leveling devices, and edge-cutting devices.
    b. Identify and demonstrate the safe and proper use of power tools including electric portable, cordless, stationary, powder-actuated, and pneumatic.
4. Building Materials, Fasteners, and Adhesives: Residential
    a. Identify the use and application of building materials in construction work, including lumber, sheet materials, engineered wood products, structural concrete, and structural steel.
    b. Identify the use and application of fasteners and adhesives used in construction work.
5. Orientation to the Construction Trade: Residential
    a. Recognize the order of operation and responsibilities of construction trade professionals such as foremen, general contractors, and laborers.

460403 Heavy Highway Construction Equipment Repair

This course introduces students to performing preventive maintenance, diagnosing malfunction, prescribing corrective actions, and repairing heavy highway equipment.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Identify the basic parts of each type of equipment and explain the differences in models of the type of equipment.
2. Identify and explain the systems that make up the drive system used on heavy equipment.
3. Explain the basics of a hydraulic system and identify hydraulic components.
4. Describe the different types of transmissions used on utility tractors.
5. Perform prestart inspection and maintenance procedures.
6. Inspect different types of heavy equipment.
7. Perform preventive maintenance.
8. Diagnose malfunction.
9. Prescribe corrective action.
10. Repair machinery used in construction, farming, rail transportation, and other industries.

460404 Heavy Equipment Operation

This course introduces students to the basic terminology and equipment used in the heavy equipment trade, working around heavy equipment safely and responsibly; commonly used heavy equipment machines, including dump trucks, trenchers, backhoes, excavators, skid steer, and dozers; drive systems and hydraulic systems; pre-operational checks and operator maintenance tasks for heavy equipment; basic tractor operation, controls, attachments, maintenance, and safety guidelines; basic concepts and procedures related to the use of heavy equipment to perform earthmoving work; preparing graded surfaces using heavy equipment; identification and interpretation of construction stakes; and describes the methods for grading slopes. Students will learn what tasks are expected from an apprenticeship program in heavy equipment.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Explain basic terminology, types, and uses of equipment.
2. Identify career opportunities available to heavy equipment operators and explain the purpose and objectives of an apprentice training program.
3. Explain the responsibilities and characteristics of a good operator.
4. Explain the importance of heavy equipment safety.
5. Demonstrate how to use various types of personal protective equipment (PPE).
6. Place barricades and temporary traffic control devices for a highway construction zone.
7. Demonstrate how to use flags or paddles to control traffic.
8. Identify the various types of heavy equipment and their uses.
9. Perform basic prestart inspection, startup, operational movement, and shutdown for different heavy equipment.
10. Properly start, warm up, and shut down a gasoline-powered and diesel-powered engine tractor.
11. Perform basic maneuvering with a tractor.
12. Attach implements to a drawbar and three-point hitch.
13. Attach and detach implements to a power takeoff.
14. Draw a plan for basic earthmoving operations.
15. Lay out a basic earthmoving operation.
16. Identify and select the proper equipment for a given earthmoving operation.
17. Identify types of stakes and markings on stakes.
18. Check horizontal and vertical distances of cut and fill slope stakes.
19. Check the finish subgrade on a cross slope.

460499 Special Topics - Heavy Equipment

Instruction related to Industrial Education – Heavy Equipment but not described in the other courses.

Recommended Grade Level: 9 – 12

Recommended Credit: .5 – 1

Students will:

1. Complete selected tasks and problems as determined by the instructor.

499910 Industrial Education Co-op*

Cooperative Education for CTE (career and technical education) courses indicated within the KY Department of Education provide supervised worksite experience related to the student's identified career major. Students who participate receive a salary for these experiences in accordance with local, state, and federal minimum wage requirements.

Recommended Grade Level: 11 – 12

Recommended Credit: 1 – 3

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

499915 Industrial Education Internship

Internships for CTE (career and technical education) courses provide supervised work-site experience for high school students who have completed courses leading to a career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. Students receiving pay for intern experience are those participating in an experience that is a semester or longer and have an established employee-employer relationship. A non-paid internship affects those students who participate on a short-term basis.

Recommended Grade Level: 11 – 12

Recommended Credit: 1 – 3

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom/lab studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

499920 Basic Blueprint Reading

This course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Review math concepts (fractions and decimals).
5. Identify the alphabet of lines.
6. Identify multiple views.
7. Arrange multiple views.
8. Arrange two-view drawings.
9. Identify one-view drawings.
10. Arrange and identify auxiliary views.
11. Demonstrate and use the size and location dimensions.
12. Demonstrate proper dimensions of cylinders and arcs.
13. Size dimensions of holes and angles.
14. Locate dimensions for the centering of holes, points, and centers.
15. Interpret the baseline dimensions on drawings.
16. Identify half, full, and removed sections.
17. Identify electrical schematic and diagram symbols.
18. Identify welding symbols and equipment.
19. Interpret ordinate and tabular dimensions.
20. Set tolerances using geometric dimensioning techniques.
21. Sketch parts with irregular shapes.
22. Sketch oblique views of various parts.
23. Sketch and dimension shop drawings.
24. Dimension parts using shop notes.
25. Calculate tolerances.
26. Identify labeling of various screw threads.
27. Calculate tapers and machined surfaces.
28. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams.

499925 Basic Troubleshooting

This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the how's and why's of planned maintenance.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Explain the reason efficient troubleshooting is important, including pre-operation checks.
2. Demonstrate good communication skills.
3. List the steps in troubleshooting a machine/system.
4. List the questions that should be asked when a machine system fails.
5. Identify a pictorial diagram, a blocking diagram, and a schematic diagram.
6. Use schematics when troubleshooting.
7. Identify differences in schematics when troubleshooting.
8. Use a troubleshooting chart.
9. Identify the current voltage characteristics of wire.
10. Demonstrate how to troubleshoot an electrical problem.
11. Identify bearing wear problems.
12. Identify pump failure problems and solutions.
13. Identify types of hosing.
14. List the information that should be recorded in a machine equipment record.
15. Identify calibration standards.
16. List preventive maintenance procedures.
17. List the signs of a machine in need of service.
18. List the questions that should be asked when a machine/system fails.
19. Identify different troubleshooting test equipment.
20. Apply all safety rules when working with electrical equipment.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

499935 Commercial Driver License

The Introduction to Commercial Driving course prepares students for entry into the trucking and logistics industry. Students explore the career opportunities and requirements of a professional tractor-trailer driver. This year's long course consists of classroom instruction, demonstrations, hands-on exercises, simulator experience, field trips and guest speakers. Upon completion of the course, students will be prepared to apply for the Commercial Learner's Permit (CLP) written exam.

Recommended Grade Level: 12

Recommended Credit: 1

Students will:

1. Explain the Commercial Driver's License Law.
2. List who must apply for a Commercial Driver's License (CDL).
3. Understand who qualifies to be exempt from the CDL laws.
4. Explain how to apply for a CDL and how to renew a CDL.
5. Demonstrate knowledge in a broad range of subjects, including vehicle operations under all kinds of conditions, cargo handling, and vehicle inspection.
6. Explain basic terminology, types, and uses of transport equipment.
7. Identify career opportunities available to Licensed Commercial Drivers.
8. Explain the responsibilities and characteristics of a Commercial driver.
9. Demonstrate the use of the safety equipment required in commercial vehicles.
10. Perform basic prestart inspection, startup, operational movement, and shutdown for different vehicles.
11. Properly start, warm up, and shut down a gasoline, and diesel-powered engine truck.
12. Perform basic maneuvering with a bobtail tractor.
13. Attach a trailer and perform basic maneuvers, including turning and backing into a dock.
14. Identify the basic parts of each type of truck and explain the differences in models and types.
15. Describe the different types of transmissions and their best uses.
16. Diagnose a malfunction and prescribe a corrective measure.
17. List preventive maintenance procedures for tractor and trailer.
18. List the signs of a tractor in need of service.
19. Show the ability to safely do on-road driving.
20. Show the ability to do a vehicle inspection.
21. Show the ability to control a vehicle in a confined space.
22. Explain why you may not drive a commercial motor vehicle if you are disqualified for any reason.
23. Know that a commercial vehicle, with few exceptions, is required to be registered under the International Registration Plan (IRP) and the International Fuel Tax Agreement (IFTA). (Keep data or file reports)
24. Demonstrate the ability to do vehicle inspections before, during, and after a trip and know what to look for.
25. Demonstrate the ability to read and understand instrument gauges.
26. Demonstrate the use of mirrors for backing and the ability to judge distance for safe parking.
27. Explain gear shifting and its purpose in a manual and automatic transmission.
28. Will explain the purpose of retarders, multi-speed rear axles and auxiliary transmissions.

29. Explain the purpose of looking far ahead and how far ahead to look for safety.
30. Demonstrate stopping on a road or the shoulder and putting out your emergency warning devices within the required time of ten minutes.
31. Demonstrate proper placement of warning devices at 10 feet, 100 feet, and 200 feet toward the approaching traffic.
32. Explain the concept of Perception Distance + Reaction Distance + Braking Distance = Total Stopping Distance.
33. Explain the need for space available around their vehicle when something goes wrong; you need to manage space for safe reaction.
34. Explain the importance of recognizing hazardous road conditions and seeing hazards that are developing.
35. Be aware of Move-Over Laws (change lanes for emergencies on the shoulder).
36. Explain how driver distraction is anything that takes your attention away from driving. Distracted driving can cause collisions, resulting in injury, death or property damage.
37. Know the types of distractions: physical distraction, mental distraction, and both physical and mental distraction.
38. Explain how drivers at night cannot see hazards as quickly as in daylight, so they have less time to respond, and the problems of night driving involve the driver, the roadway, and the vehicle.
39. Explain the steeper the grade, the longer the grade, and/or the heavier the load--the more you will have to use lower gears to climb hills or mountains.
40. Explain that when coming down long, steep downgrades, gravity causes the speed of your vehicle to increase. You must select an appropriate safe speed, low gear, and proper braking techniques.
41. Explain why you, as a driver, must go slowly enough so your brakes can hold you back without getting too hot. When brakes become too hot, they may start to "fade." If you continue to use the brakes hard, they can keep fading until you cannot slow down or stop at all.
42. Explain why you must use the braking effect of the engine as the principal way of controlling your speed. The braking effect of the engine is greatest when it is near the governed RPMs and the transmission is in the lower gears.
43. Explain why stopping is not always the safest thing to do in an emergency. When you don't have enough room to stop, you may have to steer away from what's ahead.
44. Explain that hydraulic brake failures occur for one of two reasons: Loss of hydraulic pressure and brake fade on long hills.
45. List the major signs of tire failure.
46. Explain that the Antilock Braking System (ABS) is a computerized system that keeps your wheels from locking up during hard brake applications and the advantages of the system.
47. Skid Control and Recovery.
48. Know a skid happens whenever the tires lose their grip on the road. This is caused in one of four ways: over-braking, over-steering, over-acceleration, or driving too fast for road conditions.
49. Correcting a Drive-wheel Braking Skid.
50. Explain the procedure to correct a drive-wheel braking skid. Stop Braking. This will let the rear wheels roll again and keep the rear wheels from sliding. Counter-steer. As a vehicle turns back on course, it tends to keep on turning. Unless you turn the steering wheel quickly the other way, you may find yourself skidding in the opposite direction.
51. Explain that when a front-wheel skid occurs, the only way to stop the skid is to let the vehicle slow down. Stop turning and/or braking so hard. Slow down as quickly as possible without skidding.
52. Demonstrate that when you are in an accident and not seriously hurt, you need to act to

prevent further damage or injury, protect the area, notify authorities, and care for the injured.

53. Explain the causes of truck fires and how to prevent them and know what to do to extinguish fires.
54. Demonstrate some knowledge about hazardous materials. You must be able to recognize hazardous cargo, and whether or not you can haul it without having a hazardous materials endorsement on your CDL license.
55. Explain that hazardous materials are products that pose a risk to health, safety, and property during transportation.
56. Explain the duty to follow the many rules about transporting hazardous materials. The rules intend to contain the product, communicate the risk, and ensure safe drivers and equipment.
57. Identify shipping papers related to hazardous materials.
58. Explain why drivers must keep shipping papers related to hazardous materials in a pouch on the driver's door, in clear view within reach while driving, or in the driver's seat when out of the vehicle.
59. Explain that placards are signs put on the outside of a vehicle that identifies the hazard class of the cargo.
60. Explain why a placarded vehicle must have at least four identical placards. They are put on the front, rear, and both sides.
61. Explain that If you load cargo wrong or do not secure it, it can be a danger to others and yourself.
62. Demonstrate that, whether or not you load and secure the cargo yourself, you are responsible for the following:
    a. Inspecting your cargo.
    b. Recognizing overloads and poorly balanced weight.
    c. Knowing your cargo is properly secured and does not obscure your view
    d. ahead or to the sides.
    e. Knowing your cargo does not restrict your access to emergency equipment
63. Explain that air brakes use compressed air to make the brakes work.
64. Know that air brakes are a good and safe way of stopping large and heavy vehicles and must be well-maintained and used properly.
65. Explain the parts of an air brake system.
66. Explain why trucks, buses, trailers and converter dollies) are required to be equipped with antilock brakes.
67. Students will demonstrate knowledge of the proper use of air brakes.
68. Demonstrate how to couple and uncouple a trailer correctly.
69. Explain general trailer coupling and uncoupling steps, acknowledging the differences between different truck and trailer combinations.
70. Demonstrate a vehicle inspection, showing that the vehicle is safe to drive. You will have to walk around the vehicle and point to or touch each item and explain to the examiner what you are checking and why.

MASONRY TECHNOLOGY COURSES

460112 Introductory Masonry

This course introduces various types of mortar and cement, along with the use of basic masonry tools. It emphasizes the different methods of spacing materials on a construction site, the 6-8-10 method, and the use of the transit level, brick spacing, and modular rule. It also focuses on laying straight and plumb brick to the line, bricking gables and building columns. It permits application techniques for setting up different types of masonry materials, marking off layout lines, and erecting batter boards, along with techniques employed in different types of weather and climates. The laboratory is part of the class.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Demonstrate a safe environment according to best practices in the Masonry industry and OSHA standards.
2. Proportion and mix mortars manually with a hoe and mortar box.
3. Set up and maintain a mortar mixer.
4. Proportion and mix mortar with electric and gasoline-powered mixers.
5. Set up and maintain masonry saws.
6. Stock a mortar board or pan.
7. Temper mortar.
8. Layout building lines using the 6-8-10 method.
9. Square corners with a framing square.
10. Determine coursing with a brick spacing rule and with a modular mason's rule.
11. Determine coursing with a modular mason's rule.
12. Drop jack lines.
13. Set corner poles for veneer.
14. Set freestanding corner poles.
15. Plumb and level with a mason's two (2') and four (4') foot levels.
16. Plumb with a plumb bob.
17. Chalk a line.
18. Set lines, pins, blocks, and twigs.
19. Inspect, assemble, and disassemble rigging and scaffolding.
20. Carry brick with tongs.
21. Cut masonry materials with hand tools.
22. Cut materials with a masonry saw.
23. Identify brick types.
24. Spread mortar for brick.
25. Make head joints for brick.
26. Lay inside and outside brick corner leads.
27. Gauge masonry walls with a mason's modular rule.
28. Dry bond brick.
29. Bond a brick wall for range with a rule.
30. Lay brick to a line while holding bond.
31. Tuck-point a wall.
32. Finish joints with a variety of tools.
33. Identify types of block.

34. Layout block corners and walls with a tape measure.
35. Bond corners for all widths of block.
36. Square corners with a 2’ framing Square.
37. Spread mortar for block.
38. Lay inside and outside block corner leads.
39. Lay a block wall to a line.
40. Lay closure block/brick.
41. Lay 4” partition block walls and cap block.
42. Install foundation vents.
43. Identify and explain OSHA’s regulations for exposure to Respirable Crystalline Silica as it relates to Masonry.

460113 Advanced Masonry

The advanced course provides experience in laying quoin corners, bricking in around electrical and plumbing units, and laying door and window brick sills. The student will construct expansion joints, piers, pilasters, and retaining and split face block walls.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Estimate masonry materials needed for the job.
2. Tooth a wall or corner.
3. Brick in electrical, plumbing, and air conditioning fixtures.
4. Lay door and window brick sills.
5. Clean walls with acid.
6. Determine elevations of foundation brick shelves.
7. Secure electrical, plumbing, and air conditioning fixtures, lines, and ducts in walls.
8. Lay block in a stack bond.
9. Construct expansion joints.
10. Construct piers.
11. Construct pilasters.
12. Construct a retaining wall.
13. Lay split-face block walls.

460114 Residential Maintenance Masonry

This course covers the basic aspects of masonry as it relates to the residential structure. Emphasis is placed on proper handling, mixing, placing, and finishing of Portland cement products.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Practice safe masonry procedures.
2. Use masonry trowels, hammers, and chisels.
3. Proportion and mix concrete.
4. Install concrete.
5. Edge, joint, and finish concrete.
6. Measure and mix mortar with a hoe and mortar box.
7. Repair/replace bricks.
8. Repair/replace concrete blocks.
9. Tuck-point walls.
10. Cut masonry materials with hand tools.
11. Cut masonry materials with a circular saw.
12. Clean and maintain masonry tools.
13. Estimate masonry materials.
14. Store masonry tools, materials, and equipment.

460116 Intermediate Masonry

This course builds on proficiency in competencies learned in MASE 105. It focuses on laying straight and plumb brick to the lines, emphasizing bricking gables and building columns. The laboratory is a part of the course.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Proportion and mix mortars manually with a hoe and mortar box.
2. Set up and maintain a mortar mixer.
3. Proportion and mix mortar with electric and gasoline-powered mixers.
4. Set up and maintain masonry saws.
5. Stock a mortar board or pan.
6. Temper mortar.
7. Layout building lines using the 6-8-10 method.
8. Determine coursing with a brick spacing rule and with a modular mason's rule.
9. Drop jack lines.
10. Set corner poles for veneer.
11. Plumb and level with a mason's two (2') and four (4') foot levels.
12. Gauge-plumb with a plumb bob.
13. Chalk a line.
14. Set lines, pins, blocks and twigs.
15. Inspect, assemble and disassemble rigging and scaffolding.
16. Carry brick with tongs.
17. Cut masonry materials with hand tools.
18. Cut materials with a masonry saw.
19. Identify brick types.
20. Spread mortar for brick.
21. Make head joints for brick.
22. Square corners with a 2' framing square.
23. Lay inside and outside brick corner leads.
24. Gauge masonry walls with a mason's modular rule.
25. Dry bond brick.
26. Bond a brick wall for range with a rule.
27. Lay brick to a line while holding bond.
28. Tuck-point a wall, including skate rake and concave joint.
29. Finish joints with a variety of tools.
30. Identify types of block.
31. Layout block corners and walls with a tape measure.
32. Bond corners for all widths of block.
33. Spread mortar for block.
34. Lay inside and outside block corner leads.
35. Lay a block wall to a line.
36. Lay closure block/brick.
37. Bond corners for all widths of block.
38. Install foundation vents.
39. Top out veneer walls behind frieze boards.

40. Brick a gable.
41. Build brick columns.
42. Identify and explain OSHA’s regulations for exposure to Respirable Crystalline Silica as it relates to Masonry.

460117 Anchors and Reinforcement

This course presents different types of reinforcement used in masonry units, such as installing wall ties and reinforcing wire, tying intersecting walls with metal ties, installing masonry anchor bolts, setting and anchoring door and window frames, and setting steel lintels and bearing plates. Students will also install dovetail ties to concrete, set preformed masonry lintels, and lay paving bricks in a herringbone pattern.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Install wall ties.
2. Install reinforcing wire.
3. Tie intersecting walls with metal ties.
4. Install anchor bolts.
5. Set and anchor door and window frames.
6. Set steel lintels.
7. Set preformed masonry lintels.
8. Build a reinforced block lintel in place.
9. Set bearing plates.
10. Install dovetail ties to concrete.

460118 Fireplace Construction

This course presents different types and styles of indoor and outdoor fireplaces and the principles of layout, drafting, and drawing a fireplace. Finishing dimensions of the fireplace opening, firebox layout, setting the flue lining, and applying a chimney cap are also included.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Layout fireplaces.
2. Build ash pits with clean-out doors.
3. Enclose prefabricated fireboxes.
4. Install grills and ducts for prefabricated fireboxes.
5. Install fireplace inserts.
6. Lay brick with fireclay or high-temperature mortar.
7. Construct a firebox with ash dumps.
8. Install dampers.
9. Construct smoke chambers with smoke shelves.
10. Install flue liners.
11. Cut flue liners with hand tools.
12. Install thimbles.
13. Build chimneys.
14. Install roof flashing in joints and regrets.
15. Cap off the chimney.

460119 Concrete Finishing

The focus of this course is the composition of concrete, defining the advantages of air-entrained concrete, learning how concrete is tested for strength requirements, and the steps in preparing, placing, finishing, and curing concrete. The student will be able to describe how floors, steps, footers, and pads are laid out and constructed, become familiar with construction safety practices and learn the safe and proper use of hand, portable and stationary power tools. In addition, students will develop a working knowledge of construction procedures utilized in residential and commercial construction.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Prepare wood and steel forms.
2. Prepare for pouring.
3. Install expansion joints.
4. Pour concrete.
5. Screed concrete.
6. Finish concrete by hand.
7. Finish concrete by machine.
8. Estimate cubic yards.
9. Pour concrete footers and pads.
10. Set grade stakes for footers.
11. Identify different types of concrete finishes.
12. Run a power screed.
13. Set forms.
14. Saw expansion joints.
15. Identify joint materials.
16. Add color to concrete.
17. Stamp concrete.
18. Set grade stakes.
19. Texture concrete.
20. Run a bull float.
21. Run an edger.
22. Use a finish trowel.
23. Determine concrete placement.

460179 Special Problems - Masonry

This course is designed for the student who has demonstrated specific special needs.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Complete selected tasks/problems as determined by the instructor.

460180 Co-op* (Masonry)

Coop I provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

460183 Internship (Masonry)

The Practicum provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Practicum do not receive compensation.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

499920 Basic Blueprint Reading

This course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Review math concepts (fractions and decimals).
5. Identify the alphabet of lines.
6. Identify multiple views.
7. Arrange multiple views.
8. Arrange two-view drawings.
9. Identify one-view drawings.
10. Arrange and identify auxiliary views.
11. Demonstrate and use the size and location dimensions.
12. Demonstrate proper dimensions of cylinders and arcs.
13. Size dimensions of holes and angles.
14. Locate dimensions for the centering of holes, points, and centers.
15. Interpret the baseline dimensions on drawings.
16. Identify half, full, and removed sections.
17. Identify electrical schematic and diagram symbols.
18. Identify welding symbols and equipment.
19. Interpret ordinate and tabular dimensions.
20. Set tolerances using geometric dimensioning techniques.
21. Sketch parts with irregular shapes.
22. Sketch oblique views of various parts.
23. Sketch and dimension shop drawings.
24. Dimension parts using shop notes.
25. Calculate tolerances.
26. Identify labeling of various screw threads.
27. Calculate tapers and machined surfaces.
28. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.

PLUMBING TECHNOLOGY COURSES

460511 Introduction to Plumbing

This course introduces the origin and basic principles of the plumbing industry. Also included is the orientation of methods associated with the plumbing industry.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Read a ruler.
2. Work with hand tools.
3. Work with power tools.
4. Work with steel pipe, tools, and methods.
5. Learn cast iron pipe methods of cutting.
6. Learn methods of joining cast iron pipe.
7. Work with copper tubing.
8. Learn methods of joining copper pipe.
9. Work with PVC and ABS plastics.
10. Work with PVC and CPVC water pipes.
11. Learn methods of joining different pipe materials.
12. Learn methods of pipe support.
13. Apply for a job.
14. Join copper pipe and fittings using the flaring method.
15. Join copper pipe and fittings using the compression method.
16. Bend copper pipe using spring benders.
17. Cut plastic pipe.
18. Join plastic pipe using the solvent weld and thermo welding methods.
19. Join plastic pipe using insert and threaded fittings.
20. Join pipes of different types.
21. Cut woodwork for drain, waste, and vent pipes.
22. Install fixture supports.
23. Inventory plumbing fixtures and supplies.
24. Secure pipes to wood structures.
25. Secure pipes to concrete structures.
26. Secure pipes to metal structures.
27. Install water hammer arrestors.
28. Install wall hydrants.
29. Install yard hydrants.
30. Thaw frozen water pipes.
31. Insulate water pipes.
32. Apply for a plumbing-related job.

460512 Plumbing Systems

This course presents a study of designing and sizing water distribution, drain, waste, and vent pipes, in addition to studies of code requirements and installation of common residential fixtures.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Identify drain, waste, and vent.
2. Learn code sizing of DWV.
3. Size a bathroom group.
4. Identify water distribution.
5. Learn the sizes of the water lines for a bathroom group.
6. Learn how to set a water closet.
7. Learn how to set a lavatory.
8. Learn how to install a bathtub.
9. Learn how to install a shower.
10. Learn the sizing of the kitchen and laundry.
11. Learn how to install a kitchen sink unit.
12. Identify auto-washer openings.
13. Learn cross-connections.
14. Install other plumbing fixtures.

460513 Basic Plumbing Skills

This course introduces the student to basic pipe-joining techniques.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Measure with a rule.
2. Measure, cut, ream, and thread steel pipe using hand tools.
3. Measure, cut, and ream steel pipes using power equipment.
4. Join steel pipe and fitting.
5. Cut cast iron using a hammer, chisel and other tools.
6. Cut cast iron pipe using a snap chain cutter or wheel cutter.
7. Join cast iron pipe and fittings using lead and oakum.
8. Join cast iron pipe and fittings using a compressed gasket.
9. Join cast iron pipe using a no-hub clamp.
10. Measure and cut copper pipe using a hacksaw, tubing cutters and ream.
11. Join copper pipe and fittings using the soldering method.
12. Join copper pipe and fittings using the flare method.
13. Join copper pipe and fittings using the compression method.

460514 Bathroom Install

This course will develop the skills necessary to rough-in and install a bathroom group and auxiliary fixtures for residential or commercial applications.

Recommended Grade Level: 9 – 12

Recommended Credit: 1

Students will:

1. Rough in waste and vent pipes for build-in lavatories.
2. Rough in the water supply for lavatory.
3. Install a lavatory.
4. Rough in waste and vent pipes for floor mount water closet.
5. Rough in the water supply for water closer.
6. Install a water closet.
7. Rough in waste and vent pipes for bathtub.
8. Rough in the water supply for bathtub.
9. Install a bathtub.
10. Install urinal and bidet.
11. Rough in waste and vent pipes for shower bath.
12. Rough in the water supply for shower.
13. Install shower bath.

460515 Kitchen Install

This course will develop the skills necessary to rough in and install a kitchen group and laundry fixtures for residential and commercial applications.

Recommended Grade Level: 10 – 12

Recommended Credit: 1

Students will:

1. Rough in waste and vent pipes for kitchen sink.
2. Rough in the water supply for kitchen sink.
3. Install a kitchen sink.
4. Install garbage disposal unit.
5. Install dishwasher opening.
6. Rough in waste and vent pipes for automatic washer.
7. Rough in the water supply for automatic washer.

460518 Co-op* (Plumbing)

Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

* Co-op can only be taken after the first four credits are earned, OR along with another course in the pathway, OR if the student is enrolled in an approved pre-apprenticeship program

460521 Internship (Plumbing)

The Practicum provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Practicum do not receive compensation.

Recommended Grade Level: 11 – 12

Recommended Credit: 1

Students will:

1. Gain career awareness and the opportunity to test career choices.
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

460599 Special Problems - Plumbing

This course is designed for the student who has demonstrated specific special needs.

Recommended Grade Level: 9 – 12

Recommended Credit: .5 – 1

Students will:

1. Complete selected tasks/problems as determined by the instructor.

499930 Industrial Safety

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply worksite and shop safety rules, and to apply OSHA (Occupational Safety and Health Administration) regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Recommended Grade Level: 9 – 12

Recommended Credit: .5

Students will:

1. Introduce First Aid and CPR (cardiopulmonary resuscitation).
2. Apply work site and lab safety procedures.
3. Apply personal safety rules and procedures.
4. Apply fire prevention rules and procedures.
5. Demonstrate hazardous communications procedures.
6. Describe and demonstrate universal precautions procedures.
7. Obtain 1926 Construction OSHA (Occupational Safety and Health Administration) 10 certification (recommended but not required).
8. Obtain First Aid and CPR (cardiopulmonary resuscitation) certifications if provisions allow.