

HVA - HEATING VENTILATION & AC

HVA 100 Introduction to Heating, Ventilating, Air Conditioning and Refrigeration Electrical Fabrication

This course will provide a background and understanding of electron flow, Ohm's law, wire sizing, system controls, types of motors, AC/DC theory and understanding of the use of meters and equipment components associated with this field. The math necessary to perform the calculations in this course will be covered as an integral part of instruction. The course includes theory as well as practical shop applications.

Upon successful completion of this course, students should be able to:
Define electrical circuit fundamentals.

Identify circuit symbols on a schematic diagram or plan.

Describe the difference between parallel and series circuits.

Define the relationship among voltage, amperage and resistance.

Perform calculations using Ohm's law.

Demonstrate the use of electric meters, their operation and application.

Identify current carrying capacity of conductors, use wire sizing charts and properly size conductors for system connections.

Cite the hazard potential and safety procedures when working on equipment.

Describe the types of motors used within the HVAC&R field, including both theory and operation.

Prerequisite: ((ENG 050 and REA 050) or ENG 099 or REA 075) and HVA 104*. Appropriate placement test scores may be accepted. *Courses marked with a star may be taken concurrently.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 101 Introduction to Refrigeration and Air Conditioning

This course will cover the design and functions of the major components of residential and commercial refrigeration and air conditioning. The refrigeration cycle is reviewed and heat transfer discussed. Particular attention is placed on use of hand tools, techniques of installation and service of equipment.

Upon successful completion of this course, students should be able to:

Demonstrate appropriate procedures for attaching refrigeration manifold to a refrigerator system.

Position compressor service valves for variety of operations in refrigeration and air conditioning systems.

Demonstrate knowledge of the functions of the various parts of refrigeration systems and refrigerant cycles.

Interpret pressure temperature charts and pressure-enthalpy relationships.

Demonstrate understanding of piping layout and the relevant application considerations.

Troubleshoot refrigerant problems.

Apply computations for heat loss and heat gain.

Conduct operational procedures such as pump down for refrigeration and air conditioning systems.

Demonstrate awareness of workplace safety principles and practices.

Prerequisite: HVA 100.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 103 Advanced Refrigeration and Air Conditioning

This course provides students with a background and understanding of residential, light and commercial refrigeration design, installation as well as service. The course materials will also address troubleshooting techniques of components with special emphasis on refrigerant control devices, compressors, reducing valves and dryers. Air conditioning fundamentals to be covered shall include psychrometer, air flow and duct sizing. Superheat and subcooling adjustments for both refrigeration and air conditioning will be covered.

Upon successful completion of this course, students should be able to:

Explain heat flow, change of state condensing point, evaporation point and laws of refrigeration.

Describe knowledge of the types of commercial refrigeration systems and the integral components.

Identify the common problems with valves, pressure switches, filters and dryers.

Demonstrate the adjustment of the superheat and subcooling of refrigeration and air conditioning machines for maximum efficiency.

Demonstrate understanding of psychrometric charts and its uses in air conditioning.

Measure air flow.

Diagnose common problems associated with air side residential and commercial air conditioning.

Prerequisite: HVA 101 and HVA 200.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 104 Practical Problems in Mathematics for HVAC&R Technicians

This course introduces basic mathematics for the HVAC&R student. The course includes whole and mixed numbers, fractions, decimals, ratios and proportions, basic trigonometry and Ohm's law of electrical relationships. It covers direct and computed measure and presents the use of standard formulas, graphs and graphing. Emphasis will be placed on real practical applications.

Upon successful completion of this course, students should be able to:

Solve problems using ratios and proportion.

Calculate answers using standard HVAC&R formulas.

Solve triangles using trigonometric ratios and the law of sines and cosines.

Construct airflow charts from raw data and also interpret HVAC&R related graphs.

Prerequisite: Successful Placement Test Scores or MAT 050.

3 Credits3 Weekly Lecture Hours

HVA 106 Basic Piping for Contractors

This course is an introduction to piping principles and practices as they apply to Heating, Ventilating, Air Conditioning, and Refrigeration. The course utilizes a variety of pipes, pipe materials, and fittings in the instruction of proper method of joining pipe and material lists, measuring, and assembly of manifolds. The students will develop the skills needed to work with drawings and testing procedures.

Upon successful completion of this course, students should be able to:

Identify various types of pipes and fittings.

Interpret and apply information contained in drawings and blue prints.

Perform accurate measurements.

Demonstrate procedures required for the HVAC&R pipe installation.

Demonstrate the proper procedure for valve installation.

Demonstrate appropriate procedures to test hydraulic and pneumatic pipe deficiencies.

Demonstrate required safety knowledge.

Prerequisite: Successful Placement Test Scores or (ENG 050 and REA 050) or ENG 099* or REA 075 (*may be taken concurrently).

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 107 Gas Heating

This course is designed to provide the relevant theory and skill to remove and install gas or oil heating systems. The topics of instruction will include but will not be limited to the basic system sizing selection of equipment recognizing the venting requirements for a new installation. Steps to follow for the safe removal of existing equipment will be discussed. Restate an understanding of NFPA 54 the NEC codes and the manufacturers installation instructions. Provides knowledge to perform basic electric wiring for the installation of heating equipment and how ductwork is assembled for hot air systems, the piping schematics, and components for hot water systems will also be presented.

Upon successful completion of this course, students should be able to:

Perform a startup and check operation of the equipment.

Understand basic heat loss calculation.

Restate the two types of warm air systems.

Recognize an up flow, and counter flow heater.

Recognize operating and safety controls.

Identify the function of each operating and safety control.

Calculate air combustion.

Calculate gas pipes.

Identify NFPA guidelines for venting gas.

Prerequisite: NONE New students should complete Placement Testing prior to registration. Visiting students may submit college transcript.

3 Credits3 Weekly Lecture Hours

HVA 108 Duct and Sheet Metal Fabrication and Installation - Residential

This course is designed for students who plan a career in the heating, ventilation, and air conditioning industry. Topics covered in this course includes, but is not limited to, safety, duct takeoff, sheet metal calculations, costing, installation, heat loss/gain and blueprint reading.

Upon successful completion of this course, students should be able to:

Read and use a duct factor chart.

Utilize a duct take-off form.

Determine total weight of metal needed for duct.

Utilize an installation take-off form.

Identify costing sheet metal duct, duct liner, and installation.

Fabricate air and splitter dampers and drivers.

Cut openings in duct for take-off collars.

Join duct sections.

Apply the proper method of duct sealing.

Apply external duct insulation.

Utilize tools of the trade.

Perform an oblique drawing of a duct system.

Read a blueprint.

Install grilles, registers, and diffusers.

Install flexible connectors.

Identify NFPA-54 guidelines for venting gas-fired appliances.

Identify NFPA-31 guidelines for venting oil-fired appliances.

Identify NFPA-58 guidelines for venting propane/LP-fired appliances.

Prerequisite: NONE New students should complete Placement Testing prior to registration. Visiting students may submit college transcript.

3 Credits3 Weekly Lecture Hours

HVA 109 HVAC Troubleshooting

This course presents the sequence of operation in the troubleshooting of residential air conditioning and gas-fired warm air systems. The materials and lab demonstrations promote the safe use of electrical, temperature, and pressure gages to facilitate a system diagnosis and recommended solution.

Upon successful completion of this course, students should be able to:

Collect and analyze data with the owner.

Use proper tools safely to find problems.

Operate the HVAC System to verify safe, efficient services.

Record operating pressures, temperatures, airflow, and identification numbers.

Develop a cost-effective plan of action.

Demonstrate safe working habits.

Troubleshoot flow charts.

Identify low voltage systems.

Identify diagram circuits.

Utilize pressure gauges.

Utilize electrical meters.

Use combustion analyzer.

Recognize system hazards.

Review plan of action with owner.

Prerequisite: HVA 100 and HVA 200 and MAT 128.

3 Credits2 Weekly Lecture Hours

2 Weekly Lab Hours

HVA 110 Hydronic Heating Systems

This course is an introduction to hydronic hot water heating. The course is designed to cover residential and light commercial systems, which involves many different piping disciplines. Also covered are design and building techniques of hot water heating systems.

Upon successful completion of this course, students should be able to:

Review safety rules.

Explain the principles of heat transfer.

Detail boiler design and construction.

Calculate heat loss/gain.

Identify various heat distribution systems.

Cite the different piping designs of hydronic heating systems.

Cite the sequence of operation of a gas or oil fired hot water boiler.

Cite the sequence of operation of a hydronic heating system.

Service and replace hot water boilers.

Service mechanical controls of a hydronic heating system.

Identify and install appropriate venting.

Analyze combustion procedures.

Prerequisite: HVA 112.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 111 Advanced Duct and Sheet Metal Fabrication/Installation - Commercial

This course is designed for students who plan a career in the HVAC industry. This course covers safety, duct take-off, duct support systems, installation techniques, duct design, sizing and layout, blueprint reading, and venting of heating appliances.

Upon successful completion of this course, students should be able to:
Read a blueprint.

Perform oblique drawings of a duct system.

Know the difference between supply air and return air duct systems.

Identify the different types of duct hangers, clamps, and connectors.

Identify the need for duct reducers.

Identify various duct sealing techniques.

Cut a perfect 10-inch diameter hole in a duct.

Connect various duct fittings.

Make branch connections.

Properly install flexible duct.

Install flexible connectors.

Perform an air test and balance.

Apply external duct insulation.

Apply and repair duct liner.

Install grilles, registers and diffusers.

Identify NFPA-54 guidelines for venting gas fired heating appliances.

Identify NFPA-31 guidelines for venting oil fired heating appliances.

Identify NFPA-58 guidelines for venting propane/LP gas fired appliances.

Prerequisite: HVA 108.

3 Credits2 Weekly Lecture Hours

2 Weekly Lab Hours

HVA 112 Oil Burners and Hydronic Steam Heating

This course is an introduction to oil burners and hydronic steam heating. The course covers the history of oil burners and their technological growth to present day in residential and light commercial appliances. Also discussed are petroleum crude, refinement, and distillation into light grade fuel oil. This course also covers techniques in designing and building of steam heating systems.

Upon successful completion of this course, students should be able to:

Explain the differences in fuel oil grades.

Explain the principles of oil burner combustion.

Describe fuel pump operation.

Explain the functions of safety and operating controls; their purpose and operation.

Identify the sequences of operation of an oil burner as related to hydronic steam boilers.

Identify the venting process of oil-fired appliances.

Service oil burners.

Identify methods of heat transfer.

Cite the principles of steam generation.

Describe one and two pipe steam distribution systems.

Explain the importance and operation of the Hartford Loop.

Service steam boilers.

Prerequisite: NONE New students should complete Placement Testing prior to registration. Visiting students may submit college transcript.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 113 Hydronic Troubleshooting

This course demonstrates the control functions of residential hydronic heating systems. The course materials address troubleshooting techniques, electrical and mechanical operations, and a review of basic steam and hot water design schemes. Service, safety, combustion analysis and cost-effective repair are included.

Upon successful completion of this course, students should be able to:

Operate a residential boiler.

Recognize and list safety hazards and concerns.

Use tools to determine draft and combustion.

Identify mechanical devices including pumps.

Explain fluid dynamics including pumps.

Install and wire a zone control module.

Explain principles of steam.

Identify types of electrical circuits for zoning.

Detail basic control schemes.

Explain hydronic circuits.

Replace electric mechanical components.

Identify circuits on diagram.

Use electric meter.

Recognize system hazards.

Review plan of action with owner.

Prerequisite: HVA 110 and MAT 128.

3 Credits2 Weekly Lecture Hours

2 Weekly Lab Hours

HVA 190 Heating, Ventilation and Air Conditioning Internship (1 credit)

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 60 hour internship will earn 1 college credit for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

Upon successful completion of this course, students should be able to:

Explain three program-related concepts that have been applied during the work experience.

Describe the ways that technology is utilized in the work experience.

Analyze the culture of the host organization.

Analyze an operational process within the work experience.

Demonstrate how assigned tasks depend on successful communication.

Describe how time and activity are managed to meet work-imposed deadlines.

Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.

Formulate a self-assessment for career growth and personal satisfaction.

Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).

Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.

1 Credit

HVA 194 Heating, Ventilation and Air Conditioning Internship (2 credits)

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 120 hour internship will earn 2 college credits for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

Upon successful completion of this course, students should be able to:
Explain three program-related concepts that have been applied during the work experience.

Describe the ways that technology is utilized in the work experience.

Analyze the culture of the host organization.

Analyze an operational process within the work experience.

Demonstrate how assigned tasks depend on successful communication.

Describe how time and activity are managed to meet work-imposed deadlines.

Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.

Formulate a self-assessment for career growth and personal satisfaction.

Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).

Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.

2 Credits

HVA 199 Heating, Ventilation and Air Conditioning Internship (3 credits)

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 180 hour internship will earn 3 college credits for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

Upon successful completion of this course, students should be able to:
Explain three program-related concepts that have been applied during the work experience.

Describe the ways that technology is utilized in the work experience.

Analyze the culture of the host organization.

Analyze an operational process within the work experience.

Demonstrate how assigned tasks depend on successful communication.

Describe how time and activity are managed to meet work-imposed deadlines.

Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.

Formulate a self-assessment for career growth and personal satisfaction.

Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).

Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.

3 Credits

HVA 200 Advanced HVAC&R Electrical Fabrication

This course will introduce students to the electronic operation and safety controls in refrigeration and air conditioning equipment. Also addressed will be the use and application of schematic and ladder wiring diagrams and introduce the proper troubleshooting procedures of residential and light commercial systems.

Upon successful completion of this course, students should be able to:
Demonstrate understanding of the system operation and sequence of operation for HVAC&R equipment.

Explain control circuits, their use and potential problems.

Troubleshoot refrigeration and air conditioning control systems and isolate the faulty components with the system.

Determine proper replacement procedures when defective or faulty components are found.

Follow safety requirements and regulations.

Prerequisite: HVA 100.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours

HVA 201 Refrigerant Certification

This course will instruct the students about the harmful effects of chlorofluorocarbons on the ozone, production limitations and phase-out of CFCs and HCFCs, and recycle, reclaim and recover. The course also prepares students to take EPA national certification exam.

Upon successful completion of this course, students should be able to:

Detail the chemical properties of CFCs and HCFCs.

Demonstrate understanding of the Montreal protocol and the regulations established by the international community concerning refrigerants.

Demonstrate understanding of the US Clean Air Act and the limits and prohibition of CFCs and HCFCs.

Set up record keeping and documentation for refrigerant management program.

Demonstrate understanding of how to recover, recycle and reclaim equipment.

Demonstrate understanding of how to service refrigeration and air conditioning without venting refrigerant into the atmosphere.

Prerequisite: HVA 103.

3 Credits3 Weekly Lecture Hours

HVA 203 Heat Pump Systems

This course is designed to present practical fundamentals, recommended service procedures and start-up of heat-pump systems. The course is structured to introduce the basics of each topic and then move into the more technical aspects of the topic. Topics covered include troubleshooting, standard service procedures and earth-coupled, water source heat-pump systems.

Upon successful completion of this course, students should be able to:

Demonstrate understanding of the operation of a heat pump.

Demonstrate understanding of heat-pump components and control.

Detail the operation of air-source and ground-source heat-pump systems.

Perform calculations necessary for proper heat-pump system design.

Demonstrate installation and start-up of a heat-pump system.

Troubleshoot a heat-pump system.

Prerequisites: HVA 103 and HVA 200

3 Credits2 Weekly Lecture Hours

2 Weekly Lab Hours

HVA 204 Blueprint Reading for HVAC

This course presents fundamentals in the understanding and use of basic HVAC drawings and schematics to determine construction drawings to determine methods and materials of light construction. Emphasis is placed on architectural symbols, use of scales and orthographic projection.

Upon successful completion of this course, students should be able to:

Demonstrate an understanding of residential and light commercial construction practices.

Demonstrate competencies in reading and interpreting technical drawings.

Identify appropriate types of reference sources and use them effectively.

Prerequisite: HVA 104.

3 Credits

HVA 205 Oil and Gas Burner Service

(Formerly HVA 202) This course includes review of heat transfer products and their use in institutional and commercial equipment. High efficiency heating equipment, principles and operation, sequence of operation and oil and gas burner technology will be addressed.

Upon successful completion of this course, students should be able to:

Explain principles of combustion.

Identify three methods of heat transfer.

Demonstrate the knowledge of the principles of convection of high-efficiency heating equipment.

Demonstrate knowledge of the furnace design and construction.

Identify potential venting problems with high-efficiency equipment.

Demonstrate knowledge of hydronic heating-system components and design.

Service oil and gas burners.

Prerequisite: HVA 203

3 Credits2 Weekly Lecture Hours

2 Weekly Lab Hours

HVA 206 Industrial Piping

This course provides a logical succession for the topics covered in HVA 106. In essence, this course introduces the student to additional varieties of pipe materials, pipe connectors and systems used as conductors for various materials within varied industrial facilities. Instruction will be given in the selection, installation and proper use of the different types of materials available as industrial piping. General shop safety and health, accident protection practices and procedures and OSHA/EPA requirements for the proper use of tools, ladders and hi-bay lifts for the installation, repair and replacement of piping system components will also be addressed.

Upon successful completion of this course, students should be able to:

Utilize appropriate terminology for the description of piping systems, components, devices and tools and for installation and repair.

Calculate costs and savings associated with varied types of piping systems.

Identify, select and install proper pipe for various applications, including cast-iron, copper, PVC and other plastics/composites, stainless and other alloy steels.

Investigate the correct use of water pipes (1/2" 3" in diameter) and effect field or shop installations or repairs.

Determine the correct application size and pressure rating for Wirsboro (PRO-PEX), Victaulic and LOKRING piping materials and devices.

Install, repair and list types of pipe and fittings with the appropriate tools.

Prepare job plans for the installation and repair of various piping systems.

Apply safety/health/accident protection practices and procedures for inspection/installation/repair of various piping systems.

Employ proper methods for cutting steel, cast-iron, various plastics and stainless steel pipes and tubing.

Prepare and install stainless steel pipe and fittings for food processing and pharmaceutical applications.

Select a type of piping material with regard for application and system pressure.

Utilize a T-Drill System for pipe installation and/or repair.

Prerequisite: HVA 106 and TME 115.

2 Credits1 Weekly Lecture Hour

2 Weekly Lab Hours