

# HVAC Residential Service Technician, A.A.S.

Modern residential, commercial, institutional and manufacturing operations depend on carefully monitored temperature conditions and well-trained installation and service technicians. Government researchers say graduates of training programs that emphasize hands-on experience will have a definite advantage when seeking employment in heating, ventilation and air conditioning technology. JCCC provides you the opportunity to work on actual equipment while pursuing a degree or certificate program. The 64-credit-hour associate of applied science degree program focuses on developing an awareness of basic mathematical and scientific principles. The curriculum is concerned with the manner by which these principles affect the control of temperature and the quality of air, design, testing, installation and development of heating and cooling systems.

If you select the residential degree, you will learn the theory of operation as well as installation, duct design, service and repair of gas and electric furnaces, heat pumps and central air conditioners. In addition to the 31 core hours, the following courses are required for the A.A.S. degree, residential option.

(Major Code 2880; State CIP Code 47.0201)

- HVAC (<http://www.jccc.edu/hvac>)

## Associate of Applied Science Degree

### First Semester

HVAC 121	Basic Principles of HVAC*	4
HVAC 123	Electromechanical Systems	4
HVAC 143	Reading Blueprints and Ladder Diagrams	2
HVAC 155	Workplace Skills	1
INDT 125	Industrial Safety/OSHA 30	3
ENGL 121	Composition I*	3
EMS 121	CPR I - Basic Life Support for Healthcare Provider	1
Total Hours		18

### Second Semester

HVAC 146	Plumbing Systems Applications	3
HVAC 150	Refrigerant Management and Certification	1
HVAC 137	Residential Systems: Air Conditioning*	4
HVAC 124	Equipment Selection and Duct Design*	4
HVAC 167	Sheet Metal Layout and Fabrication	3
Total Hours		15

### Third Semester

Technical Electives (see below)		4
MATH 130	Technical Mathematics I*	3
HVAC 127	Residential Systems: Heating*	4
HVAC 148	HVAC Installation and Start-up Procedures*	3
Social Science and/or Economics Elective ^		3
Total Hours		17

^ Social Science and/or Economics Elective (<http://catalog.jccc.edu/spring/degrecertificates/electives/social-sci-econ-aas>)

### Fourth Semester

Technical Electives (see below)		4
General Education Elective (see below)		3
HVAC 235	Residential Heat Pump Systems*	4
Humanities Elective ^		3
Total Hours		14

^ Humanities Elective (<http://catalog.jccc.edu/spring/degreecertificates/electives/humanities-aas>)

## Technical Electives

ELTE 122	National Electrical Code I	4
ELTE 125	Residential Wiring Methods*	4
HVAC 125	Energy Alternatives	2
HVAC 221	Commercial Systems: Air Conditioning*	4
HVAC 223	Commercial Systems: Heating*	4
HVAC 231	HVAC Rooftop Units*	3
HVAC 271	HVAC Internship*	3
HVAC 291	Independent Study*	1-7

## General Education Electives

ENGL 123	Technical Writing I*	3
SPD 120	Interpersonal Communication	3

**Total Program Hours: 64**

## Courses

### **HVAC 121 Basic Principles of HVAC\* (4 Hours)**

**Prerequisites or corequisites:** HVAC 123 or ELTE 123

This is a beginning course in heating, ventilation and air conditioning technology that is appropriate for HVAC majors and other interested students. Upon successful completion of this course, the student should be able to identify the function of the basic components of an air-conditioning system. Topics will include heat laws, refrigerants, oils and refrigeration cycles of residential and light commercial systems. In the lab, students will design, assemble and operate a working refrigeration system. Competencies will include brazing, wiring, evacuating and charging a system. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk.

### **HVAC 123 Electromechanical Systems\* (4 Hours)**

**Prerequisites or corequisites:** RDG 126 or College Reading Readiness

This is a beginning course in electrical theory that is required for HVAC, electrical and power plant technology, but is appropriate for all interested students. Common components found in the HVAC industry are used to develop these skills. Upon successful completion of this course, the student should be able to identify electrical components and their relationships to the various repair and troubleshooting techniques. The materials in this course will prove useful to service technicians whose background in electricity is limited. The course includes material from basic electrical theory to troubleshooting complex electrical circuits. This course will provide practice in application of electrical theory as well as in the interconnection of components of heating and cooling systems. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk.

### **HVAC 124 Equipment Selection and Duct Design\* (4 Hours)**

**Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify techniques and procedures used in the residential construction industry to determine proper sizing of HVAC equipment and ducts to meet the requirements for a high-quality, comfortable climate in terms of heating, cooling, humidifying, dehumidifying, ventilation and air cleaning or filtering. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk. This course is the same as EPRM 124; do not enroll in both.

### **HVAC 125 Energy Alternatives\* (2 Hours)**

**Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should be able to identify diverse methods of alternate energy production. Some of the technologies that will be discussed are wind energy, photoelectric energy, nuclear energy, hydroelectric energy, biomass and alternate fuel vehicles. Students will understand the advantages of using various alternate energy technologies, the effects or by-products of each and the problems that might be encountered. Some student research will be included in the context of the course. Emphasis will be on the most promising or effective alternate energy technologies available. 2 hrs. lecture/wk.

**HVAC 127 Residential Systems: Heating\* (4 Hours)****Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify all the components and accessories and their relation to the functions of residential heating systems. Topics covered will be natural gas, propane, oil, forced air and hydronic-types of equipment. Emphasis will be on the electrical diagrams and mechanical principles of operation of these systems. Practical instruction in service diagnosis procedures and techniques for efficient operation, maintenance, troubleshooting and repair of these systems make up the lab portion of the course. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 137 Residential Systems: Air Conditioning\* (4 Hours)****Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify all the components and accessories and their relation to the functions of residential air conditioning systems. Topics covered will include electric and natural gas air conditioner condensing units, metering devices, evaporation coils, and refrigerants. Electrical diagrams, psychrometric charts and techniques for efficient operation, maintenance, troubleshooting and repair of these systems make up the laboratory portion of the course. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 143 Reading Blueprints and Ladder Diagrams\* (2 Hours)****Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should be able to identify all types of industrial plant blueprints. Included will be a discussion of machine parts and drawings as well as hydraulic, pneumatic, piping and plumbing, electrical, air conditioning and refrigeration drawings. Sketching used in industrial plants will be covered. A portion of the course will cover the types and use of ladder logic and various components such as input, output and diagrams. The structure, symbols and terminology of ladder logic diagrams will be introduced. Logic and decision-making functions are presented, along with practice in creating ladder logic diagrams. 2 hrs. lecture/wk.

**HVAC 146 Plumbing Systems Applications\* (3 Hours)****Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should be able to demonstrate familiarity with many aspects of fuel gas piping, gas appliance venting, water heater installations, combustion air requirements and proper piping techniques. Classroom lectures center on methods for proper sizing of both fuel gas piping and vent sizing with emphasis on interpretation of both the Uniform Plumbing Code and the National Fuel Gas Code. There will be an emphasis on combustion air requirements. Laboratory competencies will include identification of materials and proper installation methods of fuel gas lines, vent piping systems and copper water line connections. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 2 hrs. lecture, 3 hrs. lab/wk.

**HVAC 148 HVAC Installation and Start-up Procedures\* (3 Hours)****Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify techniques and procedures to install new systems, retrofit systems and do an initial start-up, check-out furnaces and air conditioners. Topics will include electrical requirements, flue appliance location, permit and inspections, combustion air, sheet metal ducts, and mechanical standards. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 2 hrs. lecture, 3 hrs. lab/wk.

**HVAC 150 Refrigerant Management and Certification\* (1 Hour)****Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should have knowledge and confidence necessary to pass the EPA Refrigerant Certification exam and properly, efficiently and responsibly handle refrigerants as set forth in the Clean Air Act of 1990. 1 hr. lecture/wk.

**HVAC 155 Workplace Skills\* (1 Hour)****Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should be able to identify the job skills necessary to have a successful career in the field of their choice. Topics included listening skills, oral communication, human relations, decision making/problem solving, how to work as a team, time and resource management, work ethics, career planning and resume building. 1 hr. lecture/wk.

**HVAC 167 Sheet Metal Layout and Fabrication\* (3 Hours)****Prerequisites or corequisites:** RDG 126 or College Reading Readiness

Upon successful completion of this course, the student should be able to identify the components, equipment and operation for sheet metal layout and fabrication. Practice problems are included at the end of each unit in order to provide the student with an opportunity to apply the methods attained by sheet metal layout. Shop facilities are available. The patterns will be fabricated and joined into a line of fittings. This gives the most complete test of pattern accuracy and also provides the experience needed by a competent layout person. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 2 hrs. lecture, 3 hrs. lab/wk.

**HVAC 221 Commercial Systems: Air Conditioning\* (4 Hours)**

**Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify cooling systems used in commercial, institutional and industrial applications. Types of equipment include reciprocating and centrifugal chillers, absorption systems, cooling towers, fans and air handlers. Topics also include psychometrics, pressure-enthalpy diagrams and commercial load calculations, evacuation and charging. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 223 Commercial Systems: Heating\* (4 Hours)**

**Prerequisites:** HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify large heating systems used in commercial, institutional and industrial applications. Types of equipment include hot water, low-pressure and high-pressure steam boilers; auxiliary, safety and flame safeguard controls; steam traps; condensate return; and water treatment systems. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 229 Advanced Control Systems\* (4 Hours)**

**Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify the components and theory in electronic, pneumatic and direct digital control systems as they apply to HVAC systems. This course will reinforce and build on those competencies learned in HVAC 123 and HVAC 121. Classroom lectures will center on components, wiring diagrams, calibration and sequences of operation, system components, theory of operation, wiring diagrams and installation methods. Laboratory competencies include identification, calibration, maintenance and problem diagnosis of pneumatic, electronic and DDC systems, thermostat controllers and their related sensors/transmitters. Students will program a complete building energy management system. Interactive instructional media will be used in this course. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 231 HVAC Rooftop Units\* (3 Hours)**

**Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Topics will include electrical controls and economizers of various rooftop units, roof curbs, installation, service, diagnosis, evacuation and charging of typical light commercial rooftop units. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 2 hrs. lecture, 3 hrs. lab/wk.

**HVAC 235 Residential Heat Pump Systems\* (4 Hours)**

**Prerequisites:** HVAC 121 and either HVAC 123 or ELTE 123

Upon successful completion of this course, the student should be able to identify the function of all components and accessories of all electric and dual heat pump systems. Topics will include electric heat and heat pump fundamentals, principles and applications; refrigerant flow controls; defrost cycle controls; heat pump thermostats; indoor air distribution; dual fuel controls; and change-over stats. Emphasis will be on the electrical diagrams and mechanical principles of operation. These systems, as well as practical instruction in service and diagram procedures and techniques for the efficient operation, maintenance, troubleshooting and repair of these systems, will make up the lab portion of the course. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment. 3 hrs. lecture, 3 hrs. lab/wk.

**HVAC 271 HVAC Internship\* (3 Hours)**

**Prerequisites:** Department approval required

Upon successful completion of this course, the student should be able to apply classroom knowledge to an actual work situation. The internship will provide advanced students with on-the-job experience under the supervision of professionals in the industry. The work will be developed cooperatively with area employers, college staff and each student to provide a variety of actual job experiences directly related to the student's career goals. 1 hr. lecture, minimum 15 hrs. on-the-job training/wk.

**HVAC 291 Independent Study\* (1-7 Hour)**

**Prerequisites:** 2.0 GPA minimum and department approval

Independent study is a directed, structured learning experience offered as an extension of the regular curriculum. It is intended to allow individual students to broaden their comprehension of the principles of and competencies associated with the discipline or program. Its purpose is to supplement existing courses with individualized, in-depth learning experiences. Such learning experiences may be undertaken independent of the traditional classroom setting, but will be appropriately directed and supervised by regular instructional staff. Total contact hours vary based on the learning experience.