



Air Conditioning & Refrigeration

Program Information

Air conditioning and refrigeration systems are an intricate part of the success of almost every business. Air conditioning systems are responsible for controlling the temperature, humidity, and the total air quality in residential, commercial, and industrial buildings. Refrigeration systems make it possible to store and transport food, medicine, and other perishable items. This is a skilled occupation that requires qualified technicians to install, maintain, and repair such systems.

The Air Conditioning and Refrigeration program at Trenholm State Community College is designed to teach a student the basic principles involved in the installation, maintenance, and repair of heating, air conditioning, and refrigeration systems. Through the various courses, a student will gain technical knowledge and practical hands-on experience in servicing, troubleshooting, and maintaining these systems.

Occupational Choices

Commercial and residential building construction is expected to drive employment growth. The growing number of sophisticated climate-control systems is also expected to increase demand for qualified HVACR technicians.

Repair and replacement of HVACR systems is a large part of what technicians do. The growing emphasis on energy efficiency and pollution reduction is likely to increase the demand for HVACR technicians as climate-control systems are retrofitted, upgraded, or replaced entirely. Job opportunities for HVACR technicians are expected to be good. Candidates familiar with tablet computers and electronics, as well as those who have developed troubleshooting skills, will have the best job prospects.

As the population and economy grow and new residential, commercial, and industrial structures are built, more technicians will be needed to install and maintain climate control systems. Employment of heating, air conditioning, and refrigeration mechanics

and installers is projected to grow 15 percent from 2016 to 2026, much faster than the average for all occupations.

Source: Bureau of Labor and Statistics Occupational Outlook Handbook, 2016-2026 Edition, 2018 Survey

Average Full-Time Wage

The median annual wage for heating, air conditioning, and refrigeration mechanics and installers was \$47,080 in May 2017. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than \$29,120, and the highest 10 percent earned more than \$75,330.

Source: Bureau of Labor and Statistics Occupational Outlook Handbook, 2016-2026 Edition, 2018 Survey

Awards Available

Associate in Applied Science Degree
A/C & Refrigeration Technology

Associate in Applied Science Degree
A/C & Refrigeration Technology
Refrigeration Concentration

Certificate
A/C & Refrigeration Technology
Refrigeration Concentration

Short Term Certificate
A/C & Refrigeration Technology
Advanced A/C & Refrigeration Concentration

Program Contact

Jaime Junco
Program Coordinator/Instructor
334-420-4276
Location: Patterson Site - Bldg. E

As part of ongoing planning and evaluation, the College regularly evaluates student learning outcomes for each program.

Estimated Program Length & Cost *

Award	Length	Credit Hours	Tuition Fees	Books	Tools	Supplies
Associate Degree 1	6 Terms	68	\$10,540	\$500	\$970	\$300
Associate Degree 2	6 Terms	56	\$8,680	\$500	\$970	\$300
Certificate	5 Terms	46	\$7,130	\$500	\$970	\$300
Short Term Certificate	2 Terms	28	\$4,340	\$500	\$970	\$300

* Tax not included. Prices are subject to change without prior notice; cost of books may vary considerably among suppliers. Cost of general education books is in addition to the total listed above. The length of the program is based on full-time status of 12-15 credit hours per term. Enrollment in transitional level general education courses will alter the length of the program.

Associate of Applied Science A/C & Refrigeration

General Education Requirements (18 hours)

Area I - Written Composition (3 hours)

ENG-101	English Composition I	3
ENG-102	English Composition II	3
ENG-130	Technical Report Writing	3

Area II - Humanities & Fine Arts (3 hours)

(Humanities and Arts disciplines include but are not limited to: Area/Ethnic Studies, Art and Art History, Foreign Languages, Music and Music History, Philosophy, Ethics, Religious Studies, Theater and Dance.)

Note: If SPH-106, SPH-107, SPA-101 or SPA-102 has been taken an additional 3 semester hours in Humanities and Fine Arts must be taken to satisfy requirements in Area II.

Arts:

ART-100	Art Appreciation	3
MUS-101	Music Appreciation	3

Humanities:

PHL-106	Intro to Philosophy	3
PHL-200	Ethics in the Workplace	3
PHL-206	Ethics & Society	3
PHL-210	Ethics and the Health Sciences	3
REL-100	History of World Religions	3
REL-151	Survey of Old Testament	3
REL-152	Survey of New Testament	3
SPA-101	Intro Spanish I	3
SPA-102	Intro Spanish II	3
SPH-106	Fundamentals of Oral Comm	3
SPH-107	Fundamentals of Public Speaking	3

Literature:

ENG-251	American Literature I	3
ENG-252	American Literature II	3
ENG-261	English Literature I	3
ENG-262	English Literature II	3
ENG-271	World Literature I	3
ENG-272	World Literature II	3

Area III - Natural Science & Mathematics (6-7 hours)

(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-100	Intermediate Algebra	3
MTH-103	Intro to Technical Mathematics	3
MTH-104	Plane Trigonometry	3
MTH-110	Finite Mathematics	3
MTH-112	Precalculus Algebra	3
MTH-116	Mathematical Applications	3

Natural Sciences:

BIO-101	Introduction to Biology I	4
BIO-102	Introduction to Biology II	4
BIO-103	Principles of Biology I	4
BIO-104	Principles of Biology II	4
BIO-201	Human Anatomy & Physiology I	4
BIO-202	Human Anatomy & Physiology II	4
PHS-111	Physical Science I	4

PHS-112	Physical Science II	4
PHY-120	Introduction to Physics	4

Area IV - History, Social & Behavioral Sciences (3 hours):

(Social and Behavioral Sciences include, but are not limited to: Anthropology, Economics, Geography, Political Science, Psychology, and Sociology.)

Note: Must complete 3 semester hours.

History:

HIS-101	Western Civilization I	3
HIS-102	Western Civilization II	3
HIS-121	World History I	3
HIS-122	World History II	3
HIS-201	United States History I	3
HIS-202	United States History II	3

Social and Behavioral Sciences:

PSY-200	General Psychology	3
PSY-210	Human Growth and Development	3
SOC-200	Introduction to Sociology	3
POL-200	Introduction to Political Science	3
POL-211	American National Government	3

Area V: Pre-Professional/College Requirements:

(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ACR-111	Principles of Refrigeration	3
ACR-112	HVACR Service Procedures	3
ACR-113	Refrigeration Piping Practices	3
ACR-121	Principles of Electricity for HVACR	3
ACR-122	HVACR Electrical Circuits	3
ACR-123	HVACR Electrical Components	3
ACR-125	Fund of Gas & Electrical Htg Sys	6
ACR-128	Heat Load Calculations	3
ACR-132	Residential Air Conditioning	3
ACR-147	Refrigerant Transition and Recovery	3
ACR-152	Heat Pump Systems	6
ACR-205 *	System Sizing and Air Distribution	3
ACR-209	Commercial A/C Systems	3
ACR-210	Troubleshooting HVACR Systems	3
	Elective	3

Electives:

ACR-127	HVACR Elect Motors	3
ACR-135	Mechanical/Gas Safety Codes	3
ACR-141	Environmental Systems	4
ACR-187	Special Topics	5
ACR-192	HVAC Apprenticeship / Internship	3
CIS-146	Microcomputer Applications	3

* ACR-205 has a prerequisite requirement of ACR-128

Area V Credit Hours: 52

Total Credit Hours: 68

**Associate of Applied Science
A/C & Refrigeration
Refrigeration Concentration**

General Education Requirements (16 hours)**Area I - Written Composition (3 hours)**

ENG-101	English Composition I	3
ENG-102	English Composition II	3
ENG-130	Technical Report Writing	3

Area II - Humanities & Fine Arts (3 hours)

(Humanities and Arts disciplines include but are not limited to: Area/Ethnic Studies, Art and Art History, Foreign Languages, Music and Music History, Philosophy, Ethics, Religious Studies, Theater and Dance.)

Note: If SPH-106, SPH-107, SPA-101 or SPA-102 has been taken an additional 3 semester hours in Humanities and Fine Arts must be taken to satisfy requirements in Area II.

Arts:

ART-100	Art Appreciation	3
MUS-101	Music Appreciation	3

Humanities:

PHL-106	Intro to Philosophy	3
PHL-200	Ethics in the Workplace	3
PHL-206	Ethics & Society	3
PHL-210	Ethics and the Health Sciences	3
REL-100	History of World Religions	3
REL-151	Survey of Old Testament	3
REL-152	Survey of New Testament	3
SPA-101	Intro Spanish I	3
SPA-102	Intro Spanish II	3
SPH-106	Fundamentals of Oral Comm	3
SPH-107	Fundamentals of Public Speaking	3

Literature:

ENG-251	American Literature I	3
ENG-252	American Literature II	3
ENG-261	English Literature I	3
ENG-262	English Literature II	3
ENG-271	World Literature I	3
ENG-272	World Literature II	3

Area III - Natural Science & Mathematics (6-7 hours)

(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-100	Intermediate Algebra	3
MTH-103	Intro to Technical Mathematics	3
MTH-104	Plane Trigonometry	3
MTH-110	Finite Mathematics	3
MTH-112	Precalculus Algebra	3
MTH-116	Mathematical Applications	3

Natural Sciences:

BIO-101	Introduction to Biology I	4
BIO-102	Introduction to Biology II	4
BIO-103	Principles of Biology I	4
BIO-104	Principles of Biology II	4
BIO-201	Human Anatomy & Physiology I	4

BIO-202	Human Anatomy & Physiology II	4
PHS-111	Physical Science I	4
PHS-112	Physical Science II	4
PHY-120	Introduction to Physics	4

Area IV - History, Social & Behavioral Sciences (3 hours):

(Social and Behavioral Sciences include, but are not limited to: Anthropology, Economics, Geography, Political Science, Psychology, and Sociology.)

Note: Must complete 3 semester hours.

History:

HIS-101	Western Civilization I	3
HIS-102	Western Civilization II	3
HIS-121	World History I	3
HIS-122	World History II	3
HIS-201	United States History I	3
HIS-202	United States History II	3

Social and Behavioral Sciences:

PSY-200	General Psychology	3
PSY-210	Human Growth and Development	3
SOC-200	Introduction to Sociology	3
POL-200	Introduction to Political Science	3
POL-211	American National Government	3

Area V: Pre-Professional/College Requirements:

(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ACR-111	Principles of Refrigeration	3
ACR-112	HVACR Service Procedures	3
ACR-113	Refrigeration Piping Practices	3
ACR-121	Principles of Electricity for HVACR	3
ACR-122	HVACR Electrical Circuits	3
ACR-123	HVACR Electrical Components	3
ACR-133	Domestic Refrigeration	3
ACR-134	Ice Machines	3
ACR-147	Refrigerant Transition and Recovery	3
ACR-203	Commercial Refrigeration	3
ACR-210	Troubleshooting HVACR Systems	3
	Elective	6

Electives:

ACR-127	HVACR Elect Motors	3
ACR-135	Mechanical/Gas Safety Codes	3
ACR-141	Environmental Systems	4
ACR-187	Special Topics	5
ACR-192	HVAC Apprenticeship / Internship	3
CIS-146	Microcomputer Applications	3

Area V Credit Hours: 40

Total Credit Hours: 56

Certificate A/C & Refrigeration

General Education Requirements (6 hours)

Area I - Written Composition (3 hours)

ENG-101	English Composition I	3
ENG-102	English Composition II	3
ENG-130	Technical Report Writing	3

Area II - Humanities & Fine Arts (0 hours)

(Humanities and Arts disciplines include but are not limited to: Area/Ethnic Studies, Art and Art History, Foreign Languages, Music and Music History, Philosophy, Ethics, Religious Studies, Theater and Dance.)

Note: If SPH-106, SPH-107, SPA-101 or SPA-102 has been taken an additional 3 semester hours in Humanities and Fine Arts must be taken to satisfy requirements in Area II.

Arts:

ART-100	Art Appreciation	3
MUS-101	Music Appreciation	3

Humanities:

PHL-106	Intro to Philosophy	3
PHL-200	Ethics in the Workplace	3
PHL-206	Ethics & Society	3
PHL-210	Ethics and the Health Sciences	3
REL-100	History of World Religions	3
REL-151	Survey of Old Testament	3
REL-152	Survey of New Testament	3
SPA-101	Intro Spanish I	3
SPA-102	Intro Spanish II	3
SPH-106	Fundamentals of Oral Comm	3
SPH-107	Fundamentals of Public Speaking	3

Literature:

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ENG-252	American Literature II	3
ENG-261	English Literature I	3
ENG-262	English Literature II	3
ENG-271	World Literature I	3
ENG-272	World Literature II	3

Area III - Natural Science & Mathematics (3 hours)

(In addition to Mathematics, disciplines in the Natural Sciences include: Astronomy, Biological Sciences, Chemistry, Geology, Physical Geography, Earth Science, Physics, and Physical Science.)

Note: 3 semester hours in MTH must be completed. Additional hours can be taken in the Natural Science area.

Mathematics:

MTH-100	Intermediate Algebra	3
MTH-103	Intro to Technical Mathematics	3
MTH-104	Plane Trigonometry	3
MTH-110	Finite Mathematics	3
MTH-112	Precalculus Algebra	3
MTH-116	Mathematical Applications	3

Natural Sciences:

BIO-101	Introduction to Biology I	4
BIO-102	Introduction to Biology II	4
BIO-103	Principles of Biology I	4
BIO-104	Principles of Biology II	4
BIO-201	Human Anatomy & Physiology I	4
BIO-202	Human Anatomy & Physiology II	4
PHS-111	Physical Science I	4

PHS-112	Physical Science II	4
PHY-120	Introduction to Physics	4

Area IV - History, Social & Behavioral Sciences (0 hours):

(Social and Behavioral Sciences include, but are not limited to: Anthropology, Economics, Geography, Political Science, Psychology, and Sociology.)

Note: Must complete 3 semester hours.

History:

HIS-101	Western Civilization I	3
HIS-102	Western Civilization II	3
HIS-121	World History I	3
HIS-122	World History II	3
HIS-201	United States History I	3
HIS-202	United States History II	3

Social and Behavioral Sciences:

PSY-200	General Psychology	3
PSY-210	Human Growth and Development	3
SOC-200	Introduction to Sociology	3
POL-200	Introduction to Political Science	3
POL-211	American National Government	3

Area V: Pre-Professional/College Requirements:

(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ACR-111	Principles of Refrigeration	3
ACR-112	HVACR Service Procedures	3
ACR-113	Refrigeration Piping Practices	3
ACR-121	Principles of Electricity for HVACR	3
ACR-122	HVACR Electrical Circuits	3
ACR-123	HVACR Electrical Components	3
ACR-125	Fund of Gas & Electrical Htg Sys	6
ACR-132	Residential Air Conditioning	3
ACR-133	Domestic Refrigeration	3
ACR-134	Ice Machines	3
ACR-147	Refrigerant Transition and Recovery	3
	Elective	3

Electives:

ACR-127	HVACR Elect Motors	3
ACR-135	Mechanical/Gas Safety Codes	3
ACR-141	Environmental Systems	4
ACR-187	Special Topics	5
ACR-192	HVAC Apprenticeship / Internship	3
CIS-146	Microcomputer Applications	3

Area V Credit Hours: 40

Total Credit Hours: 46

Short Term Certificate
A/C & Refrigeration
Advanced A/C & Refrigeration
Concentration

Area V: Pre-Professional/College Requirements:

(Courses appropriate to the degree requirements and major of the individual student and electives.)

College Requirements:

ORI-101	Orientation to College	1
ACR-128	Heat Load Calculations	3
ACR-152	Heat Pump Systems	6
ACR-203	System Sizing & Air Distribution	3
ACR-205 *	System Sizing and Air Distribution	3
ACR-209	Commercial A/C Systems	3
ACR-210	Troubleshooting HVACR Systems	3
	Electives	6

Electives:

ACR-125	Fund of Gas & Electrical Htg Sys	6
ACR-127	HVACR Elect Motors	3
ACR-135	Mechanical/Gas Safety Codes	3
ACR-141	Environmental Systems	4
ACR-187	Special Topics	5
ACR-192	HVAC Apprenticeship / Internship	3
CIS-146	Microcomputer Applications	3

* ACR-205 has a prerequisite requirement of ACR-128

Total Credit Hours: 28

Course Descriptions A/C & Refrigeration

Course #	Course Title	Credit Hours
ACR-111	PRINCIPLES OF REFRIGERATION	3
	PREREQUISITE: None This course emphasizes the fundamental principles for air conditioning and refrigeration. Instruction is provided in the theory and principles of refrigeration and heat transfer, HVAC/R system components, common, and specialty tools for HVAC/R, and application of the concepts of basic compression refrigeration. Upon completion, students should identify system components and understand their functions, identify and use common and specialty HVAC/R tools, and maintain components of a basic compression refrigeration system. This is a CORE course.	
ACR-112	HVACR SERVICE PROCEDURES	3
	PREREQUISITE: None This course covers system performance checks and refrigerant cycle diagnosis. Emphasis is placed on the use of refrigerant recovery/recycle units, industry codes, refrigerant coils and correct methods of charging and recovering refrigerants. Upon completion, students should be able to properly recover/recycle refrigerants and demonstrate safe, correct service procedures which comply with the no-venting laws.	
ACR-113	REFRIGERATION PIPING PRACTICES	3
	PREREQUISITE: None The course introduces students to the proper installation procedures of refrigerant piping and tubing for the heating, ventilation, air conditioning and refrigeration industry. This course includes various methods of working with and joining tubing. Upon completion, students should comprehend related terminology, and be able to fabricate pipe, tubing, and pipe fittings. This is a CORE course.	
ACR-121	PRINCIPLES OF ELECTRICITY FOR HVACR	3
	PREREQUISITE: None This course is designed to provide the student with the basic knowledge of electrical theory and circuitry as it pertains to air conditioning and refrigeration. This course emphasizes safety, definitions, symbols, laws, circuits, and electrical test instruments. Upon completion students should understand and be able to apply the basic principles of HVACR circuits and circuit components. This is a CORE course.	
ACR-122	HVACR ELECTRICAL CIRCUITS	3
	PREREQUISITE: None This course introduces the student to electrical circuits and diagrams. Electrical symbols and basic wiring diagrams are constructed in this course. Upon completion, the student should understand standard wiring diagrams and symbols and be able to construct various types of electrical circuits. This is a CORE course.	
ACR-123	HVACR ELECTRICAL COMPONENTS	3
	PREREQUISITE: None This course introduces students to electrical components and controls. Emphasis is placed on the operations of motors, relays, contactors, starters, and other HVAC electrical components. Upon completion, students should be able to install electrical components and determine their proper operation. This is a CORE course.	
ACR-125	FUND OF GAS & ELECTRICAL HEATING SYSTEMS	6
	PREREQUISITE: None This course provides instruction on general service and installation for common gas and electrical heating systems. Emphasis is placed on components, general service procedures, and basic installation. Upon completion, students will be able to install and service gas and electrical heating systems in a wide range of applications. This is a CORE course.	
ACR-127	HVACR ELECTRIC MOTORS	3
	PREREQUISITE: None This course covers the basic maintenance of electric motors used in HVAC/R systems. Topics include types of motors, motor operations, motor installation, and troubleshooting motors. Upon completion student should be able to install and service HVAC/R electric motors.	
ACR-128	HEAT LOAD CALCULATIONS	3
	PREREQUISITE: None This course focuses on heat flow into and out of building structures. Emphasis is placed on determining heat gain/heat loss of a given structure. Upon completion, students should be able to calculate heat load and determine HVAC equipment size requirements.	

Course #	Course Title	Credit Hours
ACR-132	RESIDENTIAL AIR CONDITIONING PREREQUISITE: None This course introduces students to residential air conditioning systems. Emphasis is placed on the operation, service, and repair of residential air conditioning systems. Upon completion, students will be able to service and repair residential air conditioning systems.	3
ACR-133	DOMESTIC REFRIGERATION PREREQUISITE: None This course covers domestic refrigerators and freezers. Emphasis is placed on installation, removal, and maintenance of components. Upon completion, students should be able to service and adjust domestic refrigeration units.	3
ACR-134	ICE MACHINES PREREQUISITE: None This course introduces students to commercial ice machines. Emphasis is placed on components, electrical and mechanical operation sequences, control adjustment procedures, preventive maintenance, repairs, and installation procedures. Upon completion, student should be able to install, service and repair commercial ice machines.	3
ACR-135	MECHANICAL/GAS SAFETY CODES PREREQUISITE: None This course is to enhance the student's knowledge of the International Fuel Gas Code and International Mechanical Code as well as fire and job safety requirements. Emphasis is placed on code book content and compliance with installation requirements. Upon completion, students should be able to apply code requirements to all work.	3
ACR-141	ENVIRONMENTAL SYSTEMS PREREQUISITE: None This course provides students with knowledge and skills of environmental chambers. Topics include theory of the refrigerant components and refrigerant circuits, programmable controllers, electrical pressure and calibration instruments and places emphasis on safety. Upon course completion, students should be able to apply environmentally-safe practices.	4
ACR-147	REFRIGERATION TRANSITION AND RECOVERY PREREQUISITE: None This course is EPA-approved and covers material relating to the requirements necessary for type I, II, and III universal certifications. Upon completion, students should be prepared to take the EPA 608 certification examination.	3
ACR-152	HEAT PUMP SYSTEMS PREREQUISITE: None This course provides instruction on the operation and servicing of heat pump systems. Emphasis is placed on theory and application of refrigerants for heat pump systems and on basic service of components. Students should possess a strong foundation of electrical principles and theory. Upon completion students will be able to install and service heat pumps.	6
ACR-187	SPECIAL TOPICS IN A/C AND REFRIGERATION PREREQUISITE: None This course provides students with opportunities to experience hands-on application of specialized instruction in various areas related to the air conditioning and refrigeration industry.	5
ACR-192	HVAC APPRENTICESHIP / INTERNSHIP PREREQUISITE: None This course is designed to provide basic hands-on experiences in the work place. The student is provided with a training plan developed by the employer and instructor working together to guide the learning experience. Upon course completion, students should be able to work independently and apply related skills and knowledge. This course involves a minimum of 15 work hours weekly	3
ACR-203	COMMERCIAL REFRIGERATION PREREQUISITE: None This course focuses on commercial refrigeration systems. Emphasis is placed on evaporators, condensers, compressors, expansion devices, special refrigeration components and application of refrigeration systems. Upon completion students should be able to service and repair commercial refrigeration systems.	3
ACR-205	SYSTEM SIZING AND AIR DISTRIBUTION PREREQUISITE: None This course provides instruction in the load calculation of a structure and system sizing. Topics of instruction include heat loss, heat gain, equipment and air distribution sizing, and factors making acceptable indoor air quality. Upon course completion, students should be able to calculate system requirements.	3

Course #	Course Title	Credit Hours
ACR-209	COMMERCIAL AIR CONDITIONING SYSTEMS	3
	PREREQUISITE: None	
	This course focuses on servicing and maintaining commercial and residential HVAC/R systems. Topics include system component installation and removal and service techniques. Upon completion, the student should be able to troubleshoot and perform general maintenance on commercial and residential HVAC/R systems.	
ACR-210	TROUBLESHOOTING HVACR SYSTEMS	3
	PREREQUISITE: None.	
	This course provides instruction in the use of various meters and gauges used in the HVAC/R industry. Emphasis is placed on general service procedures, system diagnosis, and corrective measure, methods of leak detection, and system evacuation, charging and performance checks. Upon completion students should be able to perform basic troubleshooting of HVAC/R.	