

**GREAT PLAINS TECHNOLOGY CENTER  
COURSE OF STUDY**

|                                   |  |
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| <b><u>Career Cluster:</u></b>     | Architecture and Construction (AC)   |
| <b><u>Career Pathway:</u></b>     | Maintenance/Operations (AC004)   |
| <b><u>Career Major:</u></b>       | Residential HVAC Technician (AC0040008)  |
| <b><u>Career Major Hours:</u></b> | Secondary Students: 1050 Hours<br>Adult Students: 1050 Hours                                 |
| <b><u>Instructor:</u></b>         | Name: Zachary Sale<br>Office Number: (580) 250-5618<br>E-Mail Address: zsale@greatplains.edu |
| <b><u>Academic Credit:</u></b>    | Secondary Students: 3 high school credits per year<br>Adult Students: Transcript             |
| <b><u>Prerequisites:</u></b>      | None   |

**Career Major Description:**

This career major is an introduction to air-conditioning and refrigeration, exploring career opportunities in the HVAC/R industry, personal safety and work practices, and personal protective equipment. Students will be instructed in the proper handling of pressurized fluids, handling hazardous substances, hand and power tools, and equipment used to test and service air conditioning.

**Career Major Goals:**

Student enrolled in this career major will be given the opportunity to develop the skills and attitudes needed to successfully enter the HVAC field according to their personal choice, ability, and resourcefulness.

Upon achieving the goals of this career major, students will:

- Become competent in the fundamental skills of the occupation.
- Become qualified for further related education and/or entry into the job market.
- Work as a team member.
- Pass at least one Occupational State of Oklahoma certification test.
- Become qualified for further related education and/or enter the job market.
- Demonstrate independence in using problem solving and critical thinking techniques in completing all work assignments.
- Develop the ability to work with limited supervision.
- Accept and abide by the rules and regulations established by the school and/or place of employment.
- Meet the requirements of a 2nd year apprentice in the HVAC trade.

**Related Career Opportunities:**

- Residential HVAC Technician
- Residential HVAC Installer
- Natural Gas Piping Technician
- Sheet Metal Technician

- Refrigeration Technician
- HVAC Mechanic
- HVAC Helper
- Duct Installer
- Refrigeration Apprentice

**Career Major Objectives:**

After successful completion of this career major, the student will be able to:

- Use basic measurement and mathematics techniques to solve HVAC related problems.
- Complete a job application.
- Perform preventive maintenance procedures on HVAC equipment.
- Install and repair HVAC equipment with minimum supervision.
- Diagnose and repair both electrical and mechanical problems in refrigeration equipment with minimum supervision.
- Meet the requirements to become a 2<sup>nd</sup> year apprentice in the HVAC trade.

**Career Major Course Sequence:**

- HS Student and Part-time Adult (Year One): Course Sequence I
- HS Student and Part-time Adult (Year Two): Course Sequence II
- Full-time Adult (Year One): Course Sequence I and II

**DESCRIPTION OF COURSES  
SEQUENCE I**

| <u>Course #</u>   | <u>Course Name</u>                                    | <u>HST</u> | <u>HSL</u> | <u>ADT</u> | <u>ADL</u> |
|---|---|------------|------------|------------|------------|
| <b>TI00687</b>  | <b>Intro to HVAC/R, Safety, Tools and Equipment</b>   | <b>10</b>  | <b>20</b>  | <b>10</b>  | <b>20</b>  |
| This course is an introduction to air-conditioning and refrigeration, exploring career opportunities in the HVAC/R industry, personal safety and work practices, personal protective equipment, handling of pressurized fluids, handling hazardous substances, hand and power tools, and equipment used to test and service heating, air conditioning, and refrigeration equipment, including those used to measure air flow. |   |            |            |            |            |
| <b>TI00222</b>  | <b>Principles of Thermodynamics and Heat Transfer</b> | <b>20</b>  | <b>40</b>  | <b>20</b>  | <b>40</b>  |
| This course is an introduction to matter and heat behavior, fluids and pressures, refrigeration cycle/diagrams and measurement systems.   |   |            |            |            |            |
| <b>TI00717</b>  | <b>Piping and Piping Practices</b>                    | <b>15</b>  | <b>30</b>  | <b>15</b>  | <b>30</b>  |
| This course introduces students to the appropriate selection, preparation, joining and support of copper, plastic, iron and steel pipe and fittings. This course will also cover the tools, materials, and safety precautions, and depicts step-by-step procedures for soldering and brazing piping copper pipe, and cutting, threading, and joining ferrous pipe.  |   |            |            |            |            |
| <b>TI00690</b>  | <b>Electricity for HVAC/R</b>                         | <b>30</b>  | <b>30</b>  | <b>30</b>  | <b>30</b>  |
| This course teaches students fundamental and advanced concepts in electricity, including electrical generation and distribution, electrical components, electrical motors, electrical circuits and controls, and prepares them to effectively troubleshoot and replace or repair devices in electrical circuits.  |   |            |            |            |            |

**TI01134 HVAC/R Controls** 15 30 15 30

This course is an introduction to controls, gas valves, fuel controls, residential control systems-heating/cooling, commercial control systems, heat pump controls, direct digital controls (DDC) and energy management systems (EMS).

**TI01215 HVAC/R Solid State Electronics** 10 20 10 20

This course prepares students to recognize, troubleshoot, and replace solid state components in common heating, air conditioning, heat pumps, and refrigeration systems.

**TI00924 Load Calculations** 5 10 5 10

This course introduces students to psychrometrics, heating and cooling load calculations, and refrigeration load calculations.

**TI00925 Refrigerant System Components** 30 60 30 60

This course covers the refrigeration cycle and teaches students to recognize the components of refrigeration systems including metering devices, evaporators, compressors, condensers, accessories, and access valves.

**TI00685 Air Conditioning Systems** 35 85 35 85

This course is an introduction to unitary cooling, central station systems, service and problem analysis, absorption refrigeration, desiccant cooling and dehumidification.

**TI00148 Refrigerants and Lubricants** 5 10 5 10

This course covers the properties and applications of the many refrigerants used in refrigeration and air conditioning applications. Refrigeration lubricants, their properties and applications, including compatibility issues with various refrigerants, principles of safe handling for refrigerants and lubricants will be important components of this course.

**TI00934 Refrigerant Recovery** 5 10 5 10

This is an introduction to refrigerant safety, and recovery, recycling, and reclamation equipment and methods. Students are prepared to seek EPA certification.

| <b>Sequence I Subtotal Hours:</b> | <b>Theory</b> | <b>Lab</b> | <b>Total</b> |
|-----------------------------------|---------------|------------|--------------|
| High School Student:              | 180           | 345        | 525          |
| Adult Student:                    | 180           | 345        | 525          |

**DESCRIPTION OF COURSES  
SEQUENCE II**

| <b><u>Course #</u></b> | <b><u>Course Name</u></b> | <b><u>HST</u></b> | <b><u>HSL</u></b> | <b><u>ADT</u></b> | <b><u>ADL</u></b> |
|------------------------|---------------------------|-------------------|-------------------|-------------------|-------------------|
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**TI00719 Refrigerant Retrofits** 5 10 5 10

This course covers appropriate procedures in retrofitting an air conditioning or refrigeration system to run efficiently on a different refrigerant than originally equipped. Compatibility issues of refrigerants with various compressors, evaporators, condensers, expansion devices, and lubricants will be covered in depth. Proper refrigerant/lubricant recovery techniques will be reviewed and practiced.

**TI01146 Heat Pumps 10 20 10 20**

This course covers the essential knowledge necessary to install, service, troubleshoot, and repair heat pumps. Emphasis will be placed on air-to-air systems, but ground source systems will be introduced and briefly examined. Topics will include a review of the refrigeration cycle, reversing valves, the defrost cycle, defrost times including electromechanical as well as solid state devices, balance point, and backup heat systems.

**TI00922 Heating Systems 40 80 40 80**

This course covers the essential knowledge and skills of installing, maintaining, servicing, troubleshooting, and repair of various heating systems, including forced air, convection, hydronic, and radiant. Gas LP, natural gas, and electrical systems will be examined. Emphasis will be placed on gas and electric forced air systems, but heat pumps (air to air and ground source) will be introduced. Hands-on labs will be an extensive part of the course.

**TI00686 Air Handling 15 30 15 30**

This course covers the essential knowledge and skills necessary to understand airflow principles and duct design; install, and repair duct systems; measure and balance air flow; and troubleshoot and repair air flow problems. Students will be prepared to identify appropriate filtration for an air system, i.e. mechanical and electronic, and install, troubleshoot, and maintain filtration systems. Extensive coverage will be given to the different types of fans and blowers, testing for blower motor loading, correct rotation, and adjustment to change the volume of air moved.

**TI01181 HVAC/R System Installation & Start-up-Residential 40 80 40 80**

This course covers the essential knowledge and skills necessary to use the manufacturer's literature to properly install and start-up common residential HVAC/R equipment. Special attention will be given to a thorough understanding of the refrigeration cycle and equipment, heating systems, air flow and balancing systems, air quality issues, and building codes that regulate the HVAC/R industry in residential applications. Emphasis will be placed on confirming proper operation for safety, efficiency, and reliability. Minor troubleshooting and repair skills will be covered.

**TI01216 HVAC/R System Servicing & Troubleshooting-Residential 30 60 30 60**

This course covers the essential knowledge and skills necessary to perform routine residential central system servicing to promote efficient operation and long life. Extensive attention will be given to troubleshooting techniques used in solving mechanical, electrical, refrigerant, and air flow problems common to small tonnage systems commonly found in residences and small commercial applications.

**TI00500 Indoor Air Quality 5 10 5 10**

This course is an introduction to indoor air quality (IAQ) requirements, maintaining indoor air quality, air quality issues including filtration, humidification/dehumidification, and building related illness ("Sick Building Syndrome") and will cover factors that make up acceptable indoor air quality.

**TI01190 HVAC/R Preventive Maintenance 5 10 5 10**

This course covers the essential knowledge and skills necessary to use the manufacturer's literature to properly service common residential HVAC/R equipment. Emphasis will be placed on confirming proper operation for safety, efficiency, and reliability. Minor troubleshooting and repair skills will be covered.

**TI00497 HVAC/R Codes, Regulations and Standards 10 20 10 20**

This course covers the essential knowledge and skills necessary to adhere to the codes and standards pertaining to the HVAC/R industry, regulations affecting ozone depletion, state and local codes, OSHA, and government licensing requirements.

**TI00718 Professional Service** 5 10 5 10

This course covers the essential knowledge and skills necessary to provide quality customer service, build character and customer relations, and participate in professional development.

**TI00802 Workforce Staging** 0 30 0 30

This course is designed to be delivered as an integrated component within the courses taken by the individual student. The course is designed for the development of leadership, personal development and employability skills.

| <b>Sequence II Subtotal Hours:</b> | <b>Theory</b> | <b>Lab</b> | <b>Total</b> |
|------------------------------------|---------------|------------|--------------|
| High School Student:               | 165           | 360        | 525          |
| Adult Student:                     | 165           | 360        | 525          |

| <b>Career Major Total:</b> | <b>Theory</b> | <b>Lab</b> | <b>Total</b> |
|----------------------------|---------------|------------|--------------|
| High School Student:*      | 345           | 705        | 1050         |
| Adult Student:             | 345           | 705        | 1050         |

\* High school students may complete this career major in an adult enrollment status if necessary. Please see your instructor or counselor for details.

### **Evaluation Policy:**

#### **Employability Grades (100 points per week; 40% of final grade)**

The employability skills grade is based on 20 points per day (which may include: attitude, attendance, safety, punctuality, cooperation, participation, clean-up, class preparation, school/classroom rules, and time management). Points will be deducted if these responsibilities are not met at the instructor's discretion. Students will be allowed to make up unearned employability points for **excused** absences only. Full credit will be given for assignments/tests that have been made up due to excused absences only (see Student Handbook).

#### **Performance Grades (40% of final grade)**

- Live projects
- Performance or skill tests
- Written Assignments

#### **Test Grades (20% of final grade)**

- Test grades will be based on a 100-point scale.
- Test grades include written and/or skills tests.
- A test will be given for each unit of instruction.
- Tests are to be taken as a unit is completed.
- Tests must be completed within allotted time.

#### **Final Grade (9 Weeks Period)**

9-weeks grade will be calculated by averaging grades in each category and summing each category according to their assigned weight. Progress reports will be sent to home schools at six and twelve-week intervals each semester as required or requested. Grades are accessible on-line at <http://sonisweb.greatplains.edu/studsect.cfm>

**Grading Scale:**

The grading scale as adopted by the Board of Education is as follows:

- A = 90 – 100
- B = 80 – 89
- C = 70 – 79
- D = 60 – 69
- F = Below 60
- W = Withdrawn
- I = Incomplete
- N = No Grade (Refer to Student Handbook)

**Make-Up Work Policy:**

**All Make-Up Work Is The Responsibility Of The Student.** Make-up work will be handled as specified in the Student Handbook. Please be sure to read and understand all student policies, especially make-up of assignments, tests and employability due to absences. Students should always arrange for any make-up work with the instructor as per the Student Handbook. Students should keep track of his or her progress and grades.

**Attendance Policy:**

For specific information related to attendance and tardiness refer to the Student Handbook. Students should keep a written record of their absences and tardiness.

**Course Requirements and Expectations:**

The general course requirements and expectations include:

- Teaching methods consist of lecture and “hands on” projects.
- The student must demonstrate the ability to apply safety to all aspects of the HVAC field.
- All students must adhere to the policies and procedures in the GPTC Student Handbook.
- SkillsUSA is the student organization for the HVAC field. This club offers an outstanding opportunity to develop leadership and social skills. Students are highly encouraged to participate. The dues are \$10.00 and is paid for by the student.
- Students should dress and groom appropriately for the job in which they are being trained.

**Student Behavior Includes:**

- Students must wear tan **work shirt**.
- Students must wear GPTECH student ID Badge.
- Students will wear clear safety glasses at all times while in the shop environment.
- Shorts will not be permitted at any time. Full length pants are to be worn as this is a working environment. Tank tops or sleeveless shirts are not to be worn at any time. No piercing other than ears shall be visible at any time.

***NOTE: For additional information or questions regarding the GPTC School policies and procedures, please refer to the Student Handbook and/or the Instructor.***

**Industry Alignments:**

- Environmental Protection Agency (EPA)
- Oklahoma Safety and Health Act (OSHA)
- The Partnership for Air-Conditioning, Heating, Refrigeration Accreditation (PAHRA)
- Oklahoma Construction Industry Board (OCIB)
- National Association of Home Builders (NAHB)

## **Certification Outcomes:**

### **Tier 2 – Certifications Endorsed by Industry Organizations**

- ODTCE: Construction Trainee (3001)
- ODTCE: HVACR Technician (3401)
- ODTCE: Process Piping Technician (3402)
- ODTCE: Refrigeration Technician (3403)
- ODTCE: Sheet Metal Technician (3404)

### **Tier 6 – Certifications Administered/Proctored by Instructor**

- EPA: EPA 608 and 609 Refrigerant Handling Certification

## **CIP Code and SOC Code Crosswalk:**

- CIP Code – 47.0201
- SOC Code – 49-9021.01

## **Instructional Materials and Supplies:**

*Adult students are required to purchase the following list of textbooks and/or supplemental reference materials. The prices listed are approximate and subject to change.*

### **Textbooks:**

Clemons, Mark. Fundamentals of Air Conditioning and Refrigeration: Student Guide. 2<sup>nd</sup> ed. TI3140. Multistate Academic and Vocational Curriculum Consortium, Inc., 2007. (\$18.00)

Clemons, Mark. Fundamentals of Air Conditioning and Refrigeration: Student Workbook. 2<sup>nd</sup> ed. TI4140. Multistate Academic and Vocational Curriculum Consortium, Inc., 2007. (\$15.00)

Clemons, Mark. HVACR Electrical Systems: Student Guide. 2<sup>nd</sup> ed. TI3142. Multistate Academic and Vocational Curriculum Consortium, Inc., 2008. (\$14.00)

Clemons, Mark. HVACR Electrical Systems: Student Workbook. 2<sup>nd</sup> ed. TI4142. Multistate Academic and Vocational Curriculum Consortium, Inc., 2008. (\$15.00)

Tomczyk, Silberstein, Whitman & Johnson. Refrigeration and Air Conditioning Technology. 8<sup>th</sup> ed. 9781305578296. Cengage Learning, 2017. (\$138.75)

### **Reference Materials:**

International Fuel Gas Code. International Code Council, Inc., 2014. (\$79.86)

International Mechanical Code. International Code Council, Inc., 2014. (\$70.68)