

**AUSTIN COMMUNITY COLLEGE**  
**Heating, Air Conditioning & Refrigeration Technology**  
**HART1403 AC Controls**

# 00 Course Syllabus

(Rev.01/06/2014)

**Textbooks/Materials:** Modern Refrigeration and Air Conditioning 19<sup>th</sup> Edition ISBN: 978-1-60525-199-4; store at the riverside Acc bookstore. Course packet sold at the Acc bookstore.

The student is expected to purchase or otherwise secure all text books.

## **Course Objectives for HART-1403 Principles of A/C and Refrigeration**

- State the theory of a step down transformer.
- Troubleshoot and identify defective transformers.
- On a diagram, trace the flow of current from the power generating plant to the air conditioner in a residence or business.
- State the conditions necessary for proper and convenient operation of any electrical circuit.
  
- Utilize the Tecumseh Service data book to identify compressors, compressor motor resistances and compressor circuits.
- Identify the four mechanical components (compressor, condenser, metering device and evaporator) on an air conditioner, and state the operating characteristics and function of each.
- Draw the circuits found on typical window type air conditioners.
- Identify and troubleshoot and properly connect into circuits each of the following components: compressors, overloads, current relays, potential relays, hot wire relays, capacitors, switches, thermostats and fan motors.
- Trace the mechanical cycles on air conditioners and refrigerators, noting temperatures, pressures and states of refrigerants at various locations.
- Trace out a complete set of circuits on a window type air conditioner and a refrigerator, making various resistance, amperage and voltage checks.
- Use a computer word processor to write a description of exercises performed and turn in a printed copy. The written material will conform to proper sentence structure, spelling and technical content.

The lesson packet contains this course syllabus, a progress record, handouts containing instructional material and handouts which are lab exercises.

**Progress Record:** The progress record shows you what exercises you need to work on, what exercises you have completed and indicates when tests are planned. Record your grades to calculate you will earn in the course. This is the form your instructor uses to evaluate

your progress and grades.

The lab and theory lessons should be completed in the sequence they are listed on the progress record, but you are encouraged to work on the theory lessons outside of class.

**Lab:** The labs are to be completed in the laboratory. Therefore, you are encouraged to have all instructional material which proceeds a lab exercise completed before coming to class. You should also read through the lab lessons before class so that, when you come to the classroom, you are ready to begin working on the exercises.

You will turn in all measured labs for grading. Your instructor will mark all incorrect answers and record a grade on the paper. It is your responsibility to correct all missed answers. Ask your instructor to verify the accuracy of your corrected answers. Do not study a handout until all answers are correct.

**Theory Lessons:** The instructional material includes reading assignments from your textbook; supplements, and handouts which have been developed by your instructors. Most instructional material contains questions you are to answer as you read the material.

**Answer Keys:** Answer keys are available to you electronically in Blackboard and provided in the LRS lab so that you can grade your own instructional material. You will not be expected to turn in the instructional material. This material is not graded. It is your responsibility to insure that every answer is Correct.

**Quality of Work:** It is assumed that each student taking these courses intends to obtain employment in the HART industry. For this reason, it is expected that the student is here to “Learn the Subject” rather than just “Make the Grade”. Therefore, the student is encouraged make every effort to master the material rather than to just copy the answers. Remember, a degree or certificate may help you get a job, but it’s your knowledge, skills and attitude that allow you to keep the job.

**Notebook:** Please keep all of your course material in a notebook and bring all the material with you when you come to class. Insure that your name is on all papers and in your notebook. Also it is suggested that you write your name and telephone number in your textbook in ink. Any other items brought to class, such as volt-ohm meters should also have your name firmly affixed.

**Study Tip:** This is a wise study tip:

1. Insure that every answer on every handout is Correct.
2. Review every completed exercise at least one every week.
3. Before taking a test, be sure you can answer every question on every handout and that you have a good understanding of all the reading assignments. The tests cover reading assignments, instructional material and lab exercises.

Turn in each lesson when it is completed. Your instructor will grade the papers and return them to

you at the next class meeting.

- Lab Policy:**
- A. The instructor must be in class when any lab work is performed. Students are not to perform lab work outside of normal class times.
  - B. Shop clean up begins 10 minutes before end of class. All lab work should stop at that time. A student must clean up spills or mess he creates.
  - C. Student must pass welding test before using welding equipment.
  - D. Student must wear goggles when using grinder, drill, soldering or working with refrigerant.

**Grading Policy:**

- Grade of A - Maintain an average grade of 90% to 100%
- Grade of B - Maintain an average grade of 80% to 89%
- Grade of C - Maintain an average grade of 70% to 79%
- Grade of D - Maintain an average grade of 60% to 69%
- Grade of F - Average grade below 60%

To receive a grade of A, B, C or D, the student must complete all tests. Any incomplete lab exercises will be figured into the course grade average with a grade of zero.

**Grade of I (Incomplete):** A student may receive a grade of "I" if the student has **no** unexcused absences and has completed at least 75% of the required course work. The student must meet with the instructor and request the grade of incomplete.

If the instructor agrees that you have put forth your best effort but due to extenuating circumstances you were unable to complete the course, the instructor will grant a grade of "I".

**Grade of W (Withdrawal):** When a student is unable to complete the course and does not qualify for a grade of "I", the student should consider withdrawing from the course.

**It is the student's responsibility to initiate withdrawal procedures.** Do not rely on the instructor to perform this service for you.

If a student stops attending, or otherwise fails to complete the course, and does not withdraw, the student will receive a grade of F.

**Absences:** Your instructor can elect to initiate withdrawal procedures and assign a grade "W" if you accumulate as many as four unexcused absences.

Absences can be made up and your instructor will work with you in arranging to make up absences. To make up an absence you must attend a class other than the one you are registered in. You should request permission of the instructor whose class you wish to attend. At the close of the class, present the instructor with a "Class Attendance Form". Have the form filled out so that the instructor need only sign the form. Return the signed form to your official instructor.

**Excused Absences:** Verifiable family emergencies, illness or hospitalization constitute excused absences. A prolonged illness or situation which will prevent attendance of many classes may require the student to withdraw rather than receive a grade of "I". These situations should be discussed with your instructor.

**Testing:** Tests will be given as you progress thru each course. Be sure to check with your instructor for his specific testing requirements and dates. You are not authorized to take a test from anyone other than your instructor.

Lab work will account for 50% of the final grade. Section tests (4 in all) account for 30% of the course grade and the Final exam is 20% of the course grade.

**What Each Section Test Covers:** Each Section test covers all lessons following the previous Section Test. The final exam covers the entire course.

This course and the following Air Conditioning courses are highly technical. Because of their technical nature, technical terms are used. It is important that you learn the meaning of the technical terms and use them correctly. Misinterpretation or misuse of the terms can result in your work begin graded "incorrect."

**Importance of Good Grades:** The grade you earn in this and any other courses you take are recorded on your transcript. You must maintain passing grades to be allowed to continue in college. A grade of F must be offset by a grade of A to average a "C" (assuming equal credit hours in each course).

If you are unable to complete this or any other course, your best advice is to withdraw from the course. A grade of W does not count against you.

**High Quality Digital Volt Ohm Meter Required:** The lab exercises in this class require the use of a digital volt ohm meter. This meter should be capable of auto-range measuring resistances as small as 0.1 ohm, up to - as high as 20,000,000 ohms. A high quality digital volt-ohm meter should be capable of measuring A/C & D/C voltages, amperages as well as microfarads for testing capacitors. K connectors for measuring temperatures with a thermistor is also a desirable feature found on high end quality Digital Volt Ohm meters.

**State of Texas License:** The Texas Legislature has passed a bill authorizing state licensing of Air Conditioning/Heating personnel. The license became mandatory in January 1986. Cities presently requiring licensing may elect to continue or discontinue municipal licensing. If a municipality continues their licensing, the work can be done within that municipality with only the city license. The State License authorizes work anywhere within the state, regardless of city licensing. The state requires a minimum of four years experience before applying for the state examination for licensing. The state recognizes time in the ACC ACR courses as credit toward work experience.

**ACR Technicians:** *a new law passed during the 80th regular session of the Texas Legislature requires all air conditioning technicians who perform air conditioning and refrigeration maintenance work to register with the Texas Department of Licensing and Regulation. This includes persons who assist licensed air conditioning and refrigeration contractors in performing ACR maintenance work.*

To download the application for registering or for more information visit the Texas Department of Licensing and Regulation website at:

**<http://www.license.state.tx.us>**

**L.P. Gas License:** A separate license is required for anyone working on liquid petroleum (L.P.) systems such as butane or propane. The license is issued through the Texas Railroad Commission. Their Austin telephone number is (512) 463-6931.

**Federal Requirement for Technician Certification (EPA):** In April, 1993 the *Environmental Protection Agency* approved the final rule on refrigerant recovery and recycling. The final rule includes mandatory technician certification. The certification includes four levels;

Type I - for servicing small appliances

Type II - for servicing or disposing of high or very high pressure appliances

Type III- for servicing or disposing of low-pressure appliances

Type IV- (Universal) for servicing all types of equipment

This certification is obtained by passing an examination approved by the EPA. Seminars, ranging from 1/2 day to full day are providing by various agencies, including ACC. The seminars prepare you to take the exam.

## Scans Competencies Air Conditioning, Heating & Refrigeration

Principles of Air Conditioning	HART-1403	Principles of Air Conditioning	HART-1403
<b>1.0 Resources</b>		<b>5.0 Technology</b>	
1.1 Manages Time	<b>X</b>	5.1 Selects Technology	
1.2 Manages Money		5.2 Applies Technology to Task	
1.3 Manages Materials and Facility Resources	<b>X</b>	5.3 Maintains and Troubleshoots Technology	
1.4 Manages Human Resources		<b>6.0 Basic Skills</b>	
<b>2.0 Interpersonal</b>		6.1 Reading	<b>X</b>
2.1 Participates as a Member of a Team	<b>X</b>	6.2 Writing	<b>X</b>
2.2 Teaches Others	<b>X</b>	6.3 Arithmetic	<b>X</b>
2.3 Serves Clients/Customers		6.4 Mathematics	<b>X</b>
2.4 Exercises Leadership		6.5 Listening	<b>X</b>
2.5 Negotiates to Arrive at a Decision		6.6 Speaking	<b>X</b>
2.6 Works with Cultural Diversity	<b>X</b>	<b>7.0 Thinking Skills</b>	
<b>3.0 Information</b>		7.1 Creative Thinking	<b>X</b>
3.1 Acquires and Evaluates Information	<b>X</b>	7.2 Decision Making	<b>X</b>
3.2 Organizes and Maintains Information	<b>X</b>	7.3 Problem Solving	<b>X</b>
3.3 Uses Computers to Process Information	<b>X</b>	7.4 Mental Visualization	<b>X</b>
<b>4.0 Systems</b>		7.5 Knowing How to Learn	<b>X</b>
4.1 Understands Systems	<b>X</b>	7.6 Reasoning	<b>X</b>
4.2 Monitors and Corrects Performance	<b>X</b>	<b>8.0 Personal Qualities</b>	
4.3 Improves and Designs Systems		8.1 Responsibility	<b>X</b>
		8.2 Self Esteem	<b>X</b>
		8.3 Sociability	<b>X</b>
		8.4 Self-Management	<b>X</b>
		8.5 Integrity/Honesty	<b>X</b>

# HART 1403 A/C Control Principles - Progress & Evaluation Record

(rev. 08/07/2012)

Name \_\_\_\_\_ ID # \_\_\_\_\_ Synonym \_\_\_\_\_ Semester \_\_\_\_\_

Lesson	Title	Date	Labs	Tests	Final
1	Syllabus				
2	Inst. Mat. & Quest: Transformers and Power Transmission				
3	Lab. Ex.: Testing a Step down Transformer				
4	Lab. Ex.: Identifying Parts of a Hermetic Compressor				
5	Review of Resistance and Voltage				
6	<b>Test # 1</b>				
7	Inst. Mat.: Hermetic Compressor (Service Data)				
8	Inst. Mat.: Compression Systems and Compressors				
9	Lab. Ex.: Identification of Compressor Terminals				
10	Inst. Mat. & Quest. Overload Protectors				
11	Lab. Ex.: Overload Protectors				
12	Lab. Ex.: Wiring & Operation of Compressors				
15	<b>Test # 2</b>				
16	Inst. Mat. & Quest: Current Relays				
17	Lab. Ex.: Checking Current Relays				
18	Lab. Ex.: Wiring a Current Relay				
19	Lab Ex.: Potential Relays				
20	Lab. Ex.: Wiring Potential Relays				
21	Inst. Mat.: Drawing Circuits				
22	Lab. Ex.: Drawing Circuits				
23	<b>Test # 3</b>				
24 & 24a	Inst. Mat. & Quest: Capacitors - ELI the ICE man				
25	Lab. Ex.: Testing Capacitors				
27	Inst. Mat. & Lab Ex.: Switches & Thermostats				
28	Inst. Mat.: Fan Motors				
29	Inst. Quest.: Fan Motors				
30	Lab. Ex.: Wiring Fan Motors				
31	<b>Test # 4</b>				
32	Inst. Mat.: Analyzing System Circuits				
33	Lab. Ex.: Analyzing System Circuits				
35	Lab. Ex.: Tracing Circuits (GE Refrigerator)				
41	Lab. Ex.: Tracing Circuits & Wiring a Compressor				
42	<b>Final Exam</b>				

Labs total	=	÷ 16 =	X 50% =	
Ten Minute Tests	=	÷ 4 =	X 30% =	
Final total	=	X 20% =		

100-90 = A;    89.9 - 80 = B;    79.9-70 = C;    69.9-60 = D    GPA = \_\_\_\_\_    Grade = \_\_\_\_\_

**Instructor's Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_