



Course Syllabus Air Conditioning Troubleshooting HART 2336

Semester with Course Reference Number (CRN)	Summer Session 8A HART 2336-0001 72365
Instructor contact information (phone number and email address)	Armando R. Villanueva 713-718-5284 armando.villanueva@hccs.edu
Office Location and Hours	Southeast Workforce Building Room 202 Friday: 8:00am- 1:00pm by appointment
Course Location/Times	Central- J. B. Whiteley Building, HVAC classroom 104 Tuesday-Thursday 6:00pm-8:30pm
Course Semester Credit Hours (SCH) (lecture, lab) If applicable	Credit Hours: 3 Lecture Hours: 2 Laboratory Hours: 3 External Hours:
Total Course Contact Hours	80.00
Course Length (number of weeks)	8 weeks 06/04/2018-07/29/2018
Type of Instruction	Lecture/Lab
Course Description:	An advanced course in application of troubleshooting principles and use of test instruments to diagnose air conditioning and refrigeration components and system problems including conducting performance tests.
Course Prerequisite(s)	PREREQUISITE(S): <ul style="list-style-type: none">• HART 1301• HART 1341 and• HART 1345 and• HART 2342

FREQUENT REQUISITES

- INRW 0420
- MATH 0409
- INRW 0410

Academic Discipline/CTE Program Learning Outcomes

1. Demonstrate knowledge of safety rules and regulations.
2. Demonstrate the proper selection, use, and maintenance of hand and power tools and measuring instruments used in A/C and Refrigeration.
3. Demonstrate knowledge of HVAC and refrigeration controls.
4. Maintain/service/repair A/C and Refrigeration equipment.
5. Troubleshoot A/C and Refrigeration equipment.

Course Student Learning Outcomes (SLO): 4 to 7

1. Exhibit knowledge of system's sequence of operation, accessory applications, and component operation.
2. Test and diagnose electrical wiring and mechanical components.
3. Troubleshoot control circuits and load components.
4. Identify problems that can occur with the operation of the refrigeration cycle.
5. Demonstrate the ability to isolate and determine the solution for common cooling system malfunctions.
6. Describe how to troubleshoot the components related to gas and electric heating.

Learning Objectives (Numbering system should be linked to SLO - e.g., 1.1, 1.2, 1.3, etc.)

Exhibit knowledge of system's sequence of operation, accessory applications, and component operation.
Test and diagnose electrical wiring and mechanical components.
Troubleshoot control circuits and load components.
Identify problems that can occur with the operation of the refrigeration cycle.
Demonstrate the ability to isolate and determine the solution for common cooling system malfunctions.
Describe how to troubleshoot the components related to gas and electric heating.

SCANS and/or Core Curriculum Competencies: If applicable

SCANS
Exhibit knowledge of system's sequence of operation, accessory applications, and component operation.
Test and diagnose electrical wiring and mechanical components.
Troubleshoot control circuits and load components.
Identify problems that can occur with the operation of the refrigeration cycle.
Demonstrate the ability to isolate and determine the solution for common cooling system malfunctions.
Describe how to troubleshoot the components related to gas and electric heating.

Instructional Methods

Web-enhanced (49% or less)
Face to Face

Student Assignments

Exhibit knowledge of system's sequence of operation, accessory applications, and component operation.
Projects
Lab Exercises
Test and diagnose electrical wiring and mechanical components.
Projects

Lab Exercises

Troubleshoot control circuits and load components.

Projects

Lab Exercises

Identify problems that can occur with the operation of the refrigeration cycle.

Projects

Lab Exercises

Demonstrate the ability to isolate and determine the solution for common cooling system malfunctions.

Projects

Lab Exercises

Describe how to troubleshoot the components related to gas and electric heating.

Projects

Lab Exercises

**Student
Assessment(s)**

Exhibit knowledge of system's sequence of operation, accessory applications, and component operation.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Test and diagnose electrical wiring and mechanical components.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Troubleshoot control circuits and load components.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Identify problems that can occur with the operation of the refrigeration cycle.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Demonstrate the ability to isolate and determine the solution for common cooling system malfunctions.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Describe how to troubleshoot the components related to gas and electric heating.

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

Group and/or individual projects

Student Tools requirements/supplies

Tool Box/Bag

Fuse Puller

Pliers

Channel Lock Pliers

Needle Nose Pliers

Side Cutter Pliers

Screw Driver Assortment

1/8" – 3/8" Straight Blade

#0 - #2 Phillips Tip

Utility Knife

Wire Strippers

Wire Crimpers

Allen Wrench Sets (English & Metric)

Combination Wrench Sets (English & Metric)

Nut Drivers (1/4", 5/16", 11/32")

12" Adjustable Wrench

8" Adjustable Wrench

Hammer (Ball Peen or Claw)

Inspection Mirror

Padlock

Vernier Calipers

Flashlight

Roll of Electrical Tape

Roll of Duct Tape

Volt – OHM Meter

Clamp on Amp Meter

Goggles or Safety Glasses

Leather Gloves

Scientific Calculator

Paint Marker (Permanent Marker)

Highlighter

Three-ring Binder

Also recommended: 3/8" – 1" Socket Set

Refrigeration service manifold and gauges with low-loss fittings. (Recommend hi pressure set that will tolerate R-410a and R-22.)

Thermometers (digital)

Valve core stem removal and replacement tool

Refrigeration service valve wrench

*Handles and shanks should be insulated when possible

Substitutions and combinations of items are up to individuals

All tools should be marked for identification!

Course Outline Content Goals and Activities

Week 1

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition. Unit 41

Meet and greet, cover the course syllabus and course procedures, requirements and assignments. Class attendance and learning outcomes, required textbooks and tools. Class attendance and grading scales. Overview of the HVAC business and new technology.

Introduction to HVAC systems

Residential

Commercial

Industrial

Home/Business Building Automation

Work Assignments; Review Questions sent via email and will be due Thursday.

Week 2

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition, Unit 41

Home Systems

Compressors

Condensers

Outdoor Fan Motors

Indoor Fan Motors

Electrical Diagrams

Electrical Components

Work Assignments; will sent via email and will be due Thursday.

Quiz: Thursday

Week 3

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition, Unit 41

System Refrigerant

Approach Temperature

Temperature Difference

Manifold Gauge Usage

Low-Side Gauge Readings

High-Side Gauge Readings

Work Assignments:

Quiz: Thursday

Week 4

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition, Unit 41

System Temperature Readings

Ambient Temperature Readings

Inlet Air Readings

Evaporator Outlet Temperatures

Suction-Line Temperatures

Discharge-Line Temperatures

Liquid-Line Temperatures

Charging Procedures In The Field

Work Assignments:

Mid Term Exam

Week 5

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition, Unit 41

Electrical Systems

Electrical Troubleshooting

Compressor Overloads Problems

Compressor Electrical Checkup

Troubleshooting the Circuit Electrical Protectors-Fuses and Circuit
Breakers

Preventive Maintenance

Work Assignments:

Quiz; Thursday

Week 6

Reading Assignment; Refrigeration and Air Conditioning Technology
8th Edition, Unit 41

Diagnostic Chart for Air-Conditioning (Cooling) Systems

Understanding Home Systems

Work Assignments:

Quiz; Thursday

Week 7

**Reading Assignment; Refrigeration and Air Conditioning
Technology 8th Edition, Unit 41**

Service Calls

Problem Solving

Repair and Replacement

Work Assignment;

Week 8

Study and Review

Final Exam

Instructor's Requirements

As your Instructor, it is my responsibility to:

- Provide the grading scale and detailed grading formula explaining how student grades are to be derived
- Facilitate an effective learning environment through class activities, discussions, and lectures
- Description of any special projects or assignments
- Inform students of policies such as attendance, withdrawal, tardiness and make up
- Provide the course outline and class calendar which will include a description of any special projects or assignments
- Arrange to meet with individual students before and after class as required

To be successful in this class, it is the student's responsibility to:

- Attend class and participate in class discussions and activities
- All written assignments must have **written** questions and answers, including letter associated with the answer. Do not cut and paste work/lab assignments for grade.
- Read and comprehend the assigned textbook and related sources
- Complete the required assignments, labs and exams on time as scheduled.
- No assignments accepted via email, arrangements must be prior.
- Midterm Exam / Final Exam
- Ask for help when there is a question or problem
- Student attendance and participation is required to receive a passing grade
- Students must maintain course portfolio
- Excessive absences, lack of participation, assignments turned in late can affect final grade by 10%
- Keep copies of all paperwork, including this syllabus, handouts and all assignments
- Bring required student material and supplies including tools to each class time.

Program/Discipline Requirements: If applicable

Student is required to bring to class all necessary tools, and dress according to lab safety requirements. Student must bring textbooks, notebooks, and other required supplies.

HCC Grading Scale:

A = 100- 90	4 points per semester hour
B = 89 - 80:	3 points per semester hour
C = 79 - 70:	2 points per semester hour
D = 69 - 60:	1 point per semester hour
59 and below = F	0 points per semester hour
FX (Failure due to non-attendance)	0 points per semester hour
IP (In Progress)	0 points per semester hour
W (Withdrawn)	0 points per semester hour
I (Incomplete)	0 points per semester hour
AUD (Audit)	0 points per semester hour

IP (In Progress) is given only in certain developmental courses. The student must re-enroll to receive credit. COM (Completed) is given in non-credit and continuing education courses.

FINAL GRADE OF FX: Students who stop attending class and do not withdraw themselves prior to the withdrawal deadline may either be dropped by their professor for excessive absences or be assigned the final grade of "FX" at the end of the semester. Students who stop attending classes will receive a grade of "FX", compared to an earned grade of "F" which is due to poor performance. Logging into a DE course without active participation is seen as non-attending. Please note that HCC will not disperse financial aid funding for students who have never attended class.

Students who receive financial aid but fail to attend class will be reported to the Department of Education and may have to pay back their aid. A grade of "FX" is treated exactly the same as a grade of "F" in terms of GPA, probation, suspension, and satisfactory academic progress.

To compute grade point average (GPA), divide the total grade points by the total number of semester hours attempted. The grades "IP," "COM" and "I" do not affect GPA.

Health Sciences Programs Grading Scales may differ from the approved HCC Grading Scale. For Health Sciences Programs Grading Scales, see the "Program Discipline Requirements" section of the Program's syllabi.

Instructor Grading Criteria

Student Evaluation Policies/Grading Scales

Class Participation	220	22%
Quiz (8x30)	240	24%
Lab (8x30)	240	24%
Midterm Examination	150	15%
Final Examination	150	15%
Total Possible Points	1000	-
Total Percentage	-	100%

Instructional Materials

REFRIGERATION AND AIR CONDITIONING TECHNOLOGY 8TH EDITION, WHITMAN, JOHNSON, TOMCZYK ISBN-13: 978-1-305-57829-6

EGLS3 -- Evaluation for Greater Learning Student Survey System

At Houston Community College, professors believe that thoughtful student feedback is necessary to improve teaching and learning. During a designated time near the end of the term, you will be asked to answer a short online survey of research-based questions related to instruction. The anonymous results of the survey will be made available to your professors and department chairs for continual improvement of instruction. Look for the survey as part of the Houston Community College Student System online near the end of the term.

**Student Services
Policies**

<http://www.hccs.edu/district/about-us/procedures/student-rights-policies--procedures/>

**HCC Policy Statement:
*Discrimination and
Accommodations
Due to a Qualified
Disability***

Houston Community College is committed to cultivating an environment free from inappropriate conduct of a sexual or gender-based nature including sex discrimination, sexual assault, sexual harassment, and sexual violence. Sex discrimination includes all forms of sexual and gender-based misconduct and violates an individual's fundamental rights and personal dignity. Title IX prohibits discrimination on the basis of sex-including pregnancy and parental status-in educational programs and activities. If you require an accommodation due to pregnancy please contact an Abilities Services Counselor. The Director of EEO/Compliance is designated as the Title IX Coordinator and Section 504 Coordinator. All inquiries concerning HCC policies, compliance with applicable laws, statutes, and regulations (such as Title VI, Title IX, and Section 504), and complaints may be directed to:

David Cross
Director EEO/Compliance
Office of Institutional Equity & Diversity
3100 Main
(713) 718-8271
Houston, TX 77266-7517 or Houston, TX 77266-7517 or
Institutional.Equity@hccs.edu

HCC strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please meet with a campus Abilities Counselor as soon as possible in order to establish reasonable accommodations. Reasonable accommodations are established through an interactive process between you, your instructor(s) and Ability Services. It is the policy and practice of HCC to create inclusive and accessible learning environments consistent with federal and state law. For more information, please go to <http://www.hccs.edu/district/students/disability-services/>

**HCC Policy Statement:
*Sexual Misconduct***

Houston Community College is committed to cultivating an environment free from inappropriate conduct of a sexual or gender-based nature including sex discrimination, sexual assault, sexual harassment, and sexual violence. Sex discrimination includes all forms of sexual and gender-based misconduct and violates an individual's fundamental rights and personal dignity. Title IX prohibits discrimination on the basis of sex-including pregnancy and parental status-in educational programs and activities. If you require an accommodation due to pregnancy please contact an Abilities Services Counselor. The Director of EEO/Compliance is designated as the Title IX Coordinator and Section 504 Coordinator. All inquiries concerning HCC policies, compliance with applicable laws,

statutes, and regulations (such as Title VI, Title IX, and Section 504), and complaints may be directed to:

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Director EEO/Compliance
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Houston, TX 77266-7517 or Institutional.Equity@hccs.edu

**HCC Online and/or
Continuing Education
Policies**

Access DE Policies on their Web site:

All students are responsible for reading and understanding the HCC Online Student Handbook, which contains policies, information about conduct, and other important information. For the HCC Online Student Handbook click on the link below or go to the HCC Online page on the HCC website.

The HCC Online Student Handbook contains policies and procedures unique to the online student. Students should have reviewed the handbook as part of the mandatory orientation. It is the student's responsibility to be familiar with the handbook's contents. The handbook contains valuable information, answers, and resources, such as HCC Online contacts, policies and procedures (how to drop, attendance requirements, etc.), student services (ADA, financial aid, degree planning, etc.), course information, testing procedures, technical support, and academic calendars. Refer to the HCC Online Student Handbook by visiting this link:

<http://www.hccs.edu/media/houston-community-college/distance-education/student-services/HCC-Online-Student-Handbook.pdf>

Access CE Policies on their Web site:

<http://www.hccs.edu/continuing-education/>

Campus Carry

At HCC the safety of our students, staff, and faculty is our first priority. As of August 1, 2017, Houston Community College is subject to the Campus Carry Law (SB11 2015). For more information, visit the HCC Campus Carry web page at <http://www.hccs.edu/district/departments/police/campus-carry/>.

**Special Statement
Regarding Impact of
Hurricane Harvey**

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so.