HOUSTON COMMUNITY COLLEGE

Course Syllabus

Residential Air Conditioning

HART 1341

Semester with Course Reference Number (CRN)	SPRING 2018 HART 1341 - 0002 (58343)
Instructor contact information (phone number and email address)	Armando R. Villanueva 713-718-5284 armando.villanueva@hccs.edu
Office Location and Hours	Southeast – Campus, Workforce Building Room 202 Friday: 8:00am – 1:00pm By appointment
Course Location/Times	Southeast – Workforce Building II Rm 130 MON - WED 1:45PM – 3:20PM
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 03/19/2018 – 05/13/2018
Type of Instruction	Lecture/Lab
Course Description:	A study of components, applications, and installation of mechanical air conditioning systems including operating conditions, troubleshooting, repair, and charging of air conditioning systems.

Course Prerequisite(s)

PREREQUISITE(S):

- HART 1301
- HART 1307

CO-REQUISITE(S):

- TECM 1301

FREQUENT REQUISITES

- MATH 0306 (Basic Math Pre-Algebra)
- GUST 0339 (5th -7th Grade Reading)
- ENGL 0300 or 0347

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. Maintain A/C and Refrigeration equipment.
4. Service/repair A/C and Refrigeration equipment.
5. Troubleshoot A/C and Refrigeration equipment.

Course Student Learning Outcomes (SLO): 4 to 7

1. Given refrigeration principles and practices, the student will understand theory of heat transfer and knowledge of pressure/temperature relationship. Performance will be satisfactory when the student can interpret the pressure and temperature of refrigerants and identify appropriate refrigerants for air conditioning systems by passing 80% on the quiz and lab assignments.
2. Given a lab assignment along with lectures, the student will identify four major refrigeration system components (compressor, condenser, evaporator, metering device). Performance will be satisfactory when the student can sketch the refrigeration cycle of a mechanical system and identify the function of each component by passing 80% of accuracy on the practice.
3. Give a lab assignment along with demonstration, the student will list mechanical refrigeration components (compressor, condenser, evaporator, metering devices). Performance will be satisfactory when the student can recite refrigerant flow of refrigeration cycle and record pressure and temperature of refrigeration system performance by passing 90% of accuracy on the practice.
4. Given a complete air conditioning system diagram, the student will identify high/low voltage and controllers of an air conditioning system. Performance will be satisfactory when the student can construct both high voltage power supply and control circuits' connection of an air conditioning system by passing 90% of accuracy on the practice
5. Given air conditioning system, the student will diagnose refrigeration system. Performance will be satisfactory when the student can record pressure/temperature and analyze the performance of refrigeration cycle of a mechanical system by passing 100% accuracy on the practice.
6. Given a lab assignment along with demonstration, the student will identify and select mechanical refrigeration components (compressor, condenser, evaporator, metering devices). Performance will be satisfactory when the student can interpret a complete mechanical refrigeration system and test system performance by passing 90% of accuracy on the practice. Identify different types of system applications.

Learning Objectives (Numbering system should be linked to SLO - e.g., 1.1, 1.2, 1.3, etc.)	**Given refrigeration principles and practices, the student will understand theory of heat transfer and knowledge of pressure/temperature relationship. Performance will be satisfactory when the student can interpret the pressure and temperature of refrigerants and identify appropriate refrigerants for air conditioning systems by passing 80% on the quiz and lab assignments.** **Given a lab assignment along with lectures, the student will identify four major refrigeration system components (compressor, condenser, evaporator, metering device). Performance will be satisfactory when the student can sketch the refrigeration cycle of a mechanical system and identify the function of each component by passing 80% of accuracy on the practice.** **Give a lab assignment along with demonstration, the student will list mechanical refrigeration components (compressor, condenser, evaporator, metering devices). Performance will be satisfactory when the student can recite refrigerant flow of refrigeration cycle and record pressure and temperature of refrigeration system performance by passing 90% of accuracy on the practice.** **Given a complete air conditioning system diagram, the student will identify high/low voltage and controllers of an air conditioning system. Performance will be satisfactory when the student can construct both high voltage power supply and control circuits' connection of an air conditioning system by passing 90% of accuracy on the practice** **Given air conditioning system, the student will diagnose refrigeration system. Performance will be satisfactory when the student can record pressure/temperature and analyze the performance of refrigeration cycle of a mechanical system by passing 100% accuracy on the practice.** **Given a lab assignment along with demonstration, the student will identify and select mechanical refrigeration components (compressor, condenser, evaporator, metering devices). Performance will be satisfactory when the student can interpret a complete mechanical refrigeration system and test system performance by passing 90% of accuracy on the practice**
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pressure/temperature and analyze the performance of refrigeration cycle of a mechanical system by passing 100% accuracy on the practice.
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Instructional Methods

Face to Face

Student Assignments

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Various assigned readings from textbooks, peer-rev
Discussions
Projects

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Various assigned readings from textbooks, peer-rev
Discussions
Projects

Student Assessment(s)

Assessments will be administered to determine understanding and comprehension of the course and to determine an appropriate grade.

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Various assigned readings from textbooks
In-class discussions
Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

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Various assigned readings from textbooks
In-class debates
Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

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

COURSE OUTLINE, CONTENT GOALS AND ACTIVITIES

Week 1

Reading assignments ~ Unit 35 Comforts and Psychometrics
Review syllabus and course procedures, requirements and assignments
Discuss general safety orientation
Course description and outcomes
Class attendance, academic calendar, and grading scales
Overview of the HVAC business
Required assignments and labs
Required textbooks and tools
Comfort
Heat transfer
Comfort chart
Psychometrics
Moisture
Absolute humidity & relative humidity
Dry bulb & wet bulb temperatures
Plotting the chart
Quiz; Wednesday
Lab; *Using a Psychrometric Chart, pinpoint 75°F DB, and 62.5°F WB, find the values of Dew point temperature, Total heat content of 1lb of air, Moisture content of 1lb of air, Relative humidity, and Specific volume of air.* ***Due Wednesday***
Work assignments: Review Questions 1 – 18 ~ due Wednesday

Week 2

Reading assignments ~ Unit 36 Refrigeration Applied to Air Conditioning
Refrigeration
Heat gain
Evaporative cooling
Refrigerated cooling
The evaporator
The function of the evaporator
Design conditions

The compressor
The condenser
Condenser design
Expansion devices
Air-side components
Quiz; Wednesday
Lab; *Explain how the scroll compressor is highly efficient.* ***Due Wednesday***
Work assignments: Review Questions 1 – 17 ~ due Wednesday

Week 3
Reading assignments ~ Unit 37 Air Distribution and Balance
Correct air quality
The forced air system
The blower
System pressures
Types of fans
The supply duct system
The plenum system
The return air duct system
Sizing duct
The air friction chart
Quiz; Wednesday
Lab; *Explain the difference measuring air movement between round duct and rectangular duct.* ***Due Wednesday***
Work assignments: Review Questions 1 – 22 ~ due Wednesday

Week 4
Reading assignments ~ Unit 34 Indoor Air Quality
Sources of indoor air pollution
Common pollutants
Detecting and eliminating the source of contamination
Ventilation
Air cleaning
Duct cleaning
Air humidification
Sizing humidifiers
Installation
Service, troubleshooting, and preventative maintenance
Quiz; Wednesday
Lab; *Briefly explain ways to control the indoor quality in the HVAC industry, list some examples.* ***Due Wednesday***
Work assignments: Review Questions 1 - 22 ~ due Wednesday

MID-TERM EXAMS ~ Wednesday 4th week

Week 5
Reading assignments ~ Unit 14 Automatic Control Components and Applications

Temperature Controls
Low-Voltage Space Temperature Controls
Line-Voltage Space Temperature Controls
Sensing the Temperature of Solids
Measuring the Temperature of Fluids
Pressure-Sensing Devices
Pressure Transducers
High Pressure Controls
Low-Pressure Controls
Oil Pressure Safety Controls
Air Pressure Controls
Gas Pressure Switches
Switchless Devices That Control Fluid Flow
Water Pressure Regulators
Gas Pressure Regulators
Mechanical and Electromechanical Controls
Maintenance of Mechanical Controls
Maintenance of Electromechanical Controls
Service Technician Calls
Quiz; Wednesday
Lab; *Explain in detail how different is the heat anticipator to the cold anticipator.* ***Due Wednesday***
Work assignments: Review Questions 1 – 35 ~ due Wednesday

Week 6
Reading assignments ~ Unit 40 Typical Operating Conditions
Mechanical operating conditions
Relative humidity
Systems components
Evaporator
High evaporator loads
Grades of equipment
Documentations with the unit
Equipment efficiency rating
Compressor running amperage
Quiz; Wednesday
Lab; *Explain the importance of humidity, necessity to the grade of air conditioning equipment.* ***Due Wednesday***
Work assignments: Review Questions 1 – 15 ~ due Wednesday

Week 7
Reading assignments ~ Unit 41 Troubleshooting
Mechanical troubleshooting
Approach Temperature and temperature difference
Gauge manifold usage
When to connect gauges
Low-side gauges
High-side gauges
Temperature reading

Charging procedures in the field
Electrical troubleshooting
Compressor overload problems
Compressor electrical checkup
Troubleshooting the circuit electrical protectors – fuses and breakers
Written Assignments; all assignments due Wednesday
Lab; All labs are due Wednesday

Quiz; Wednesday
Lab; *List 3 problems, possible cause and possible repairs.* ***Due Wednesday.***
Work assignments: Review Questions 1 – 20 ~ due Wednesday
Week 8
EGLS3 -- Evaluation for Greater Learning Student Survey System due Monday
REVIEW
FINAL EXAM ~ Wednesday

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
- Accept no assignments via email, texts, and or any other social media, without prior arrangements.

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

- Attend class and participate in class discussions and activities
- Read and comprehend the textbook
- Complete the required assignments and exams: all assignments must be in at assigned times.
- Written assignments must have questions and answers, with letter associated with the answer.
- Midterm Exam / Final Exam
- Ask for help when there is a question or problem
- All assignments must have written questions and answers, including letter associated with the answer, must be in at assigned time.
- Do not cut and paste work/lab assignments for grade.
- Ask for help when there is a question or problem

Keep copies of all paperwork, including this syllabus, handouts and all assignments

Student attendance and participation is required to receive a passing grade.

Students must maintain course portfolio. Excessive absences, lack of participation can affect final grade by 10%.

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, SILBERSTEIN, ISBN-13: 9781305578296

OPTIONAL
LAB MANUAL TO ACCOMPANY REFRIGERATION & AIR CONDITIONING TECHNOLOGY 8TH EDITION, WHITMAN, JOHNSON, TOMCZYK, SILBERSTEIN ISBN-13: 9781305578708

NCCER HEATING, VENTILATING, AND AIR CONDITIONING 4TH LEVEL 2, PEARSON, ISBN-13; 9780133404272

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:

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

Distance Education and/or Continuing Education Policies

Access DE Policies on their Web site:

http://de.hccs.edu/media/houston-community-college/distance-education/student-services/2015-HCC-DE-Student-Handbook-(Revised-1_7_15).pdf

Access CE Policies on their Web site:

http://www.hccs.edu/continuing-education/students/financialaid/continuing-education/

HCC Policy Statement:

HCC ADA STATEMENT (Services to Students with Disabilities)

Any student with a documented disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the Disability Services Office at the respective college at the beginning of each semester. Faculty is authorized to provide only the accommodations requested by the Disability Support Services Office. For questions, please contact (713) 718-8397 or the Disability Counselor at your college. To visit the ADA Web site, please visit www.hccs.edu then click on Information for… Students, scroll down the page and click on the words Disability Services.

Southeast ADA Counselor: Mr. John Reno, MA, CRC – Tel. (713)718-8397 or (713)718-7144

Discrimination:

Students should be aware that discrimination and/or other harassment based on race, sex, gender identity and gender expression, national

origin, religion, age, disability, sexual orientation, color or veteran status is prohibited by HCC Policy G.1 Discrimination and Harassment and D.1.1 Equal Educational Opportunities. Any student who feels they have been discriminated against or harassed on the basis of race, sex, gender identity, gender expression, national origin, religion, age, disability, sexual orientation, color or veteran status including sexual harassment, has the opportunity to seek informal or formal resolution of the matter. All complaints/concerns should be directed to the Office of Institutional Equity, 713 718-8271 or oie@hccs.edu. Additional information may be obtained online. Visit http://www.hccs.edu/district/departments/institutionalequity/ Complaints involving sexual misconduct to include but not limited to: sexual assault, stalking, dating violence, sexual harassment or domestic violence should be directed to the HCC Title IX Coordinator, Renée Mack at 713 718-8272 or renee.mack@hccs.edu

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.

SUPPLIES & TOOLS LIST

1. Refrigeration Ratchet
2. 8” Adjustable Wrench
3. 10” Adjustable Wrench
4. Screwdriver: Phillips #2 with insulated handle
5. Screwdriver: Standard ¼ “Slotted blade with insulated handle
6. 8” Needle Nose Pliers with insulated handles
7. Wire Strippers with insulated handles
8. Wire Crimpers with insulated handles
9. OSHA approved Safety Glasses with side shields
10. 10” Slip joint pliers
11. Claw Hammer
12. Refrigeration manifold gauges to be used with R-22, R-134a, R-410a, and R-407
13. Quick Disconnect Refrigerant Hose Valves
14. Digital Pocket Thermometer
15. Flaring kit with block, tool
16. Tubing Cutter with reamer

17. Small tubing cutter (IMP)
18. Inspection Mirror
19. Swaging tool ¼”, ⅜”, ½”
20. Tool bag or box
21. 25’ measuring tape
22. Nut Driver ¼” x 7”
23. Nut Driver 5/16” x 7”
24. Small pocket knife
25. Electric VOM meter (Volt-Ohm)
26. Electric Clamp-On Ammeter