Eastfield College  
Career Technologies Division  
Fall Semester 2015  
HART 2449-41701  
HEAT PUMP

LEC Room: T101  
Time: 5:30pm – 8:00pm Mondays, Tuesdays and Wednesdays  
LAB Room: T106  
Time: 8:10pm – 10:40pm Mondays, Tuesdays and Wednesdays  
Instructor: Don Sutton  
Instructor Office: T147  
Office Hours: 3:00pm – 4:00pm M, 4:30pm – 5:30pm T, W, H, 11:00am – 12:00pm F  
Office Phone: 972-860-7674  
E-Mail: donsutton@dccc.edu  
Division Office: T143  
Division Phone: (972) 860-7143  
Class Schedule: Begins 11/11/15 Ends 12/16/15  
Drop Date: 12/09/15

**This syllabus is intended as a set of guidelines for this course. Eastfield College and your instructor reserves the right to make modification in content, schedule and requirements as necessary to promote the best education possible within prevailing conditions affecting the course.**

Course Description:

PREREQUISITES:
HART 1403 AC Control Principles and HART 1407 Principles of Refrigeration  
A study of heat pumps, heat pump control circuits, defrost controls, auxiliary heat, air flow, and other topics related to heat pump systems.  
(4 hr Lecture, 4 hr Lab., 4 Credit Hr.)

Textbook:
Refrigeration and Air Conditioning Technology; 7th Edition,  
By Whitman, Johnson, Silberstein and Tomczyk. Delmar Publishing

Developmental Courses:
The Texas Success Initiative (TSI) is a statewide program designed to ensure that students enrolled in Texas public colleges and universities have the basic academic skills needed to be successful in college-level course work. The TSI requires assessment, remediation (if necessary), and advising of students who attend a public college or university in the state of Texas. The program assesses a student’s basic academic skills in reading, writing, and math. Passing the assessment is a prerequisite for enrollment in many college-level classes such as English 1301/1302, History 1301/1302, Math 1414, etc. Students who do not meet assessment standards may complete prerequisite requirements by taking developmental courses in the deficient area and passing them with a grade of C or higher. In some cases, retesting will also be required. It is up to each student to be aware and informed about requirements that are subject to change. 

Additional information is available from the TSI Office. 
https://www1.dcccd.edu/cat0910/admiss/tsi.cfm?loc=4

End-of-Course Outcomes: Explain a reverse cycle system; list the mechanical and electrical components for the heat pump operation; and explain the operation of heat pump modes including cooling, heating, defrost, emergency heat, and auxiliary heat modes. Identify and explain different methods of accomplishing defrost; charge a system correctly in the heating and cooling mode; troubleshoot electrical and mechanical components; perform tests for adequate air flow; and determine balance point and coefficient of performance (C.O.P.); and define attributes of geothermal heat pump systems.

Student Learning Outcomes:
The student will explain a reverse cycle; list the mechanical and electrical components for the heat pump operation. Explain the operation of heat pump modes including; cooling, heating, defrost, emergency heat, and auxiliary heat mode. The student will identify and explain different methods of accomplishing defrost; charge a system correctly in the heating and cooling mode; troubleshoot electrical and mechanical components; perform tests for adequate air flow; and determine balance point and C.O.P. (coefficient of performance).

Modules:
1. Reverse Cycle System Operations
2. Electric Components and Controls
3. Supplemental Heat
4. Geothermal Systems
5. Wiring Diagrams
6. Indoor Air Quality
The following list of course goals will be addresses in the course. These goals are directly related to the performance objectives (Addendum A). (*designates a CRUCIAL goal)

1. display punctuality (Personal Qualities F13.4)
2. display cooperative attitude (Personal Qualities F15.4)
3. use safe habits (Resources C1.4)
4. use correct hand tools (Personal Qualities F13.4)
5. clean work area (Resources C3.4)
6. list heat pump components
7. list heat pump types
8. identify heat pump components
9. list heat pump types
10. describe heat pump supply air temperature
11. describe outdoor unit location
12. list ways defrost is initiated
13. list ways defrost is terminated
14. determine balance point
15. describe ground source heat pump operating
16. contrast cooling and heat pump metering devices
17. describe liquid filter-driers
18. contrast regular and heat pump thermostats
19. list changes while in defrost
20. test check valve operation
21. perform leak detection
22. check heat pump metering device operation
23. record pressure and temperature readings
24. analyze pressure and temperature readings
25. repair refrigerant leak
26. perform refrigerant recovery
27. check heat pump refrigerant charge
28. charge heat pump
29. perform performance test
30. draw heat pump ladder schematic
31. write heat pump sequence of operation
32. wire heat pump
33. repair electric connection
34. troubleshoot heat pump control circuit (Technology C20.4)
35. troubleshoot heat pump line voltage circuit (Technology C20.4)
36. troubleshoot defrost circuit (Technology C20.4)
37. troubleshoot heat pump compressor (Technology C20.4)
38. troubleshoot heat pump mechanical problems (Technology C20.4)
39. troubleshoot four way valve (Technology C20.4)
40. service heat pump
41. replace blower motor
42. replace relay
Course Evaluation:
Your final grade will be made up of these parts;

Daily work
Out of class assignment, 100 points
(Home work, pop quizzes, and other daily work) 100 points each.

Homework: You are expected to turn in the written assignments on time. All homework will have due date on Blackboard, and will not be accepted if it is late.

Lab work
Lab assignments, 100 points each
(Part of the lab grade will be how well you work as a team member in the lab and selection of tools to perform lab.)

Laboratory Work: You cannot work in the lab if you do not have your required tools. The list of required laboratory tools will be given out in the first class meeting. You are expected to have your tools by the beginning of the second week of class. The laboratory work sheets are due at the end of each laboratory assignment. You are to work with your laboratory partner, working on the assignment until both of you have completed the assignment.
Your instructor will retain all of your lab work until the week before an exam. After the lab work is returned to you, these lab assignments will not be accepted for grade. NO EXCEPTIONS.

Students will be removed from labs if they do not have their safety glasses. The campus bookstore and several off campus stores have safety glasses for sale.

Major Exams, 200 points each
Homework assignments, 100 points each
Final Exam, 300 points

Note: You must average 70% on the written final exam and lab final exam in order to receive a passing grade in this course.
**Exams:** The exams will cover material from the assigned chapters in your textbook, quizzes, handouts and other assigned material. The exam can include multiple choice questions, true/false questions, fill-in-the-blank and short essay questions. There will be no make-up exam unless arrangements have been made with the instructor before the exam date! All assignments will be given a due date and will not be accepted late without a penalty.

**Final:** It is comprehensive, covering some material from the first two tests. The final can include multiple choice questions, true/false questions, fill-in-the-blank and short essay questions.

*****Note: You are expected to be here for each exam (Lab Exam, Major Exams, and Final Exam). You cannot “make-up” exams unless you have made specific arrangements with me before the scheduled exam. You MUST be present at the scheduled time for the final exam.*****

**Quizzes:** There will be quizzes and in-class assignments throughout the semester, covering material from your textbook, lecture and handouts. These quizzes and assignments may be announced or unannounced. There will NOT be any make-up for these quizzes.

**Grade Breakdown:**

- 90 to 100 % of total possible points = A
- 80 to 89 % of total possible points = B
- 70 to 79 % of total possible points = C
- 60 to 69 % of total possible points = D
- Below 60 % of total possible points = F

**Obtaining Final Course Grades Using eConnect:**

Final Grade Reports are no longer mailed. Convenient access is available online at www.econnect.dcccd.edu. Use your identification number when you log onto eConnect, an online system developed by the DCCCD to provide you with timely information regarding your college record. Your grades will also be printed on your Student Advising Report, which is available in the Admissions Office.

**Eastfield College Email Policy:**

Faculty and students must have and use a DCCCD account for all correspondence relating to academic coursework. For information on setting up a DCCCD student email account go to: [https://www1.dcccd.edu/netmail/input_ssn.cfm](https://www1.dcccd.edu/netmail/input_ssn.cfm)
Course Outline:
*****This syllabus in intended as a set of guidelines for this course. Eastfield College and your instructor reserve the right to make modifications in content, schedule and requirements as necessary to promote the best education possible within prevailing conditions affecting the course.

1. Introduction – Safety
2. Basic Heat Pumps Theory.
3. Read before class 43.1 thru 43.8.
4. Read before class 43.9 thru 43.17.
5. Read before class, 43.18 thru 43.25. Answer questions on Blackboard.
6. Read before class, 43.26 thru 43.34. Answer questions on Blackboard.
8. Read before class 30.1 thru 30.15. Answer questions on Blackboard.
9. First major exam.
10. Read before class 44.1 thru 44.6. Answer questions on Blackboard.
11. Read before class 44.7 thru 44.11. Answer questions on Blackboard.
12. Read before class 34.1 thru 34.6. Answer questions on Blackboard.
13. Read before class 34.7 thru 34.12. Answer questions on Blackboard.
14. Handout on Wiring Diagrams for Heat Pumps
15. Continue working on Wiring Diagrams for Heat Pumps
16. Second major exam.
17. Handout on Heat Pump Installation and Start up.
18. Continue on handout on Heat Pump Installation and Start up.
19. Lab Exam. (MUST pass a minimum requirement, 70 %, in order to complete the HART 2449 course.)
20. Final Exam. (MUST pass a minimum requirement, 70 %, in order to complete the HART 2449 course.)

Attendance Policy:
You are expected to attend EACH CLASS MEETING, and you are expected to be here on time, prepared, with your book and materials. Please consult with me whenever an absence is necessary. If you miss a class, you are responsible to cover the missed material on your own. Have a classmate share notes with you and make sure you know about home work or other assignments due during the next class period.
Students who are receiving any form of financial aid should check with the Financial Aid Office prior to withdrawing from classes. Withdrawals may affect your eligibility to receive further aid and could cause you to be in a position of repayment for the current semester. Students who fail to attend or participate after the drop date are also subject to this policy.

Financial Aid Statement for Distance Learning Classes:
If you are receiving Financial Aid grants or loans and are enrolled in a Distance Learning class, you must show participation in this class prior to the certification date by either e-mailing or contacting the instructor or logging on to eCampus. Do not drop or stop attending any class without consulting the Financial Aid Office. Changes in your enrollment level and failing grades may require that you repay financial aid funds.

Repeating This Course: (Third Attempt to Enroll in a Course)
Effective for Fall Semester 2005, the Dallas County Community Colleges will charge additional tuition to students registering the third or subsequent time for a course. All third and subsequent attempts of the majority of credit and Continuing Education/Workforce Training courses will result in additional tuition to be charged. Developmental Studies and some other courses will not be charged a higher tuition rate. Third attempts include courses taken at any of the Dallas County Community Colleges since the Fall 2002 Semester. See Third Attempt to Enroll in a Course at: http://www.dcccd.edu/thirdcourseattempt/

Academic Honesty Statement
Scholastic dishonesty is a violation of the Code of Student Conduct. Scholastic dishonesty includes, but is not limited to, cheating on a test, plagiarism, and collusion.

As a college student, you are considered a responsible adult. Your enrollment indicates acceptance of the DCCCD Code of Student Conduct published in the DCCCD Catalog at http://www1.dcccd.edu/cat0506/ss/code.cfm

Academic dishonesty includes, but is not limited to, cheating on tests, plagiarism and collusion. Cheating includes copying from another student’s test or homework paper, using materials not authorized, collaborating with or seeking aid from another student during a test, knowingly using, buying, selling, stealing, or soliciting the contents of an unadministered test, and substituting for another person to take a test. Plagiarism is the appropriating, buying, receiving as a gift, or obtaining by any means another’s work and the unacknowledged submission or incorporation of it in
one’s own written work. **Collusion** is the unauthorized collaboration with another person in preparing written work for fulfillment of course requirements. Academic dishonesty is a serious offense in college. You can be given a failing grade on an assignment or test, can be failed for the class, or you can even be suspended from college.

**Food and Drink Policy:**
Food, drinks, and tobacco products are prohibited in Eastfield College classrooms. No electronic cigarettes in class room or lab.

**ADA Statement:**
Students with a physical, mental or learning disability who require accommodations should contact the college Disability Services Office in C237. Call 972.860.8348 or email efcdso@dcccd.edu. For more information: [http://www.eastfieldcollege.edu/SSI/DSO/index.html](http://www.eastfieldcollege.edu/SSI/DSO/index.html)

**Religious Holidays** Absences for observance of a religious holy day are excused. Notification of the absence must be given to the instructor in writing at least two weeks prior to the date of the holy day. A student whose absence is excused to observe a religious holy day is allowed to contract with the instructor to take a make-up examination or complete an assignment within at a mutually agreed upon time after the absence.

**Withdrawal Policy**
If you are unable to complete this course, it is your responsibility to formally withdraw by the drop date at the top of the page.

If you drop a class or withdraw from the college on or before the official drop/withdrawal deadline, you will receive a “W” (Withdraw) in each class dropped. Failure to complete and official withdrawal by the assigned date will result in your receiving a performance grade, usually an “F.”

For complete information on the drop requirements, policies and procedures, refer to the current online college catalog at [www.dcccd.edu](http://www1.dcccd.edu/catalog/ss/oep/dw.cfm?use_nav=acad_info&loc=ec)
STOP BEFORE YOU DROP
For students who enrolled in college level courses for the first time in the fall of 2007, Texas Education Code 51.907 limits the number of courses a student may drop. You may drop no more than 6 courses during your entire undergraduate career unless the drop qualifies as an exception. Your campus counseling/advising center will give you more information on the allowable exceptions. Remember that once you have accumulated 6 non-exempt drops, you cannot drop any other courses with a “W”. Therefore, please exercise caution when dropping courses in any Texas public institution of higher learning, including all seven of the Dallas County Community Colleges. For more information, you may access: https://www1.dcccd.edu/coursedrops

Family Educational Rights and Privacy Act of 1974 (FERPA)
In compliance with the Family Educational Rights and Privacy Act of 1974 (FERPA), the College may release information classified as “directory information” to the general public without the written consent of the student. Directory information includes: (1) student name, (2) student address, (3) telephone numbers, (4) date and place of birth, (5) weight and height of members of athletic teams, (6) participation in officially recognized activities and sports, (7) dates of attendance, (8) educational institution most recently attended, and (9) other similar information, including major field of student and degrees and awards received. Students may protect their directory information at any time during the academic year. If no request is filed, directory information is released upon written inquiry. No telephone inquiries are acknowledged. No transcript or academic record is released without written consent from the student, except as specified by law.

Classroom Etiquette:
The classroom serves as a learning environment for everybody participating in this class. To facilitate academic and personal growth for everyone, you are expected to be courteous and respectful toward the instructor and other students. While I encourage an informal and friendly classroom environment that facilitates discussion and exploration, we must still accommodate one another’s differing perspectives and opinions.

Each student must adhere to the Student Code of Conduct. The Student code of conduct was passed out to each student at the beginning of this class. The Student Code of Conduct can be found in the current Eastfield College Catalogue, or on the web site.

Ringing cell phones during the class period are a distraction. Unless it is an emergency call from a family member, all other cell phone calls are to be avoided. Family members and friends should be advised not to call during class time. If a
student continues to receive numerous cell phone calls during the class period, the instructor may request the cell phone be turned Off. A student that is on call by his/her company may answer cell phones in the classroom. The student will then remove themselves from the classroom for the conversation. All other calls are to be avoided. The instructor may amend this rule as he/she sees fit.

Voice mail and test messages can be retrieved during the break between class lecture and lab.

There will not be any profanity in the class room.

Hazardous Material:
You have the right to know that you may be working with, or in the presence of Hazardous Materials. A list of specific materials is posted on the “Green” Safety Bulletin Boards. Material safety Data sheets are available from the tool room. Students will be trained on the safe handling of these materials. The student will be asked to sign off on completion of Hazmat training.

Safety:
Safety is a must in our classes. You will be trained in safety and asked to sign off upon completion of the training.

The instructor reserves the right to amend this syllabus as necessary.

AIR CONDITIONING AND REFRIGERATION
Tool and Instruments list

Note: The supply and tool room does not have tools for student use.

The student must purchase tools within two weeks of the beginning of the first HVAC class.

GENERAL TOOLS:

- Safety glasses
- Leather gloves
- Tool box or pouch
BASIC INSTRUMENTS:

**Choose one of the following:**
Any multimeter that will measure: Volts, Amps, Ohms, Temperature and Capacitance.
Examples of these meters are the following:
- Fluke 116/322 HVAC Comb. Kit
- Fieldpiece SC76 or SC 77
- UEI DL 379 or DL 389
- Klein CL 200 (this meter will only check capacitance 0 -100 mfd)

REFRIGERANT TOOLS:

- Compound manifold gauge set with hoses and one 90° low loss fitting.
- Refrigerant valve core tool
- You will be required to purchase a second set of manifold gauges- this set will be used with refrigerant 410a ONLY.

HAND TOOLS:

- 8 in. and 12 in. adjustable open-end wrenches
- Allen wrench set
- Refrigeration ratchet wrench & adapter
- 6 “. combination pliers
- Wire cutter pliers
- Crimping pliers
- Six in one screwdriver
- Fire place lighter
- Insulated test/jumper leads with alligator clips

IN ADDITION THE FOLLOWING TOOLS WILL BE NEEDED FOR HART-2438:

- Ball peen hammer
- Laytex or vinyl gloves
- Cordless drill (with fully charged battery) and socket bits (1/4”, 5/16”, 3/8” and 7/16”)