Eastfield College Career Technologies

HART 1445-43701

GAS AND ELECTRIC HEATING

SPRING Semester 2015

Class: HART 1445-43701

Time: 5:45 PM to 8:00 PM Lecture, 8:10 PM to 10:25 PM Lab,

Monday, Tuesday, Wednesday, and Thursday

Instructor: Joe Dana

Dates: 01/20/15 – 02/18/15

Room: Lecture T105  Lab T104

E-Mail: joedana@dcccd.edu

Drop Date: 02/11/15

Division Office: 972-860-7143 (Leave Message)

TEXTBOOKS and Other Course Materials:

Refrigeration and Air Conditioning Technology; 7th Edition

By; Whitman, Johnson, Silberstein, and Tomczyk. Delmar Publishing


Guide to the NATE/ICE Certification Exams Third Edition

Robert Featherstone and Jesse Riojas.
This book is required for this course. Later in your studies in the Heat Pump course (HART 2449), you will be required to take the I.C.E. (Industry Competency Exam). This is an excellent study guide for this exam. ISBN-13:078-0-13-231970-6

COURSE DESCRIPTION:

A study of the procedures and principles used in serving heating systems including gas fired and electric furnaces.

(3hr Lecture, 3 hr. Lab., 4 Credit. Hr.)

COURSE OBJECTIVES:

The student will identify different types gas furnaces; identify and discuss component operation of gas furnaces; service and troubleshoot gas furnaces; perform safety inspections on gas and electric furnaces; identify unsafe operation of gas furnaces; identify and discuss component operation of electric furnaces; and service and troubleshoot electric furnaces.

PREREQUISITES: HART 1403 AC Control Principles and HART 1401 Principles of Electricity for HVAC

MODULES:

1. Safety
2. Heat Sources and Combustion
3. Gas Orifices, Burners and Flames
4. Heat Exchanger
5. Warm Air Systems and Heating Equipment
6. Gas-Fired Furnaces
7. Venting and Combustion Air
8. Electric Furnaces
9. Installation Procedures

STUDENT LEARNING OUTCOMES:
The following list of course goals will be addressed in this course. These goals are directly related to the performance objectives. (Addendum A)(*designates a CRUCIAL goal)

The student will be able to:

1. identify different types of gas furnaces
2. identify parts of a gas furnace
3. list basic controls of a gas furnace
4. list function of gas furnace components
5. identify different types of furnace blowers
6. change blower motor speed
7. state function of fan switch (BASIC SKILLS F2.4 & F6.4)
8. state function of limit switch (BASIC SKILLS F2.4 & F6.4)
9. state purpose of gas regulator (BASIC SKILLS F2.4 & F6.4)
10. describe operation of gas pressure regulator
11. identify different types of gas valves
12. list heating values of common fuel gases
13. light gas furnace
14. troubleshoot pilot thermocouple
15. replace pilot thermocouple
16. troubleshoot gas valve
17. identify different types of pilots
18. adjust pilot flame
19. function of solid state ignition system
20. function of hot surface ignition system
21. set heat anticipator
22. adjust fan switch
23. check limit switch operation
24. list fuel gases
25. list differences in fuel gases
26. list components necessary for combustion
27. describe perfect combustion
28. list reasons for incomplete combustion
29. name by-products of incomplete combustion
30. size gas line
31. leak test gas line
32. state gas line pressure
33. measure gas manifold pressure
34. adjust gas manifold pressure
35. identify different types of gas burners
36. adjust gas burner flame
37. clean gas burner
38. define burning speed
39. describe fuel-air mixture effect on burning speed
40. analyze gas burner flames (THINKING F9.4)
41. calculate gas flow rate
42. determine combustion efficiency
43. list factors for good vent design
44. test flue system
45. draw wiring schematic of gas furnace
46. wire gas furnace
47. list components of an electric furnace
48. test sequencer operation (BASIC SKILLS F4.4)
49. measure current flow of heating elements
50. determine heat output of heating element
51. install electric heating element
52. calculate air flow
53. test fusible link
54. draw wiring schematic of an electric furnace
55. wire an electric furnace
56. troubleshoot an electric furnace

End-of-Course Outcomes: Identify different types of gas furnaces; identify and discuss component operation of gas furnaces; service and troubleshoot gas furnaces; perform safety inspections on gas and electric heating systems; identify unsafe operation of gas furnaces; identify and discuss component operation of electric heating systems; and service and troubleshoot electric heating systems.
STUDENT CONTRIBUTIONS:

Attendance is critical in this class. Students should make every effort to be in class on time and prepared for class.

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., if you have an emergency call or you are on call from your company, you will take your conversation in the hallway as quietly as possible (Do Not Disrupt the Class).

There will be no cell phone conversations during class time and no texting.

The instructor reserves the right to assign seating.

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.

WRITING EXPECTATIONS:

In completing homework assignments and summary statements on labs, you must write in a complete legible sentence. The answer must also be written in a complete legible sentence. No abbreviations or short words. Turning in a homework paper that does not meet these standards will result in the paper being returned to you with a comment to “Redo”. If I am unable to read your handwriting you will be asked to type your assignments.

COURSE EVALUATION:
Your final grade will be made up of several parts:

Daily work  10 % total (Homework and pop quizzes) 5 % each.

Notebook 10 % (Notebook will be graded on organization and neatness.)  
(Information C6-4)

Lab work Lab assignments, 20%

(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.)  
(Interpersonal C9-4 Technology C18-5)

Lab Exams, 20 % total Will be 2 exams at 10 % each one for gas furnace and one for electric furnace.

Major Exams, 20 % total Will be 2 major exams 10 %, each

Final Exam, 20 %

Note:  You must average 70% on the written final exam and lab final exam in order to receive a passing grade in this course. The lab final will consist of drawing ladder diagram for gas furnace and electric furnace and wiring both.

**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 exams. The final can include multiple choice questions, true/false questions, fill-in-the-blank and short essay questions. It will also include wiring diagrams for gas and electric furnaces.

**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.

**Notebook:** The notebook will be a binder with tabbed sections (name of the section on the tab). There will be a cover sheet at the front. The notebook will contain – safety worksheet – all class work – all class notes – all handouts – all tests – all labs – and any project papers. The notebooks will be turned in at the beginning of class on the final exam or as directed.

**GRADE BREAKDOWN:**

100% to 90% = A  
89% to 80% = B  
79% to 70% = C  
69% to 60% = D  
59% or below = F

**COURSE POLICIES:**

**Attendance:** 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 homework or other assignments due during the next class. You are not allowed more than 2 unexcused absences without a points penalty, this will be deducted from your final grade.
**Preparation:** You are expected to do the reading assignment before you get to class. There are several advantages to such an effort by you. You will have read the material, and the class will not have to spend time bringing you up to where the rest of the class is.

**Daily Tests:** You must be present in class each day when a daily test or pop quiz is given. You cannot “make-up” any daily test or pop quiz.

**Major Tests:** You are expected to be here for each 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. Your major tests are taken on a scan-tron system you will not receive a copy of the test so do not ask for it or try to remove a copy from the testing room.

**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 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. If you miss a lab assignment you have 3 class days to make it up, if not turned in you will receive a grade of zero. **NO EXCEPTIONS**

Your instructor will return your lab work as needed.

**Safety Glasses:** Safety glasses are required in all HVAC lab classes where the student is working on operating equipment. Your instructor is charged with enforcing this policy.

All students will be issued a pair of safety glasses at the beginning of the beginning of their first year of class. The toolroom will not issue safety glasses to students after they receive their initial pair. 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 for those students who can’t keep up with theirs.
**Homework:** You are expected to turn in the written assignments on time. All homework is due at the beginning of the next scheduled class, and will not be accepted if it is late without a penalty.

Your instructor will retain all of your homework until the week before an exam. After the homework is returned to you, these homework assignments will not be accepted for grade. **NO EXCEPTIONS**

**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](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.

**FINANCIAL AID STUDENTS:**

If you are receiving Financial Aid grants or loans, you must begin attendance in all class. Do not drop or stop attending any class without contacting the financial Aid Office. Changes in your enrollment level and failing grades may require that you repay financial aid funds. Failure to contact the instructor will result in your name being submitted to the Financial Aid Office as a “non-attendee”. All students receiving financial aid must open an e-mail account through NetMail. See direction in the syllabus for opening an e-mail account.
ABSENCE FOR OBSERVATION OF HOLY DAYS:

Please notify me during the first days of the class, of any days you expect to be absent for religious observances. You will be allowed to make up work missed on these days. See me for the necessary forms.

ADA Statement

Students requiring accommodations due to the presence of a disability must identify themselves thirty days before the semester begins and demonstrate/document the need for accommodation at the Disability Services Office. For information regarding the rights and responsibilities of students with disabilities, contact the DSO at 972-860-8348. http://www.eastfieldcollege.edu/SSI/DSO/

EMERGENCY & INCLEMENT WEATHER PROCEDURE:

In case of emergency or inclement weather conditions, Eastfield students should listen to KEOM-FM Radio station (88.5) as the primary media source. In partnership with the Mesquite Independent school District, Eastfield College Administration will notify KEOM immediately after a decision is made to cancel classes on any given day of inclement weather or for emergency purposes. Students may also monitor other local radio and television stations. The earliest an announcement may be broadcast on KEOM Radio is 6 a.m. Students may also refer to the Eastfield College web page www.eastfieldcollege.edu for the Inclement Weather announcement under the Features area of the front page. The announcement will be posted immediately following the decision to close the college.

REPEATABILITY ISSUE

Pending legislative action and DCCCD Board approval, effective for the Fall Semester 2005, the Dallas County Community Colleges will charge a higher tuition rate to students registering the third or subsequent time for a course. All third and subsequent attempts of the of credit and Continuing education/Workforce Training courses will result in higher 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. For complete information and updates, go to http://www.dcccd.edu/ThirdCourseAttempt/.
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)

Obtaining Final Course Grades Using eConnect

Final Grade Reports are no longer mailed. Convenient access is available online at [www.econnect.dcccd.edu](http://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.

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 nonexempt drops, you cannot drop any courses with "W". Therefore, please exercise caution when dropping courses in any Texas public institution of higher learning, including all 7 of the Dallas County Community Colleges. For more information, you may access: [https://www1.dcccd.edu/coursedrops](https://www1.dcccd.edu/coursedrops)

Food and Drink Policy

Food, drinks, and tobacco products are prohibited in Eastfield College classrooms.

WITHDRAWAL POLICY

If you are unable to complete this course, it is your responsibility to withdraw formally. The withdrawal request must be received in the Registrar’s Office by 2/11/15. Failure to do so will result in your receiving a performance grade, usually an “F.”.

Dropping a Course or Withdrawing from College
Important information you need to know about dropping courses. Effective 2007, section 51.907 of the Texas Education Code applies to first-time freshman students who enroll in a Texas public institution of higher education in the fall semester of 2007 or thereafter. High school students currently enrolled in Dual Credit, Early College and Collegiate High School are waived from this requirement until they graduate from high school.

Based on this law, the college or any other Texas Public institution of higher education may not permit students to drop more than six college level credit courses for unacceptable reasons during their entire undergraduate career without penalty. All college-level courses dropped after the official drop and add period for the course are included in the six-course limit, including courses dropped at another Texas public institution of higher education, unless the student demonstrates to an appropriate college official that one of the following events occurred to the student during the semester or summer session:

1. A severe illness or other debilitating condition that affects the student's ability to satisfactorily complete the course.

2. The student's responsibility for the care of a sick, injured, or needy person if the provision of that care affects the student’s ability to satisfactorily complete the course.

3. The death of a person who is considered to be a member of the student's family or who is otherwise considered to have a sufficiently close relationship to the student that the person's death is considered to be a showing of good cause.

4. The active duty service as a member of the Texas National Guard or the armed forces of the United State of either the student or a person who is considered to be a member of the student's family or who is otherwise considered to have a sufficiently close relationship to the student that the person’s active military service is considered to be a showing of good cause.

5. The change of the student's work schedule that is beyond the control of the student, and that affects the student's ability to satisfactorily complete the course.

6. Other good cause as determined by the college official.
Contact your college’s Admissions/Registrar’s or counseling/advising office for further details related to exceptions or visit the FAQ’s on Facts about Dropping Classes at https://econnect.dcccd.edu/eConnect/droppingfacts.html

The Texas Higher Education Coordinating Board finalized its rules associated with this statute on October 25, 2007. Students affected by this law who plan to attend another institution of higher education should become familiar with that institution’s policies on dropping courses.

To drop a class or withdraw from the college, you must follow the prescribed procedure. It is your responsibility as a student to drop or withdraw. Failure to do so will result in your receiving a performance grade, usually a grade of "F".

You can drop or withdraw from classes in three ways:

1. In person

   Visit your college Admissions/Registrar’s Office at http://www.dcccd.edu/Why/Apply/Pages/AdmRegOff.aspx and complete a drop/withdrawal form.

2. Online

   Drop classes online through eConnect at https://econnect.dcccd.edu/eConnect/eConnect?TOKENIDX=8094075819&SS=LG
   RQ&APP=ST&URL=HTTPS%3A%2F%2Feconnect.dcccd.edu%3A443%2FeConnect%2FeConnect%3FTYPE%3DP%26PID%3DST-
   WESTS04C%26CONSTITUENCY%3DWBST&ERROR=Please+Log+In+before+accessing+Workflow+item+WESTS04C.&CONSTITUENCY=WBST . In certain instances you may not be able to drop online; you will have to drop in person.

   A drop/withdrawal request by any means must be received in the Admissions/Registrar’s Office by the official drop/withdrawal deadline as indicated on the Academic Calendar and the current class schedule. No drop or withdrawal requests are accepted by telephone or email.

   See Refund Policy for possible refund eligibility. Students who drop or withdraw should be aware of the course Repeat Policy.

INCOMPLETE S:

An incomplete grade of “I” may be given when an unforeseen emergency prevents you from completing the work in a course. The “I” must be converted to a performance grade (A-F) within 90 days after the first day in the subsequent regular semester. If the
work is not completed after 90 days, the “I” is converted to a performance grade, usually an “F”.

**PRINTING ON CAMPUS:**

Printing in the Computer Lab (L-108), Library, and Learning Assistance Center will cost 5 cents a page. Students must bring a $1.00, $5.00, $10.00, or $20.00 bill to the lab to create an account. Accounts must be created before attempting to print. No change is made in the lab. Once the money is in the bill acceptor, it cannot be retrieved. Cash refunds are not possible. Accounts stay active as long as the account has value.

**HAZARDOUS MATERIAL:**

All students in this class have the right to know that they 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 from the manufacturers are available in the Tool room or Tech room. Students will be trained and tested on the safe handling of these materials.

After taking training, student will asked to sign off on the training.

**Family Education Rights and Privacy Act of 1974 (FERPA)**

In compliance with the Family 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 information and sports, (7) dates of attendance, (8) educational institution most recently attended, and (9) other similar 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.

**Sexual Harassment:**
Eastfield College has a zero tolerance policy on sexual harassment. All students shall report complaints of sexual harassment to the college Human Resources Director or formally to the Vice Chancellor of Educational Affairs.

The instructor reserves the right to amend or modify this syllabus.

**Course Calendar for HART 1445**

**Residential Heating**

**HOMEWORK ASSIGNMENTS**

Answer "Review Questions" If there is a letter answer be sure to include that letter in your answer otherwise use complete sentences.

Assignment #1 Unit 31 Questions 1-15, 18, 19 and 20
Assignment #2 Unit 31 Questions 21-26, 30, 31, 33-40
Assignment #3 Unit 31 Questions 41-54. 59, 60, and 61
Assignment #4 Unit 30 Questions 1 thru 15

**TENTATIVE ASSIGNMENTS**

1. Introduction and Unit 31, 31.1 thru 31.5
2. Read before class Unit 31, 31.6 thru 31.14
3. Read before class Unit 31, 31.15 thru 31.20
4. Review for first test.
5. Read before class Unit 31, 31.21 thru to end
6. Continue Working on Unit 31
7. Lab Final (Gas Furnace)
8. Review and second test.
9. Read before class Unit 30, 30.1 thru 30.10
10. Read before class Unit 30, 30.11 thru to end of chapter
11. Continue Working on Unit 30
   Answer "Review Questions" at the end of the Unit 30
12. Lab Final (Electric Furnace)
13. Review for Final
14. Final Exam. (will be on electric furnace and gas furnace)

**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
- Latex or vinyl gloves
- Cordless drill (with fully charged battery) and socket bits (1/4", 5/16", 3/8" and 7/16")

Developed/Revised Dec. 12, 2013