

Refrigeration Fundamentals

Lecture

ACR100 (3 credit hours)

Class Schedule M/W 8:00am-9:15am Bld E Room 7E

Web-Enhanced (bowlinggreen.kctcs.edu)

Link "Blackboard" BGTC Web-page

Instructor:

Professor Lemuel B. Palmer
Office: Bldg. E, Room 7B
(270) 901-1030
lem.palmer@kctcs.edu

Office Hours:

Mon. – Wed. 9:30am- 10:30am
Tue- Thru. 1:15pm-3:30pm
Fri. 8:00-10:30 a.m.

BGTC Contact Person **Ron Baldwin** Applied Tech Division chair 901-1002

Course Description:

Introduces the fundamentals of refrigeration, refrigeration terms and the basic refrigeration cycle. Proper use of tools, test equipment, and materials is stressed. Environmental issues including refrigerant handling and discussed. Refrigerant piping and methods used to join them are taught. General and specific safety is emphasized.

Prerequisites: None **Co-Requisites:** Refrigeration Fundamentals Lab (ACR101)

Additional Course Requirements:

Students ***must pass an EPA certification test*** before completion of the course can be granted. (Note : Test can be repeated and cost \$60.00)

Textbooks/Supplies:

Refrigeration & Air Conditioning Technology 5TH Edition Whitman, Johnson, and Tomczyk
EPA Certification Exam Preparatory Manual. ESCO Institute.

Technology/Media Component: Internet, Computer Simulations

Drop/Add Policy: Refer to Student Handbook / [Spring 2008 Bulletin for times & dates](#)

Course Objectives:

- ◆ Match terms relating to basic mechanical refrigeration with their correct definitions.
- ◆ Match major refrigeration system components with their functions.

- ◆ Identify types of metering devices, condensers, evaporators, compressors, and their applications.
- ◆ Solve problems about system design and sensory troubleshooting.
- ◆ Solve problems about “no venting” regulations and complete a group of typical questions from a technician certification test.

Course Outline:

- I. Basic Refrigeration Cycle
 - A. parts of system cycle
 - B. design of systems
- II. Use of Refrigeration Tools, Test Equipment, and Materials
 - A. EPA Certification
 - B. Safe use of tools and test equipment

Course Competencies:

Upon completion of this course, the student can:

1. Practice/observe safety practices/techniques.
2. Explain the history of refrigeration.
3. Compare the benefits of closed vs. open system.
4. Identify and explain the operation of the four major components.
5. Identify the high and low sides of the system.
6. Define matter and heat.
7. Distinguish between the three states of matter.
8. Explain the direction and rate of heat flow.
9. Describe the three methods of heat transfer.
10. Identify the reference points of temperature: boiling point, freezing point, critical temperature, absolute zero.
11. Explain the difference between heat and temperature.
12. Explain the differences between latent and sensible heat.
13. Explain the relationship of pressures and fluids at different temperatures.
14. Calculate absolute and gauge pressures.
15. Measure absolute and gauge pressures.
16. Explain how fluids react in a closed vs. open system.
17. Compare temperature with pressure (P/Chart).
18. Explain why fluids flow.
19. Define the properties of refrigerants.
20. Explain the uses of different refrigerants.
21. Identify color coding of refrigerant cylinders.
22. Explain classifications of refrigerants.
23. List proper transfer and storage of refrigerants.
24. Explain the four parts of the refrigeration cycle.
25. Draw a refrigeration system on a pressure-enthalpy (Ph) chart.
26. Explain the benefits of superheat and sub cooling.
27. Identify the effects of improper refrigerant in a system.
28. Identify basic tools and accessories: various screwdrivers, nut drivers, socket wrenches, Allen (hex) wrenches, open & box end wrenches, flare wrench.
29. Identify power tools: general-purpose drills, power screwdriver, hammer drill, reciprocating saws, screw gun, etc.
30. Identify fasteners: bolts, screws, masonry anchors, various electrical connectors, conduit, pipe and cable clamps, nails, etc.
31. Identify pipe and tubing tools: pipe cutters, reamers and threaders, tubing cutters and reamers, benders, flaring tools, swaging tools, pipe vises, etc.
32. Describe lubrication methods utilizing: grease guns, oilers, sprays.
33. Measure pressures with the refrigeration gauge manifold.
34. Evacuate systems with a two stage vacuum pump.
35. Measure vacuums with a vacuum gauge.
36. Measure temperatures with thermometers.

37. Charge a system with an electronic charging scale.
38. Check for leaks with electronic leak detector, dye, and electrosonic leak detector.
39. Identify types of pipe and tubing used in refrigeration work.
40. Identify various types of fittings.
41. Describe methods of insulating pipe and tubing.
42. Identify soldering and brazing alloys used in HVACR.
43. Explain applications of soldering and brazing alloys.
44. Flare copper tubing.
45. Swag copper tubing.
46. Bend copper tubing.
47. Identify types of torches.
48. Solder and braze copper tubing.
49. Cut and thread iron pipe.
50. Describe heat sink methods.
51. Describe heat exchange techniques.
52. Explain saturation temperature.
53. Determine the METD (mean effective temperature difference).
54. Check for and repair refrigerant leaks.

WORK ETHICS POLICY

Work Ethics is an important part of our class as well as being a productive member of the workforce. Work Ethics include class participation, attendance, taking lecture notes, having pencil/pen/paper/textbook/CD/, having Scantron sheets and jump/memory stick, and having work completed on time.

Grading:

Exams/Quizzes--60%, Homework--20%, Workplace Readiness--20%
TOTAL--100%

Policies on Attendance and Late/Missed Work:

Students shall assume responsibility for regular attendance, completion of all assignments, completion of all examinations, and completion of required laboratory projects.

Students are expected to keep absenteeism to a minimum and may be asked for official written verification. The student shall notify the instructor of the absence(s) and the reason either before the absence(s) or as soon thereafter as possible. Such notification is the sole responsibility of the student.

Proper make-up work and completion of all course requirements will determine the grade of that student. Any requirements not completed will receive a grade "0".

If the absence is excused, then it is the student's responsibility to contact the instructor within three days for makeup. However, all makeup is at the discretion of the instructor.

Withdrawal Policy: It is the **student's responsible** to withdraw from the class. If a student "drops" the class without completing necessary paperwork, a grade of "E" will be awarded. (procedures dates and times in Bulletin information)

Withdrawal Policy: Through the midterm of the session, a student may officially withdraw from a course and receive a “W.” After this period, a student may officially request to withdraw from a course and receive a W which may be given at the discretion of the instructor. Each instructor shall state on the first or second class meeting the factors to be used in determining if a student will be allowed to withdraw during the discretionary period. The student must initiate the official withdrawal. Withdrawal from a course or courses is a serious decision and, in many cases, affects financial assistance and academic progress. In addition, withdrawal does not relieve students from their financial obligation. See the Spring 2008 Schedule of Classes for dates.

Financial Aid Statement: PELL, SEOG, and Student Loan recipients (Title IV) who stop attending or withdraw prior to the 60% point in the semester may be obligated to repay a portion of their financial aid.

KCTCS Code of Student Conduct: Kentucky Community and Technical College System (KCTCS) faculty and students are bound by principles of truth and honesty that are recognized as fundamental for a community of teachers and scholars. The College expects students and faculty to honor, and faculty to enforce, these academic principles. The College affirms that it will not tolerate academic dishonesty including, but not limited to, violation of academic rights of students and student offenses. Students may refer to the KCTCS Code of Student Conduct, www.kctcs.edu/student/code.htm, for more information on student rights, academic offenses, and the student’s right to appeal. Further information on student rights is available on the BGTC website under the Become a Student tab, Student Services. (<http://www.kctcs.edu/student/studentcodeofconduct.pdf>)

Safety/General:

- ◆ **No student will operate any equipment without having received safety information on that equipment.** It is the student’s responsibility to make sure he/she has had this instruction.
- ◆ All personal safety equipment is the responsibility of the student. The student will be asked to move to a safe area if all safety equipment is not available.
- ◆ Any student endangering the safety of another student will be asked to leave the class at that time. The student will be allowed to return to class the next period and disciplinary action will be taken.
- ◆ Students will not operate any machine or tool unless the instructor is present.
- ◆ Students are not allowed to operate a vehicle owned by KCTCS.

Research Project: **Students are required to submit either a power point presentation or a three-page essay concerning Basic Refrigeration.** The project will require use of three types of references. (Examples internet sites, Articles, Periodicals, and Journals. The project will be worth 5 % of your homework grade.

Web Assignment: Students are required to turn in the Research Project using their student email account with an attachment. The assignment is worth 5 % of your homework grade.

Plagiarism, cheating, Falsification or assisting in academic dishonesty can result in a “0” or removal from class

ACADEMIC POLICIES AND PROCEDURES

*(Referenced in the Rules of the Community College Senate, Section VII
and in the Rules of the Technical College Senate, Section VII)*

2.1 Academic Honesty Policy:

The KCTCS faculty and students are bound by principles of truth and honesty that are recognized as fundamental for a community of teachers and scholars. The college expects students and faculty to honor, and faculty to enforce, these academic principles. The college affirms that it will not tolerate academic dishonesty including, but not limited to, violation of academic rights of students (section 2.2) and student offenses (section 2.3).

A student can find information about academic rights and academic offenses and the student's right to appeal in the Kentucky Community and Technical College System CODE OF STUDENT CONDUCT, Revised June 2002.

2.2 Academic Rights of Students:

When a student believes any of the following six academic rights have been violated, he/she should refer to section 2.4.1.1 for information on the Student Appeals process.

2.2.1 Information about course content: A student has the right to be informed in reasonable detail in writing by the first or second class session, or in the introductory materials for a distance learning course, about the nature of the course and to expect the course to correspond generally to its official description.

2.2.2 Information about course grading criteria: A student has the right to be informed in writing by the first or second class session, or in the introductory materials for a distance learning course, about the criteria to be used in evaluating the student's performance, a course grading system that includes specific expectations with relative weights, and to expect that the grades described in the *KCTCS Catalog* will be used.

2.2.3 Contrary opinion: A student has the right to take reasoned exception to the data or views offered in the classroom and laboratory without being penalized. A student may appeal the fact of guilt for all three faculty sanctions listed in 2.3.2.1. Also, a student may appeal the severity of the sanction of a failing grade for the course.

2.2.4 Academic evaluation. A student has the right to receive a grade based only upon a fair and just evaluation of performance in the course as measured by the standards presented at the first or second class session or in the introductory materials for a distance learning course. Grades determined by anything other than the instructor's good-faith judgment based on such standards are improper. Among irrelevant considerations are race, color, religion, gender, disability, national origin, political affiliation, sexual orientation, or activities outside the classroom that are unrelated to the course work.

2.2.5 Academic records. A student has the right to have academic records kept confidential unless the student consents in writing to have them released. The chief executive officer or designee may disclose the academic record of a student without the student's consent to authorized college personnel if the information is required for official use, such as advising students, writing recommendations, or selecting candidates for honorary organizations.

2.2.6 Evaluation of student character and ability. A student has the right to have character and ability evaluated only by individuals with a personal knowledge of the student. Records containing information about a student's character and ability shall indicate when the information was provided, by whom, and the position of the individual providing the information.

KCTCS ACADEMIC OFFENSES

ACADEMIC DISHONESTY

PLAGIARISM: In accordance with the Kentucky Community and Technical College (KCTCS) Code of Conduct (Section 2.3.1.1) – “Plagiarism is the act of presenting ideas, words, or organization of a source, published or not, as if they were one's own. All quoted material must be in quotation marks, and all paraphrases, quotations, significant ideas, and organization must be acknowledged by some form of documentation acceptable to the instructor for the course.

Plagiarism also includes the practice of employing or allowing another person to alter or review the work that a student submits as the student's own. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual material is completed, it must be done by the student and the student alone. The use of the term “material” refers to work in any form including written, oral and electronic.

All academic work, written or otherwise, submitted by a student to an instructor or other academic supervisor, is expected to be the result of the student's own thought, research, or self-expression. In any case in which a student feels unsure about a question of plagiarism involving the student's work, the student must consult the instructor before submitting the work.”

CHEATING: In accordance with the Kentucky Community and Technical College (KCTCS) Code of Conduct (Section 2.3.1.2) – “Cheating includes buying, selling, stealing, or otherwise obtaining unauthorized copies of examinations or assignments for the purpose of improving one's academic standing. During examinations or in-class work, cheating includes having unauthorized information, and/or referring to unauthorized notes or other written or electronic information. In addition, copying from others, either during examination or in the preparation of homework assignments, is a form of cheating.”

STUDENT CO-RESPONSIBILITY: KCTCS Code of Conduct (Section 2.3.1.3) - “Anyone who knowingly assists in any form of academic dishonesty shall be considered as guilty as the student who accepts such assistance. Students should not allow their work to be copied or otherwise used by fellow students, nor should they sell or give unauthorized copies of examinations to other students.”

MISUSE OR STUDENT FALSIFICATION OF ACADEMIC RECORDS: KCTCS Code of Conduct (Section 2.3.1.4) – “The misuse or actual or attempted falsification, theft, misrepresentation, or other alteration of any official academic record of the college is a serious academic offense. As used in this context, “academic record” includes all paper and electronic versions of the partial or complete academic record.”

Information regarding Faculty Academic Sanctions is found in the KCTCS Code of Student Conduct, Section 2.3.2; Student Appeals and Responsibilities, Section 2.4. Student Discrimination Grievance Procedures are located in the Bowling Green Technical College Student Handbook.

Grievance Procedures: Located in Bowling Green Technical College Student Handbook

The Kentucky Community and Technical College System has zero tolerance for illegal discrimination of any kind. Any student who feels he/she may have been discriminated against or subjected to harassment by students or employees because of their race, color, national origin, sex, sexual orientation, marital status, religion, beliefs, political affiliation, veteran status, age, or disability (including denial of a request for an accommodation), has the

right to pursue an informal and/or formal discrimination grievance. The informal student discrimination grievance procedure is described below.

The chief student affairs officer or his/her designee shall be responsible for investigating student discrimination grievances. If appropriate, this shall be conducted in collaboration with the college human resources director. Each college shall provide a letter, statement, or poster containing information regarding the KCTCS Student Discrimination Grievance Procedure with the name, address, and phone number of the local chief student affairs officer.

Most difficulties can be resolved by talking to someone. Therefore, students are encouraged to discuss these problems promptly and candidly with the chief student affairs officer or his/her designee.

1. If a student thinks that he/she has been discriminated against, the student shall inform the chief student affairs officer or his/her designee with thirty (30) calendar days of the occurrence of the alleged incident. The chief student affairs officer or his/her designee shall conduct a preliminary investigation of the discrimination grievance.
2. The student, chief student affairs officer or his/her designee, and other involved parties shall work informally to negotiate a solution within fourteen (14) calendar days. The informal student discrimination grievance procedure shall be completed within forty-four (44) calendar days of the occurrence of the alleged incident.
3. If the grievance is not resolved to the satisfaction of the student through the informal grievance procedure, the student may file a formal appeal according to the *KCTCS Student Code of Conduct*.

Contact information: Dr. Bob Bohman, Chief Student Affairs Officer
Bowling Green Technical College
1845 Loop Drive
Bowling Green, Kentucky 42101
Telephone (270) 901-1114

ADA Statement/ Information

Students with disabilities Needing Accommodations

Bowling Green Technical College would like to help students with disabilities achieve their highest potential in college. If you need an accommodation because of a documented disability, you are required to register with Disability Services **each semester**. Contact Pam Bulle, Disability Services Coordinator at 901-1202. If you require assistance during an emergency evacuation, notify Disability Services immediately.