
HEATING, AIR CONDITIONING & REFRIGERATION TECHNOLOGY DEPARTMENT

COURSE SYLLABUS

COURSE NUMBER: **Hart 2342**

COURSE TITLE: **COMMERCIAL REFRIGERATION**

CREDITS: # (2 lectures, 3 labs)

PREREQUISITE / COREQUISITE: Hart 1301 & Hart 1303 & Hart 1307

COURSE DESCRIPTION

Theory of practical application in the maintenance of commercial refrigeration: high, medium, and low temperature applications and ice machines.

END-OF-COURSE-OUTCOMES

By studying this course, students will be able to:

- Discuss the various types of commercial refrigeration systems and their applications
- Define the high, medium, and low temperature applications
- Differentiate between the commercial refrigeration and industrial applications
- Identify mechanical refrigeration systems: R/I cooler, W/I cooler, Freezer, Display case
- Understand Vapor compression cycle
- Discuss TXV system
- Discuss the Capillary Tube systems
- Understand hermetic and semi hermetic compressor
- Understand the Mollier Diagrams
- Analyze refrigeration cycle to enhance troubleshooting skills
- Identify methods of temperature controls
- Read schematics for high, medium, and low temperature application
- Understand Defrost and temperature control in low temp unit
- Initiate the sequence of operation of freezer: refrigeration cycle, defrost cycle, Re-cooling cycle
- Practice service procedures for troubleshooting low temp applications
- Identify different types of ice makers

- Understand the operation of ice cubes and flaked ice
- Trace the water flow in ice machines and refrigeration cycle
- Practice preventive maintenance and service procedures

STUDENT LEARNING OUTCOMES

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SLO # 1	Given a mechanical refrigeration system major components and system pictorial diagram. Performance will be satisfactory; the student can differentiate between the high, medium, and low temperature applications by passing 80 % on the quiz assignments.
SLO # 2	Given a lab assignment along with demonstration, the student will analyze refrigeration cycle. Performance will be satisfactory; the student can interpret the thermodynamic properties of refrigerants in Mollier diagram by passing 80 % on the quiz assignments.
SLO # 3	Given a lab assignment along with lectures, the student will demonstrate the use of various measuring instruments and testing devices. Performance will be satisfactory when the student can operate the proper tools for servicing equipment by passing 80 % of accuracy on the practice.
SLO # 4	Given commercial refrigeration electrical circuit, the student will identify the type of temperature control in refrigeration systems. Performance will be satisfactory; the student can state the sequence of operation in refrigeration unit by using an electrical diagram and required passing 90 % of accuracy on the practice.
SLO # 5	Given a complex electrical diagram of ice maker, the student will analyze the electrical sequence. Performance will be satisfactory when the student state the sequence of operation for cooling mode, defrost mode, and Re-cooling mode by passing 90 % of accuracy on the practice.
SLO # 6	Given a service diagnostic chart, the student will list the possible cause and corrective actions associated to any service problems. Performance will be satisfactory when the student can give performance audit for each service problem by passing 100 % of accuracy on the practice

COURSE POLICIES

Attendance

Students are expected to attend classes regularly, and to be on time for every class period. Students can be dropped from a class due to excessive absences. Excessive tardiness may be considered absences. Students are responsible for subjects, assignments, and projects covered during their absences. Consult the ***Student Handbook*** for more details or visit <http://www.hccs.edu/hccs/current-students>.

Academic Honesty

Scholastic dishonesty is treated with the utmost seriousness by the instructor and the College. Academic dishonesty includes, but it is not limited to the willful attempt to misrepresent one's work, cheat, plagiarize, or impede other students' scholastic progress. Consult the ***Student Handbook*** for more details.

Students with Disabilities

The Disability Support Services Office (DSSO) assists students with physical, learning, or emotional disabilities in developing independence and self-reliance. Students with Disabilities are urged to contact the DSSO at least 30 to 60 days prior to the first day of class. The goal is to ensure that students with disabilities get off to a good start and have the support necessary for them to succeed. The DSSO are committed to compliance with the Americans with Disabilities Act (ADA) and Rehabilitation Act of 1973 (section 504).

Student can contact by phone at 713.718.6164 - TTY 713.718.6335. Fax 713.718.1468

Course Repeater Policy:

Beginning in the Fall 2006, students who repeat a course for a third or more times will face significant tuition/fee increases at HCC and other Texas public colleges and universities. Please ask your instructor and/or counselor about opportunities for tutoring/other assistance prior to considering course withdrawal or if you are not receiving passing grades.

Cell Phones

All cell phones must be muted, set to vibrate, or turned off during class. Cell phone activity during class is deemed disruptive to the academic process and will not be tolerated. If you need to make or receive an ***Emergency Call***, please leave the classroom.

Calculators

If the course allows the use of a calculator during class, lab projects, and exams, the student is responsible to bring his/her calculator. Cell phones are not calculators, and are not allowed to be used for that purpose during class, tests, or exams.

Student ID

Students are required to obtain a Student ID. For additional information, consult the ***Student Handbook***.

Parking Rules and Regulations

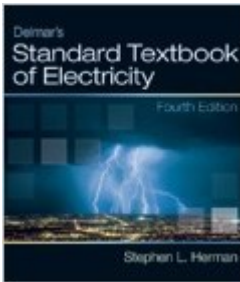
Students are required to follow HCC's regulations regarding parking and permits. For additional information, visit <http://www.hccs.edu/hccs/about-hcc/police/parking/parking-rules-and-regulations>

Books, Tools and Supplies

Students are required to purchase and bring to class the required textbooks, tools, notebooks, supplies, and writing instruments as required by the instructor.



By Bill Whitman; Bill Johnson; John Tomczyk; Eugene Silberstein
Publisher: Delmar
Edition: 6th Edition
Publication Date: 2009
ISBN: 13- 9781428319363



By Stephen Herman
Publisher: Delmar
Edition: 004
Publication Date: 2009
ISBN: 13: 9781418065805



Tool list is available to student during the first day of class meeting or find it at HCC Learning Web - Central

Campus listed by instructor name: Hoang N Do

Dress Code

Dress code must be appropriate for the class. Students must dress in a way that clothing and accessories do not compromise their safety, and the safety of others. Proper foot wear is required in all laboratories. Absolutely no sandals or other footwear that exposes the feet will be allowed.

Classroom & Laboratory Conduct

Proper behavior is expected in all classes and laboratories. Foul language and horseplay are not allowed. Making or receiving cell phone calls during class are not allowed. Sleeping in class is not allowed.

Course Withdrawal

It is the responsibility of the student to officially withdraw from a course before the official withdrawal deadline. A student who does not withdraw from a course by the deadline will receive an "F" as the final grade. Also note that under Section 51.907 of the Texas Education Code, an institution of higher education may not allow a student to drop more than six courses.

Student Evaluation Policies/Grading Scales:

<i>Class participation</i>	100	10 %
<i>Quiz (12 x 30)</i>	360	36 %
<i>Lab (6 x 40)</i>	240	24 %
<i>Midterm Examination</i>	150	15 %
<i>Final Examination</i>	150	15 %
<i>Total possible points =</i>	1000 pts	
<i>Percentage =</i>		100%

Grading Points

The percentage of total points that students achieve is converted to a letter grade as follow:

94% to 100%	=	4.00	A
87% to 93%	=	3.00	B
80% to 86%	=	2.00	C
73% to 79%	=	1.00	D
72% to below	=	0.0	F

COURSE OBJECTIVES / GOALS

Upon completion of this course, the student will able to:

- Week 1** Class orientation
- Week 2** Identify different mechanical refrigeration systems
- Week 3** Review Vapor Compression Cycle
- Week 4** Describe the operation of different types of metering devices
- Week 5** Explain the Mollier Diagram
- Week 6** Understand the operation of R/I cooler, freezer, and Walk in cooler/freezer

- Week 7** Explain electrical systems
- Week 8** Identify different methods of temperature control in low temperature applications
- Midterm examination**
- Week 9** Practice basic refrigeration system start-up, leak test, evacuation, and recharge
- Week 10** Practice the electrical sequence of Reach in cooler and freezer
- Week 11** Practice the electrical sequence of Walk in cooler and freezer
- Week 12** Understand different methods of defrost system
- Week 13** Describe Ice Makers
- Week 14** Explain electrical sequence and water flow of ice maker
- Week 15** Demonstrate service and troubleshooting ice Makers
- Week 16** Review service diagnostic chart and develop troubleshooting skills
- Final Exam**
- Instructor evaluation by using [online survey](#)
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COURSE OUTLINE, CONTENT GOALS & ACTIVITIES

COURSES OUTLINE – GOALS & ACTIVITIES

Week 1 Class orientation

- Syllabus requirements and Assignments
- Course description and Learning Outcomes
- Required Textbooks and Tools
- Class attendance and grading scales
- Advising student about HVAC degree plan

Week 2 Identify different mechanical refrigeration systems

- Understand the difference between high, medium, and low temperature applications
- List the components in commercial refrigeration applications
- State the essential components of the vapor compression system
- Discuss the operation of each component

- Define the superheat and the sub cooling conditions of refrigerants by using T/P chart
- **Quiz 01**
- **Lab - 01**

Week 3 Review Vapor Compression Cycle

- Define four major components of Vapor Compression Cycle
- Describe the operation of each major component
- Understand the operation of accessory components
- Differentiate the difference between air conditioning unit and commercial refrigeration unit
- **Quiz 02**

Week 4 Describe the operation of different types of metering devices

- Define a metering devices
- Explain the operation of capillary tubing device
- Explain the operation of AEV device
- Explain the TXV device
- Differentiate the internal TXV and external TXV operation
- Understand the relationship of superheat and TXV for a variety of refrigeration applications
- Understand the limit of thermostat and pressure switch relating to metering devices
- Review troubleshooting service chart of TXV
- **Quiz 03**
- **Lab - 02**

Week 5 Explain the Mollier Diagram

- Define the Mollier diagram or pressure enthalpy diagram
- Understand the term related to diagram
- Define the saturated vapor and saturated liquid
- Define the critical temperature
- Understand the flash gas conditions of refrigeration applications
- Analyze a refrigeration cycle by using the pressure enthalpy diagram
- Understand the effect of high or low discharge pressure
- Understand the effect of high or low suction pressure
- Understand the effect of excess refrigerant in refrigeration unit

- Analyze the Mollier diagram for different metering devices and understand its effect

- **Quiz 04**

Week 6 Understand the operation of R/I cooler, freezer, and Walk in cooler/freezer

- Explain the difference between commercial R/I cooler and domestic refrigerator
- State the refrigeration circuit of cooler
- Identify components of a cooler and a freezer
- State electrical operation of a cooler and freezer
- Demonstrate the service troubleshooting chart
- Analyze the service problem

- **Quiz 05**

Week 7 Explain electrical systems

- Define basic instruments using in refrigeration application for measuring data
- Explain schematic wiring diagram for commercial cooler and freezer
- Understand the operation of thermostat and pressure controls
- Explain defrost timer operation and defrost thermostat settings
- Identify two different methods for defrost system
- Explain the defrost systems: hot gas defrost and electric defrost

- **Quiz 06**

- **Lab - 03**

Week 8 Identify different methods of temperature control in low temperature applications

- Discuss the different types of temperature controls
- Understand the process how to control refrigeration temperature
- List all methods of temperature control in refrigeration applications
- Practice schematic wiring diagrams for different temperature controls
- Identify temperature control by studying a system's wiring schematic

- **Mid term examination**

Week 9 Practice basic refrigeration system start-up, leak test, evacuation, and recharge

- Explain the pre start visual inspection
- Analyze the performance audit to current system condition
- Practice three basic leak testing: timed or 1 hr method, triple evacuation, and a micron evacuation

- Understand the charging process for refrigeration unit
- Understand the temperature difference (TD) and the Split in evaporator
- **Quiz 07**
- **Lab - 04**

Week 10 Practice the electrical sequence of Reach in cooler and freezer

- Identify an energized circuit of a cooler and freezer
- Connect the proper electrical instrument to measure ohm reading, voltage, and amperage
- List the proper sequence how to use a specific instrument to record Volt/Ohm/Amp
- Study schematic wiring diagram for troubleshooting electrical problems
- **Quiz 08**
- **Lab - 05**

Week 11 Practice the electrical sequence of Walk in cooler and freezer

- Discuss the electrical sequence of walk in cooler and freezer
- Differentiate the difference between w/l cooler diagram and w/l freezer diagram
- Discuss temperature control of a cooler
- Discuss temperature control of a freezer
- Practice wiring diagrams
- **Quiz 09**

Week 12 Understand different methods of defrost system

- Define two different methods of defrost system
- Explain electric defrost system
- Explain a hot gas defrost system
- Demonstrate the use of defrost system for different refrigeration system
- Interpret the sequence of operation
- Practice wiring diagrams
- Demonstrate a service troubleshooting chart for locating a cause and effect
- Analyze the system performance
- **Lab - 06**
- **Quiz 10**

Week 13 Describe Ice Makers

- Describe the operation of flake and cube ice makers
- Explain how the ice maker operates
- Demonstrate a systematic inspection procedures to locate service problems
- Explain the ice maker capacity and its performance
- Understand three subsystems combined in ice machine: water, refrigerant, electrical
- Demonstrate the water system of ice machine
- Explain the refrigerant circuit of ice machine
- Interpret the sequence of operation in ice machine: pre-cooling, harvest, re-cooling
- Analyze each sequence operation

Week 14 Explain electrical sequence and water flow of ice maker

- Practice water flow problems in ice machine
- Practice electrical problems in cooling, harvest, and re-cooling
- Interpret and read manufacturer's wiring diagrams
- **Quiz 11**

Week 15 Demonstrate service and troubleshooting ice Makers

- Demonstrate a service troubleshooting chart for different ice makers
- List a common problems associated to ice machines
- Analyze a service chart to determine the cause and effect
- **Quiz 12**

Week 16 Review service diagnostic chart and develop troubleshooting skills

- Review a service chart
- Develop a common procedure to troubleshooting ice machines
- Analyze each task and duty to audit ice machine performance
- **Final examination**
- Instructor evaluation by using **online survey**

The End