

JEFFERSON COLLEGE
COURSE SYLLABUS

HRA249
COMMERCIAL REFRIGERATION SYSTEMS
5 Credit Hours

Prepared by
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November 30, 2010

Revised by
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April 25, 2012

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HRA249 Commercial Refrigeration Systems

I. CATALOGUE DESCRIPTION

- A. Prerequisite: HRA101 Electricity for HVAC, HRA105 Principles of Refrigeration, EPA Certification (acquired on own or through HRA125 Refrigeration and Air Conditioning Mechanical Systems class), and Reading Proficiency
- B. 5 Credit Hours
- C. Commercial Refrigeration will cover large and small commercial applications including high pressure systems, low pressure systems, lithium bromide systems, and ammonia systems (F,S)

II. EXPECTED LEARNING OUTCOMES/ ASSESSMENT MEASURE

Students will identify purposes and operation of commercial controls	Quizzes and Lab
Students will assemble a commercial refrigeration system and its component parts	Quizzes and Lab projects
Students will troubleshoot and identify multiple evaporator systems	Quizzes and Lab
Students will explain operation of cooling towers and pumps and how to service these systems	Quizzes
Students will explain principles of lithium bromide and ammonia systems	Quizzes and Exams
Students will troubleshoot and service commercial refrigeration systems	Quizzes and Labs

III. OUTLINE OF TOPICS

- A. High pressure, low pressure, and absorption chilled water systems
 - 1. Chillers
 - 2. Compression cycle chillers
 - 3. Reciprocating compressor chillers
 - 4. Cylinder unloading and variable frequency drives
 - 5. Scroll compressor chillers
 - 6. Rotary screw compressor chillers
 - 7. Centrifugal compressor chillers
 - 8. Evaporators for high pressure chillers

9. Direct expansion evaporators
10. Flooded evaporator chillers
11. Condensers for high pressure chillers
12. Water cooled condensers
13. Condenser subcooling
14. Air cooled condensers
15. Subcooling circuits
16. Metering devices for high pressure chillers
17. Thermostatic expansion valves
18. Orifice
19. Float type metering device
20. Electronic expansion device
21. Low pressure chillers
22. Compressors
23. Condensers for low pressure chillers
24. Metering devices for low pressure chillers
25. Purge units
26. Absorption air conditioning chillers
27. Solution strength
28. Solutions inside the absorption unit
29. Circulating pumps for absorption units
30. Capacity control
31. Crystallization
32. Purge systems
33. Absorption system heat exchangers
34. Direct fired systems
35. Motors and drives for compression cycle chillers
36. Part winding start
37. Autotransformer start
38. Wye-delta
39. Electronic starters
40. Motor protection
41. Load limiting devices
42. Mechanical-electrical motor overload protection
43. Electronic solid state overload device protection
44. Anti-Recycle control
45. Phase failure protection
46. Voltage unbalance
47. Phase rehearsal

- B. Cooling towers and pumps
 - 1. Cooling tower function
 - 2. Types of cooling towers
 - 3. Fire protection
 - 4. Fill material
 - 5. Flow patterns
 - 6. Tower materials
 - 7. Fan section
 - 8. Tower access
 - 9. Tower sump
 - 10. Makeup water
 - 11. Blowdown
 - 12. Water pumps

- C. Operation, maintenance, and troubleshooting chilled water systems
 - 1. Chiller startup
 - 2. Scroll chiller startup
 - 3. Reciprocating chiller startup
 - 4. Rotary screw chiller startup
 - 5. Valves for large systems
 - 6. Centrifugal chiller startup
 - 7. Scroll and reciprocation chiller startup
 - 8. Large positive displacement chiller operation
 - 9. Centrifugal chiller operation
 - 10. Air cooled chiller maintenance
 - 11. Water cooled chiller maintenance
 - 12. Absorption chiller system startup
 - 13. Absorption chiller operation and maintenance
 - 14. General maintenance for all chillers
 - 15. Low pressure chillers
 - 16. Recovering refrigerant from a low pressure chillers
 - 17. High pressure chillers
 - 18. Refrigerant safety
 - 19. Service technician calls

- D. Ammonia system
 - 1. Generators
 - a) Gas
 - b) Electric
 - 2. Evaporators
 - a) Air conditioners
 - b) Refrigerators
 - c) Small appliances
 - 3. Secondary refrigerants
 - a) Freeze protection
 - b) Pumps
 - c) Circulation systems
 - 4. Condensers
 - a) Natural draft
 - b) Forced draft
 - 5. System maintenance
 - a) Charging
 - b) Purging
 - c) Mixing refrigerants

IV. METHOD(S) OF INSTRUCTION

- A. Lecture
- B. Labs
- C. Videos
- D. Demonstrations

V. REQUIRED TEXTBOOK(S)

Whitman, William C. *Refrigeration & Air Conditioning Technology*. (Current Edition). Clifton Park, NY: Delmar Cengage Learning.

VI. REQUIRED MATERIALS

HRA tool kit - Estimated Total Cost - \$420 (purchased through the HRA Department)

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHOD OF EVALUATION

A.	Exams	50%
B.	Quizzes	10%
C.	Labs	40%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website, <http://www.jeffco.edu>).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.