JEFFERSON COLLEGE
COURSE SYLLABUS

HRA 249
COMMERCIAL REFRIGERATION SYSTEMS
5 Credit Hours

Prepared by:
William Kaune
November 30, 2010

Updated by:
William Kaune
April 25, 2012

Career & Technical Education
Dena McCaffrey, Ed.D., Interim Dean
Mary Beth Ottinger, Ph.D., Division Chair
HRA 249 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

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

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. METHODS OF INSTRUCTION

A. Lecture

B. Labs

C. Videos

D. Demonstrations

V. REQUIRED TEXTBOOK(S)


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 (Library; phone 636-797-3000, ext. 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.ecu/jeffco/index.php?option=com_weblinks&catid=26&Itemid=84)