Air-Conditioning, Refrigeration and Heating Technology
Syllabus
2013-2014

Instructor Name: Hugh McCombs
Department Name: Instructional
Office/Classroom Location: 102 Barge Port
Phone Number: 386-329-3931
Email Address: Hugh.Mccombs@fctc.edu

Instructor Office/Testing Hours:
Monday - Thursday  10:00 am – 11:00 am
1:30pm –  2:30pm

Student Hours:
Monday, Tuesday
Morning Session  6:40am – 11:00am
Lunch            11:00am – 11:40pm
Afternoon Session 11:40pm – 3:30pm

Wednesday
Morning Session  8:30am – 11:00am
Lunch            11:00am – 11:40pm
Afternoon Session 11:40pm – 3:40pm

Thursday
Morning Session  6:40am – 11:00am
Lunch            11:00am – 11:40pm
Afternoon Session 11:40pm – 2:30pm

Program Hours:
• OCP A ( ACR0041 ), 250 hrs
• OCP B ( ACR0043 ), 250 hrs
• OCP C ( ACR0047 ), 250 hrs
• OCP A ( ACR0049 ), 250 hrs
• OCP B ( ACR0044 ), 350 hrs

Program Description:
The purpose of this program is to prepare students for employment or advanced training in the heating, air-conditioning (A/C), and refrigeration and ventilation industry. This program prepares students for employment as A/C, Refrigeration and Heating Helper, A/C, Refrigeration and Heating Mechanic Assistant, A/C, Refrigeration and Heating Mechanic, A/C, Refrigeration and Heating Technician, and Refrigeration Technician (SOC 49-9021).

The student should obtain EPA certification prior to leaving school in order to be employed in any job that requires work with refrigerants.

This program focuses on broad, transferable skills, stresses the understanding of the heating, air-conditioning, refrigeration and ventilation industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, the underlying principles of technology, and health, safety, and environmental issues.

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Architecture and Construction career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Architecture and Construction career cluster.

Updated: 7/23/13
Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points. The recommended sequence allows students to complete specified portions of the program for employment or to remain for advanced training. A student who completes the applicable competencies at any exit occupational completion point may either continue with the training program or terminate as an occupational completer.

Classroom Protocol:
To Apply Yourself at First Coast Technical College we encourage you to plan with the end in mind. Be a self-advocate, an active learner and embrace your changing paradigm. This course will provide you with a set of technical competencies organized to distinguish your career objectives. Come to class on time and prepared; remain ready to focus while exhibiting productive behaviors prescribed for mature learning environments. Please respect all classmates, instructors, and FCTC facilities. Take responsibility for your education and let FCTC navigate you to your professional goals.

College Policies, Student Attendance:
FCTC encourages and expects all students enrolled in programs to attend regularly, to derive maximum benefit from the instructional program, and develop habits of punctuality, self-discipline and responsibility. It is the student's responsibility to understand and adhere to the attendance rules. Students are expected to telephone the instructor when absent.

- **After three (3) absences** during the nine weeks, the instructor will meet with the student, address the situation and start the appropriate student attendance referral.
- **After four (4) absences** during the nine weeks, the student will receive intervention counseling from the teacher documented on the student attendance referral.
- **After five (5) absences** during the nine weeks, the teacher will complete the student attendance referral and send to the Discipline Coordinator for a preliminary meeting.
- **After six (6) absences** during the nine weeks, students will be referred to the Discipline Committee for withdrawal determination.
- **(6) Consecutive absences** will be an automatic drop from the program. Students will not be re-enrolled for a period of 45 days unless approved by the Discipline Committee.

Required Book(s):
- Refrigeration and Air Conditioning Technology 7th ISBN13: 97811111644475
- HVACR Electrical Systems Student Workbook Item 400642 ISBN13: 9788888897202

Required Material(s):
- * AUDIO HEAD PHONES 1
- * SAFETY GLASSES 1
- ADJ. WRENCH 10" 1
- ADJ. WRENCH 6" 1
- CHANNEL LOCK PLIERS 1
- DIAGONAL CUT PLIERS 1
- FLASHLIGHT 1
- INSPECTION MIRROR 1
- LOCKING PLIERS 1
- MULTIMETER W/CAPACITANCE 1
- NEEDLE NOSE PLIERS 1
- PADLOCK COMBINATION 1
- PIPE / TUBING CUTTER 1
- SCREWDRIVER 6-IN-1 1
- THERMOMETER PROBE 1
- TOOL BAG 1
College Policies, Academic Integrity:
Your commitment as a student to learning is evidenced by your enrollment at First Coast Technical College. Faculty members are required to report all infractions to their supervisor. Instances of academic dishonesty will not be tolerated. Cheating on exams, student activities or plagiarism will result in failing grade and sanctions by the College.

According to the Center for Academic Integrity there are five fundamental values that characterize an academic community of integrity:

- **Honesty.** The quest for truth and knowledge requires intellectual and personal honesty in learning, teaching, research and service.
- **Trust.** Academic institutions must foster a climate of mutual trust in order to stimulate the free exchange of ideas.
- **Fairness.** All interactions among students, faculty and administrators should be grounded in clear standards, practices and procedures.
- **Respect.** Learning is acknowledged as a participatory process, and a wide range of opinions and ideas is respected.
- **Responsibility.** A thriving community demands personal accountability on the part of all members and depends upon action in the face of wrongdoing.

Student Learning Outline:

<table>
<thead>
<tr>
<th>Week</th>
<th>DOE Standard</th>
<th>Activities</th>
</tr>
</thead>
</table>
| 1    | • 04.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.  
• 01.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. | • Research local HVAC/R companies and educational requirements for employment.  
• Identify and use appropriate fire extinguishers and other such safety devices. |
|      | • 02-0 Identify, use, and maintain the tools and tool accessories used in the heating, air-conditioning, and refrigeration industry.  
• 03-0 Demonstrate mathematics knowledge and skills. | • Identify and use basic hand tools and tool accessories, power tools pipe and tube-working tools of the trade, specialized tools of the trade.  
• Math and Measurements 1-18 to analyze and apply data and measurements to solve problems. |

Updated: 7/23/13
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</thead>
<tbody>
<tr>
<td>1</td>
<td>17.0 Describe the history and</td>
<td>Read The History of HVAC-R &amp;</td>
</tr>
<tr>
<td></td>
<td>06-0 Troubleshoot heating, air-conditioning, and refrigeration electrical control systems and their components.</td>
<td></td>
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<tr>
<td>4</td>
<td>07-0 Select and test electrical generation and distribution components for commercial heating and air conditioning systems.</td>
<td>Read Unit 13 Automatic Controls Labs – Draw Transformers Read Unit 14 Automatic Controls &amp; Applications</td>
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<tr>
<td></td>
<td>10-0 Operate solid-state electronics as used in heating, air-conditioning, and refrigeration systems.</td>
<td></td>
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<tr>
<td>5</td>
<td>12-0 Explain the function of basic electronics.</td>
<td>Read Unit 15 Controls Labs – A/C circuit evaluation Read Unit 17 Electric Motors Solve motor problems Install motor start kits and other start components.</td>
</tr>
<tr>
<td></td>
<td>08-0 Maintain, test, and troubleshoot electrical motors and their components for commercial heating and air conditioning systems.</td>
<td>Identify Power supply and determine voltage.</td>
</tr>
<tr>
<td>6</td>
<td>11.0 Evaluate single-phase and three-phase power as used in heating, air-conditioning, and refrigeration systems.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>09-0 Troubleshoot and wire electrical motors and their components.</td>
<td>Read Unit 18 Application of Electrical Motors. Wire Single and Dual voltage motors and equipment View GTEC Videos</td>
</tr>
<tr>
<td></td>
<td>14.0 Use information technology tools.</td>
<td></td>
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<tr>
<td>8</td>
<td>13.0 Demonstrate language arts knowledge and skills.</td>
<td>Draw Ladder diagrams and label. Computer Lab. SMS Electrical Troubleshooting Program</td>
</tr>
<tr>
<td></td>
<td>15.0 Solve problems using critical thinking skills, creativity and innovation.</td>
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</tbody>
</table>

*Time frame based on a full time adult student enrolled for 30 hours.*
|  | concepts of heating, air-conditioning, and refrigeration.  
18.0 Demonstrate science knowledge and skills. | Report Summary.  
• Read Unit 1 Heat and Pressure.  
• Unit I Lab activity |
|---|---|---|
| 2 | 19.0 Explain the properties of matter and heat behavior.  
16.0 Read construction documents. | Read Unit 2 Matter & Energy.  
• Unit 2 Lab activity  
• GTAC Video 2 -4 |
| 3 | 23.0 Demonstrate personal money-management concepts, procedures, and strategies. | Unit 6 Assignments 1 - 8 |
| 4 | 27.0 Fabricate and service the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry. | Read Unit 7 Tubing & Piping  
• Lab activity Fabricate Tubing project. |
| 5 | 26.0 Maintain, test, and troubleshoot commercial evaporators.  
30.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems and the larger environment. | Read Unit 21 Evaporators  
• Develop team structure.  
• Lab activity – Team-up and evaluate evaporator functions. |
| 6 | 29.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.  
25.0 Test and adjust commercial evaporative condensers. | Lab Team Roles & Goals  
• Read Unit 22 Condensers  
• Lab activity – Team-up and evaluate condenser functions. |
| 7 | 22.0 Describe the importance of professional ethics and legal responsibilities.  
24.0 Select appropriate commercial compressors. | Focus Internet Activity & summery  
• Read Unit 23 Compressors  
• Lab activity Compressor Functions |
| 8 | 21.0 Evaluate heating, air-conditioning, and refrigeration system components and accessories.  
28.0 Explain the importance of employability and entrepreneurship skills.  
• Analyze fluids, pressures, refrigerants, and related codes. | Read Unit 24 Expansion Devices  
• Lab activity evaluate TXV  
• Read Unit 15 EPA Testing  
• Lab activity Refrigeration Color code Identification/pressure/temperature. |
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<tr>
<th>Week</th>
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<th>Activities</th>
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</thead>
</table>
| 1    | 31.0 Identify basic principles of heating, air conditioning, refrigeration and ventilation piping sizing. | • Read Unit 16 Direct digital controls.  
• Read Unit 25 Special controls.  
• Read Unit 39 Controls. |
| 2    | 36.0 Interpret, use and modify construction drawings and specifications. | • Lab activity - System designs. |
| 3    | 35.0 Demonstrate a working knowledge of refrigerants and oils. | • Read Unit 9 Recovery, Recycling and Reclaim.  
• Read Unit 10 System Charging  
• Lab activities - System charging |
| 4    | 32.0 Utilize and operate mechanical refrigeration servicing and testing equipment. | • Read Unit 41 System Troubleshooting  
• Lab activity - Troubleshoot the major system components. |
| 5    | 34.0 Conduct start-up and check-out procedures for mechanical heating and air-conditioning systems. | • Read Unit 21 Evaporators  
• Develop team structure.  
• Lab activity – Team-up and evaluate evaporator functions. |
| 6    | 29.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.  
• 25.0 Test and adjust commercial evaporative condensers. | • Lab Team Roles & Goals  
• Read Unit 22 Condensers  
• Lab activity – Team-up and evaluate condenser functions. |
| 7    | 22.0 Describe the importance of professional ethics and legal responsibilities.  
• 24.0 Select appropriate commercial compressors. | • Focus Internet Activity & summery  
• Read Unit 23 Compressors  
• Lab activity - Compressor Functions |
| 8    | 21.0 Evaluate heating, air-conditioning, and refrigeration system components and accessories.  
• 28.0 Explain the importance of employability and entrepreneurship skills.  
• Analyze fluids, pressures, refrigerants, and related codes. | • Read Unit 24 Expansion Devices  
• Lab activity evaluate TXV  
• Read Unit 15 EPA Testing  
• Lab activity - Refrig. Color code identification/pressure/temperature. |
### Adult Student Outline --- ACR0049

<table>
<thead>
<tr>
<th>Week</th>
<th>DOE Standard</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.</td>
<td>• Read Units 31 Gas Heat&lt;br&gt;• Unit 31 Lab activities Gas furnace&lt;br&gt;• Read Unit 9C &amp; 10C Gas Fired Furnaces</td>
</tr>
<tr>
<td></td>
<td>.</td>
<td>• Read Unit 9C &amp; 10C Gas Fired Furnaces&lt;br&gt;• SMS Gas Furnace Simulator</td>
</tr>
<tr>
<td>2</td>
<td>.</td>
<td>• Read Unit 43 Air Source Heat Pumps&lt;br&gt;• Lab activities – Evaluate &amp; Test Systems performance.</td>
</tr>
<tr>
<td></td>
<td>.</td>
<td>• Read Unit 28 Special Refrigeration Applications&lt;br&gt;• Lab activity Inspect and evaluate installations.</td>
</tr>
<tr>
<td>3</td>
<td>.</td>
<td>• Read Unit 16 Introduction to Hydronics&lt;br&gt;• Lab activity - Design and layout steam heating system.</td>
</tr>
</tbody>
</table>

### Adult Student Outline --- ACR0044

<table>
<thead>
<tr>
<th>Week</th>
<th>DOE Standard</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.</td>
<td>• Read Unit 35 Installation Controls.</td>
</tr>
<tr>
<td>2</td>
<td>.</td>
<td>• Lab activity – Identify HVAC-R control systems</td>
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<tr>
<td>3</td>
<td><strong>10.0</strong> Determine the properties of air.</td>
<td>• Read Unit 1C Psychrometrics • Lab activities 1 - 3</td>
</tr>
<tr>
<td>4</td>
<td><strong>12.0</strong> Explain the standards for and ways to measure indoor-air quality.</td>
<td>• Read Unit 2C Psychrometrics for Light Commercial HVAC • Lab activity 1-4 • Read Unit 34 Indoor Air Quality</td>
</tr>
<tr>
<td>5</td>
<td><strong>19.0</strong> Evaluate commercial airside systems.</td>
<td>• Read Unit 4 Duct Design and Sizing • Lab activity 1-4</td>
</tr>
<tr>
<td>6</td>
<td><strong>20.0</strong> Balance an air distribution system.</td>
<td>• Read Unit 37 Air Distribution and Balance • Lab activity 37-1 Team-up and evaluate duct size.</td>
</tr>
<tr>
<td>7</td>
<td><strong>18.0</strong> Install air distribution systems.</td>
<td>• Read Unit 38 Duct System Installation • Lab activities 1-4</td>
</tr>
<tr>
<td>8</td>
<td><strong>17.0</strong> Calculate commercial heating and air-conditioning loads.</td>
<td>• Read Unit 6C Light Commercial Load Calculations • Lab activity - Building load calculations</td>
</tr>
<tr>
<td>9</td>
<td><strong>16.0</strong> Maintain, troubleshoot, and repair commercial heating and air-conditioning systems. <strong>11.0</strong> Use a pressure enthalpy chart to diagram refrigerant cycles.</td>
<td>• Read Unit 14C Heat Pump Systems for Light Commercial HVAC • Lab activity 1-4 • Read Unit 45 Domestic Refrigerators • Lab activity – Use pressure enthalpy chart.</td>
</tr>
<tr>
<td>10</td>
<td><strong>21.0</strong> Select energy conservation equipment.</td>
<td>• Read Unit 50 Commercial Packaged Rooftop, Variable Refrigerant Flow &amp; Variable Air Volume Systems • Lab activity - Identify and select equipment</td>
</tr>
<tr>
<td>11</td>
<td><strong>22.0</strong> Analyze building management systems.</td>
<td>• Read Unit 16 Direct Digital Controls (DDCs) and Pneumatics • Lab activity – Unit review and lab assignment.</td>
</tr>
<tr>
<td>12</td>
<td><strong>13.0</strong> Operate environmental control</td>
<td>• Read Unit 30 Electric Heat</td>
</tr>
</tbody>
</table>
|   | systems as used in commercial heating and air-conditioning systems. | and Balance Points  
|   | Lab activity - Balance Points |  
| 13 | 15.0 Maintain and repair thermal storage systems. | Read Unit 44 Geothermal Heat  
|   | Lab activity - Design and maintenance of storage systems. |   |