

FLORIDA STATE COLLEGE AT JACKSONVILLE

COLLEGE CREDIT COURSE OUTLINE

COURSE NUMBER: ACR 1611

COURSE TITLE: Applied Heating Lab I

PREREQUISITE(S): None

COREQUISITE(S): None

STUDENT ADVISING NOTES: Suggested Course: ACR 1052

CREDIT HOURS: 3

CONTACT HOURS/WEEK: 5

CONTACT HOUR BREAKDOWN:

Lecture/Discussion:	2
Laboratory:	3

FACULTY WORKLOAD POINTS: 3.5

STANDARDIZED CLASS SIZE ALLOCATION: 24

COURSE DESCRIPTION:

Topics include gas furnaces, gas controls, properties of gas, gas piping, gas combustion, gas burners, ventilation and combustion air, gas troubleshooting, electric heat, heat pumps and gas efficiency checkout.

SUGGESTED TEXT(S): Carrier GTR, Chapters 1-16, Carrier, 1964.

Refrigeration and Air Conditioning Technology, 4th edition,
Whitman - Johnson - Tomczyk, Copyright 2000

IMPLEMENTATION DATE: Fall Term, 2004 (20051)

REVIEW OR MODIFICATION DATE: Fall Term, 2008 (20091) - outline review, 2007

COURSE TOPICS	CONTACT HOURS <u>PER TOPIC</u>
I. Gas Furnaces A. Upflow B. Downflow C. Horizontal D. Components E. Heat Exchanger	10
II. Gas Controls A. Use B. Construction C. Function D. Adjusting E. Check Out F. Gas Regulator G. Pressure Adjustment	10
III. Properties of Gas A. Fuel Gases B. Propane C. Butane D. Methane E. Propane and Butane Air F. Gas Molecules	10
IV. Gas Piping A. Pipe Sizing B. Iron C. Copper D. Aluminum E. Steel F. Piping Layouts G. Pipe Joints H. Threaded I. Compression	5
V. Gas Combustion A. Fuel B. Oxygen C. Heat D. Water Vapor E. Carbon Dioxide F. Methane G. Primary and Secondary Air	5

COURSE TOPICS (Continued)	CONTACT HOURS <u>PER TOPIC</u>
VI. Gas Burners	10
A. Yellow Flame Burners	
B. Bunsen Burners	
C. Shutters	
D. Air Openings	
E. Gas Orifice	
VII. Ventilation and Combustion Air	5
A. Gas Venting	
B. Combustion	
C. Excess Air	
D. Venting Power	
E. Combustion Gas Volume	
VIII. Gas Troubleshooting	5
A. Gas Density	
B. Blue Flame	
C. Combustion Testing	
D. Yellow Tipping	
E. Percentage of CO ₂	
F. Safety	
IX. Electric Heat	5
A. Power Distribution	
B. Disconnect Switches	
C. Fuse Blocks	
D. Heating Contactors	
E. Fan Relays	
F. Heating Sequencers	
X. Heat Pumps	5
A. Indoor and Outdoor Coil	
B. Suction Accumulators	
C. Reversing Valve	
D. Heat pump Compressors	
E. Crank Case Heaters	
F. Metering Devices	
XI. Gas Efficiency Check-Out	5
A. CO ₂ Test	
B. Smoke Test	
C. Flue Gas Temperature	
D. Efficiency Calculation	
E. Fuel Unit Pressure Test	
F. Fuel Unit Vacuum Test	

PROGRAM TITLE: Air Conditioning, Refrigeration & Heating Systems
Technology

COURSE TITLE: Applied Heating Lab I

CIP NUMBER: 0615050100

LIST PERFORMANCE STANDARD ADDRESSED:

NUMBER(S): TITLES(S):

- 1.0 DEMONSTRATE KNOWLEDGE OF ORIENTATION PRACTICES--The student will be able to:
- 01.01 Demonstrate understanding of school and shop policies.
 - 01.02 Complete course administrative forms and activities.
- 02.0 APPLY BASIC AIR CONDITIONING AND REFRIGERATION SKILLS--The student will be able to:
- 02.01 Apply safety practices.
 - 02.02 Apply basic mathematics skills.
 - 02.03 Apply recordkeeping skills.
 - 02.04 Install and service tubing and fittings.
 - 02.05 Install and service pipe and fittings.
 - 02.06 Identify and use hand and power tools.
 - 02.07 Identify and use specialized tools.
 - 02.08 Write job specifications.
 - 02.09 Read blueprints and mechanical drawings.
 - 02.10 Prepare, analyze, and evaluate technical reports and data.
- 03.0 APPLY TUBING, PIPING, SOLDERING AND BRAZING SKILLS--The student will be able to:
- 03.01 Install and service tubing and fittings.
 - 03.02 Install and service pipe and fittings.
 - 03.03 Use soft soldering practices.
 - 03.04 Use brazing practices.
- 04.0 APPLY BASIC REFRIGERATION FUNDAMENTALS SKILLS--The student will be able to:
- 04.01 Apply basic refrigeration safety practices.
 - 04.02 Identify basic refrigeration cycle.
 - 04.03 Compare refrigerant pressure to temperature relationships.
 - 04.04 Identify and service refrigeration system and components.
 - 04.05 Apply dehydration and evacuation procedures.
 - 04.06 Service and charge a basic refrigeration system.
 - 04.07 Locate and repair refrigeration system leaks.
 - 04.08 Test, analyze and replace compressors.
 - 04.09 Apply troubleshooting techniques for refrigeration systems.
 - 04.10 Design basic refrigeration.
- 05.0 APPLY BASIC ELECTRICAL SKILLS--The student will be able to:
- 05.01 Apply basic electrical safety practices.
 - 05.02 Identify the nature of electricity.
 - 05.03 Identify magnetism and electromagnetism induction.

LIST PERFORMANCE STANDARD ADDRESSED: (Continued)

- | NUMBER(S): | TITLES(S): |
|------------|---|
| 05.04 | Identify electrical components symbols and diagrams. |
| 05.05 | Apply basic electrical theory and calculations. |
| 05.06 | Calculate and measure electrical valves in series and parallel circuits. |
| 05.07 | Compare alternating to direct current. |
| 05.08 | Test electrical components. |
| 05.09 | Test single and three phase motors. |
| 05.10 | Test capacitors. |
| 05.11 | Test solid state components |
| 05.12 | Troubleshoot/diagnose electrical circuits. |
| 05.13 | Read schematics and diagrams. |
| 05.14 | Design electrical systems. |
|
 | |
| 06.0 | <u>INSTALL AND SERVICE AIR CONDITIONING AND REFRIGERATION ELECTRICAL SYSTEMS</u> --The student will be able to: |
| 06.01 | Install and service electrical components. |
| 06.02 | Install and service electrical controls. |
| 06.03 | Troubleshoot/diagnose electrical components and controls. |
| 06.04 | Test, analyze, remove and replace single phase motors. |
| 06.05 | Test, analyze, remove and replace three phase motors. |
| 06.06 | Test, analyze, remove and replace thermostatic controls. |
|
 | |
| 07.0 | <u>INSTALL, MAINTAIN AND REPAIR RESIDENTIAL AIR CONDITIONING SYSTEMS</u> --The student will be able to: |
| 07.01 | Install, test, analyze and repair air to air systems. |
| 07.02 | Install, test, analyze and repair water to air systems. |
| 07.03 | Install, test, analyze and repair heat pump systems. |
| 07.04 | Test and analyze air movement systems. |
| 07.05 | Apply local and national codes. |
| 07.06 | Design, construct, install and service comfort systems. |
| 07.07 | Calculate job cost estimates. |
|
 | |
| 08.0 | <u>INSTALL, MAINTAIN AND REPAIR COMMERCIAL AIR CONDITIONING SYSTEMS</u> --The student will be able to: |
| 08.01 | Install, test, analyze and repair air to air systems. |
| 08.02 | Install, test, analyze and repair water to air systems. |
| 08.03 | Install, test, analyze and repair heat pump systems. |
| 08.04 | Install, test, analyze and repair chiller systems. |
| 08.05 | Test and analyze air movement systems. |
| 08.06 | Apply local and national codes. |
| 08.07 | Install, service and repair cooling towers. |
| 08.08 | Install, service and repair water cooled condensers. |
| 08.09 | Install, service and repair water treatment systems. |
| 08.10 | Apply accepted industry pipe sizing and installation procedures. |
| 08.11 | Calculate, design and layout environmental systems. |
| 08.12 | Calculate job cost estimates. |

LIST PERFORMANCE STANDARD ADDRESSED: (Continued)

- | NUMBER(S): | TITLES(S): |
|------------|--|
| 09.0 | <u>INSTALL, MAINTAIN AND REPAIR COMMERCIAL REFRIGERATION SYSTEMS</u> --The student will be able to: |
| 09.01 | Install, test, analyze and adjust refrigerant pressure regulating devices. |
| 09.02 | Test, analyze and replace electrical controls and components. |
| 09.03 | Test, analyze and replace defrost systems. |
| 09.04 | Test, analyze and replace pump down systems. |
| 09.05 | Use various refrigeration equipment electrical diagrams. |
| 09.06 | Apply industry accepted piping installation procedures. |
| 09.07 | Apply industry pipe sizing standards. |
| 09.08 | Install, service and repair ice machines and specialty systems. |
| 09.09 | Apply local and national codes. |
| 09.10 | Calculate loads, design and layout refrigeration. |
| 09.11 | Calculate job cost estimates. |
| 10.0 | <u>INSTALL, MAINTAIN AND REPAIR HEATING SYSTEMS</u> --The student will be able to: |
| 10.01 | Install, service and repair a gas furnace. |
| 10.02 | Install, service and repair an oil furnace. |
| 10.03 | Install, service and repair electric furnace. |
| 10.04 | Install, service and repair duct heaters. |
| 10.05 | Install, service and repair auxiliary heat strips. |
| 10.06 | Design, install, service and repair solar heating systems. |
| 10.07 | Install, service and repair miscellaneous heating equipment. |
| 10.08 | Apply local and national codes. |
| 10.09 | Install, service and repair hydronic systems. |
| 10.10 | Test and analyze heating air movement systems. |
| 10.11 | Calculate loads, design and layout heating systems. |
| 10.12 | Calculate job cost estimates. |
| 11.0 | <u>DEMONSTRATE BASIC HEAT GAIN, HEAT LOSS AND DESIGN SKILLS</u> --The student will be able to: |
| 11.01 | Calculate heating and cooling requirements from specifications. |
| 11.02 | Calculate and design air distribution systems. |
| 11.03 | Determine air properties by use of psychrometrics. |
| 11.04 | Calculate cooling and heating equipment sizes. |
| 11.05 | Design, construct and install air movement systems. |
| 12.0 | <u>DEMONSTRATE APPROPRIATE COMMUNICATION SKILLS</u> --The student will be able to: |
| 12.01 | Write logical and understandable statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry. |
| 12.02 | Read and understand graphs, charts, diagrams, and tables commonly used in this industry/occupation area. |
| 12.03 | Read and follow written and oral instructions. |
| 12.04 | Answer and ask questions coherently and concisely. |
| 12.05 | Read critically by recognizing assumptions and implications and by evaluating ideas. |
| 12.06 | Demonstrate appropriate telephone/communication skills. |

LIST PERFORMANCE STANDARD ADDRESSED: (Continued)

- | NUMBER(S): | TITLES(S): |
|------------|--|
| 13.0 | <u>DEMONSTRATE APPROPRIATE MATH SKILLS</u> --The student will be able to: |
| 13.01 | Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares, and cylinders. |
| 13.02 | Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches. |
| 13.03 | Add, subtract, multiply and divide using fractions, decimals, and whole numbers. |
| 13.04 | Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items. |
| 13.05 | Demonstrate an understanding of federal, state and local taxes and their computation. |
| 14.0 | <u>DEMONSTRATE APPROPRIATE UNDERSTANDING OF BASIC SCIENCE</u> --The student will be able to: |
| 14.01 | Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content. |
| 14.02 | Draw conclusions or make inferences from data. |
| 14.03 | Identify health related problems which may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials. |
| 14.04 | Understand pressure measurement in terms of P.S.I., inches of mercury, and K.P.A. |
| 15.0 | <u>DEMONSTRATE EMPLOYABILITY SKILLS</u> --The student will be able to: |
| 15.01 | Conduct a job search. |
| 15.02 | Secure information about a job. |
| 15.03 | Identify documents which may be required when applying for a job interview. |
| 15.04 | Complete a job application form correctly. |
| 15.05 | Demonstrate competence in job interview techniques. |
| 15.06 | Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees. |
| 15.07 | Identify acceptable work habits. |
| 15.08 | Demonstrate knowledge of how to make appropriate job changes. |
| 15.09 | Demonstrate acceptable employee health habits. |
| 15.10 | Demonstrate a knowledge of the "Florida Right-To-Know Law" as recorded in Florida Statutes Chapter 442. |
| 16.0 | <u>DEMONSTRATE AN UNDERSTANDING OF ENTREPRENEURSHIP</u> --The student will be able to: |
| 16.01 | Define entrepreneurship. |
| 16.02 | Describe the importance of entrepreneurship to the American economy. |
| 16.03 | List the advantages and disadvantages of business ownership. |
| 16.04 | Identify the risks involved in ownership of a business. |
| 16.05 | Identify the necessary personal characteristics of a successful entrepreneur. |
| 16.06 | Identify the business skills needed to operate a small business efficiently and effectively. |



NOTE: Use either the Tab key or mouse click to move from field to field. The box will expand to accommodate your entry.

<i>Section 1</i>	
COURSE PREFIX AND NUMBER: <u>ACR 1611</u>	SEMESTER CREDIT HOURS: <u>3</u>
COURSE TITLE: <u>Applied Heating Lab I</u>	

Section 2

TYPE OF COURSE: (Click on the box to check all that apply)

<input type="checkbox"/> AA Elective	<input type="checkbox"/> AS Required Professional Course	<input type="checkbox"/> College Prep
<input type="checkbox"/> AS Professional Elective	<input checked="" type="checkbox"/> AAS Required Professional Course	<input checked="" type="checkbox"/> Technical Certificate
<input type="checkbox"/> Other _____		
<input type="checkbox"/> General Education: (For General Education courses, you must also complete Section 3 and Section 7)		

Section 3 (If applicable)

INDICATE BELOW THE DISCIPLINE AREA FOR GENERAL EDUCATION COURSES:

<input type="checkbox"/> Communication	<input type="checkbox"/> Social & Behavioral Sciences	<input type="checkbox"/> Mathematics
<input type="checkbox"/> Natural Sciences	<input type="checkbox"/> Humanities	

Section 4

INTELLECTUAL COMPETENCIES:

<input checked="" type="checkbox"/> Reading	<input type="checkbox"/> Speaking	<input type="checkbox"/> Critical Analysis	<input type="checkbox"/> Quantitative Skills	<input type="checkbox"/> Scientific Method of Inquiry
<input checked="" type="checkbox"/> Writing	<input checked="" type="checkbox"/> Listening	<input type="checkbox"/> Information Literacy	<input type="checkbox"/> Ethical Judgment	<input checked="" type="checkbox"/> Working Collaboratively

<i>Section 5</i>	
LEARNING OUTCOMES	METHOD OF ASSESSMENT
• Utilize manual and power tools.	ARI Module Certification Score 70% or better
• Apply electrical skills.	ARI Module Certification Score 70% or better
• Read and interpret building codes.	ARI Module Certification Score 70% or better
• Read blueprints.	ARI Module Certification Score 70% or better
• Apply basic heat gain, heat loss and design skills.	ARI Module Certification Score 70% or better
• Apply piping, soldering and brazing skills.	ARI Module Certification Score 70% or better
• Install, maintain and repair heating systems.	ARI Module Certification Score 70% or better
• Communicate effectively.	ARI Module Certification Score 70% or better
• Demonstrate problem solving skills.	ARI Module Certification Score 70% or better
• Identify safe working conditions and observe safety precautions.	ARI Module Certification Score 70% or better

Section 6 Name of Person Completing This Form: Jim Yurko