HVAC/R IV Curriculum

August 2011

I. COURSE DESCRIPTION

HVAC/R IV is a full year course that incorporates instruction from the previous year. The emphasis this year will be to bring the students abilities up to workplace readiness level. The student will refine skills in the following areas: electricity, electric motors, basic wiring schematics, semi-hermetic & hermetic compressors, commercial refrigeration systems, commercial defrost systems, commercial controls, commercial wiring diagram comprehension, central air conditioning systems layout & design, air conditioning wiring diagrams, ductwork basic layout and design, blueprint reading, Rooftop HVAC/R Systems, Heating systems, retrofitting, Air to Air Heat-pumps, Geo-thermal Heat-pumps, combustion efficiency and preparation for the ACCA exam & Green awareness exam. Incorporated into the student's year round instruction will be workplace safety, workplace terminology and a refinement & understanding of construction building codes as applies to the HVAC/R industry.

II. COURSE OBJECTIVES/OUTLINE ALIGNED WITH THE NJCCCS

A. REINFORCING THE BASICS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Increase student understanding of basic skills
2. Review general shop safety procedures.
3. Increase understanding of copper tubing use and procedures.
4. Reinforce their understanding of HVAC/R tools.
5. Review refrigerant recovery, recycling, reclaiming and regulations as it pertains to the ACCA exam.

B. REINFORCING BASIC ELECTRICITY NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Review and receive updated information on safety procedures for the shop concerning the use of electricity.
2. Define and understand workplace electrical terminology.
3. Refine their understanding of electrical theory.
4. Improve his or her ability to work with electrical theory.
5. Increase the student's ability to work with electrical theory in the workplace and apply it to practical situations.
6. Clarify the understanding by the student as to how electricity functions in a field related environment.
7. Analyze wiring schematics.
8. Solve electrical problems.

C. SEMI-HERMETIC COMPRESSORS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify different types of semi-hermetic compressors.
2. Develop confidence when working on semi-hermetic compressors.
3. Strengthen their ability to identify and explain different types of semi-hermetic compressor parts with respect to workplace readiness.
4. Apply workplace readiness skills on a fully functional semi-hermetic compressor.

D. <u>COMMERCIAL REFRIGERATION</u> NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1.Comprehend safety procedures for working on commercial refrigeration systems.
2.Define the terms necessary for workplace readiness when working on commercial refrigeration systems.
3. Work on commercial refrigeration systems.
4. Identify and explain the different control systems found on a commercial refrigeration system.
5. Strengthen their ability and confidence when working on a commercial refrigeration system.
6. Enhance his or her technical base that will help him/her to understand complex refrigeration systems.
7. Answer questions on the ACCA exam about commercial refrigeration.

E. <u>COMMERCIAL SYSTEM WIRING</u> NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Work on commercial control wiring.
2. Identify and explain the different controls found on a commercial refrigeration system.
3. Strengthen their ability and confidence when working on commercial refrigeration control systems.
4. Enhance the student's technical base that will help him/her to understand complex refrigeration control systems.

F. <u>LOW PRESSURE CONTROLS</u> NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Analyze commercial LPC wiring.
2. Identify and explain the different LPC controls found on a commercial refrigeration system.
3. Strengthen their ability and confidence when working on commercial LPC refrigeration controls.
4. Enhance the student's technical base that will help him/her to analyze complex LPC refrigeration control systems.
5. Answer questions on LPCs on the ACCA exam.

G. <u>CENTRAL AIR CONDITIONING</u> NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Understand all safety procedures related to Central Air conditioning systems.
2. Identify terms necessary for workplace readiness when working on central air conditioning systems.
3. Enhance their ability to identify the different types of electrical systems found in central air conditioning systems.
4. Improve their ability to repair all types of central A/C units.
5. Improve their ability to work with wiring diagrams.
6. Increase the student's competence for workplace readiness.
7. Enhance the student's ability to answer questions on the ACCA exam.

H. DUCTWORK SYSTEMS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Review all safety procedures related to working with ductwork and sheet metal.
2. Identify terms necessary for workplace readiness when working with ductwork and sheet metal.
3. Enhance his or her ability to perform ductwork procedures.
4. Improve the student's understanding through the use of associated programs about blueprint reading, layout and design.
5. Increase the student's workplace readiness with regards to field related situations.
6. Enhance the student's understanding of airflow as related to ductwork
7. Enhance the student's ability to design a duct system.
8. Design sheet metal trunk lines and return plenums.
9. Relate heat load to airflow on Central A/C systems.
10. Identify CFM requirements and ductwork configuration.

I. Building Codes for HVAC/R NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify building codes & their use.
2. Understand building codes.
3. Enhance their ability to work with building codes.
4. Understand the need for building codes.
5. Apply building codes to installations.
6. Increase the student's competence for workplace readiness.

J. ROOFTOP HVAC/R SYSTEMS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Review all safety procedures related to Rooftop HVAC/R systems.
2. Identify terms necessary for workplace readiness when working on Rooftop HVAC/R systems.
3. Identify the different types of electrical systems found in Rooftop HVAC/R systems.
4. Work on different types of Rooftop HVAC/R systems.
5. Work with rooftop wiring diagrams.
6. Exhibit competence for workplace readiness.
7. Understand the relationship between ductwork & rooftop HVAC/R systems.
8. Answer questions about rooftop A/C systems on the ACCA exam.

K. HEATING TECHNOLOGY NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Review all safety procedures related to heating systems technology.
2. Identify terms necessary for workplace readiness when working on all types of heating systems.
3. Identify the different types of electrical systems found in heating systems.
4. Repair all types of heating systems.
5. Embellish the student's ability to work with wiring diagrams.
6. To increase the student's competence for workplace readiness.
7. Comprehend combustion efficiency standards for the industry.
8. Apply Combustion efficiency to the Green awareness exam.
9. Apply carbon monoxide safety measures to heating appliances.

L. THE ACCA CERTIFICATION EXAM NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Review all terms necessary for taking the ACCA certification exam.
2. Review information necessary to take the core certification exam.
3. Review information necessary to take the type I certification exam.
4. Review information necessary to take the type II certification exam.
5. Review information necessary to take the universal certification exam.

M. THE GREEN AWARENESS EXAM

Students will be able to:

1. Comprehend the Green Awareness exam.
2. Take the Green Awareness Exam

III. METHODS OF STUDENT EVALUATION

Students will be evaluated using the following criteria:

Tests	= 40%
Quizzes	= 20%
Shop	= 20%
Classwork	= 10%
Participation	= 10%
Total	= 100%

IV. LIST OF TEXTBOOKS AND INSTRUCTIONAL MATERIALS & SOFTWARE

TEXTBOOK

Refrigeration & Air Conditioning Technology
Whitman, Johnson, Tomczyk
1999 Delmar
Albany, New York

Green Awareness
Korcal, Petit, Pacella, Campbell, Collins, Rasmussen
2008, ESCO Press & Ferris State University
U.S.A.

INDUSTRY ASSOCIATED

AIR CONDITIONING CONTRACTORS OF AMERICA

1. Certification publications
2. Industry standards and reference guides
3. Audio visual aid materials
4. Computer programs for enhancing technical skills
5. EPA generated materials
6. Congressional publications with regards to industry standards
7. The ACCA/EPA Test

The International Building Code
1. Industry related publications
2. RSES reference guides
3. Audio visual aid materials
4. EPA generated materials

THE AIR CONDITIONING REFRIGERATION INSTITUTE
1. Industry related publications and reports
2. ARI teaching manuals
3. Computer programs for enhancing technical skills
4. EPA generated materials

Software
MA-500/550 Simu-Air (ACCA)
MB-500/550 Simu-Hydro (ACCA)
Refrigerant Journal software from the ACCA

V. INSTRUCTIONAL STRATEGIES

The teaching methods used in this course will include: exercises from the textbook, related worksheets, reading from the text, lecture with practical examples, modeling, hands-on application for the student in shop situations and audio visual presentations. All work is predicated upon the student's understanding the concepts taught previously or a review will be necessary prior to attempting any new work. Notes given in class will be very important the student must maintain a neat and accurate notebook. In order to meet the individual needs of our students, differentiated instruction is utilized in every class. This involves the use of a variety of instructional strategies, including but not necessarily limited to: readings and exercises from the approved text(s) and related supplemental materials; hands-on practical projects; cooperative group activities; teacher generated handouts; lecture in conjunction with class discussion and notes; debates; role playing activities; oral and written reports; simulations; multimedia presentations; related field trips; and Internet and ITV presentations and conferences.

VI. HVAC/R IV. SCOPE AND SEQUENCE CHART

Key I = Introduced
D = Developed in Depth
R = Reinforced

Suggested Grade Levels

	9	10	11	12
Practice shop safety procedures	ID	DR	**DR**	R
Drawing HVAC & R Diagrams		ID	**D**	DR
Understanding how to braze & solder	I	D	**DR**	R
Understanding how to work with ACR copper	I	D	**DR**	R
Comprehending the basics of refrigeration	I	D	**DR**	R
Comprehending the basics of Sheet-metal	I	D	**DR**	R
Understanding how system components work	I	D	**DR**	R
Understanding how refrigerants affect the environment	I	D	**DR**	R
Understanding Heat Transfer Principals		ID	**DR**	R
Understand the basic laws of air conditioning	I	D	**DR**	DR
Relating Pressure to Temperature		ID	**DR**	DR
Fabricating a Tubing Project		D	**DR**	DR
Understanding The Basic Refrigeration Cycle		I D	**DR**	DR
Understanding The Basic Refrigeration Cycle		I D	**DR**	R
Retrofitting Systems to R-134A		ID	**DR**	DR
Understanding Superheat & Sub-cooled		ID	**DR**	R
Understanding How to Read Manifold Gauges		ID	**DR**	R

Understand How To Use a Vacuum Pump		ID	**D**	R
Understand how to recover a system		ID	**DR**	R
Understanding electrical safety		ID	**D**	R
Understanding Basic Electrical Controls & circuits		ID	**D**	R
Understanding Basic sheet metal skills & Safety		ID	**DR**	R
Understanding The Importance of HVAC & R.		ID	**D**	R
Demonstrate heating system operations			**ID**	R
Understand P.V.C. piping uses			ID	R
Demonstrate retrofitting techniques		I	**D**	R
Can take the ACCA Exam		I	DR	R
Understand Green Technology & its value to the trade	I	D	**DR**	R
Comprehend Green Technology	I	D	**DR**	R
Can take Green Awareness Certification exam	I	D	**DR**	R

VII. PACING CHART

The course will be taught in approximate 2 week, 2 day increments. All new work is predicated on the student's understanding of previous concepts or a review will be necessary prior to attempting any new material.

TOPICS	PACING
A. REINFORCING THE BASICS	week 1
B. REINFORCING BASIC ELECTRICITY	week 2 – 3
C. SEMI-HERMETIC COMPRESSORS	week 4 – 6
D. COMMERCIAL REFRIGERATION	week 7 – 10
E. COMMERCIAL SYSTEM WIRING	week 11 – 16
F. LOW PRESSURE CONTROLS	week 17 – 20
G. CENTRAL AIR CONDITIONING	week 20 – 25
H. DUCTWORK SYSTEMS	week 26 – 29
I. BUILDING CODES FOR HVAC/R	week 30
J. ROOFTOP HVAC/R SYSTEMS	week 31—32
K. HEATING TECHNOLOGY	week 33– 34
L. THE ACCA CERTIFICATION EXAM	week 35
M. THE GREEN AWARENESS EXAM	week 36

VIII. STUDENT HANDOUT HVAC/R IV

Course Overview

HVAC/R III is a full year course that incorporates instruction from the previous year. The emphasis this year will be to bring the students abilities up to workplace readiness level. The student will refine skills in the following areas: electricity, electric motors, basic wiring schematics, semi-hermetic & hermetic compressors, commercial refrigeration systems, commercial defrost systems, commercial controls, commercial wiring diagram comprehension, central air conditioning systems layout & design, air conditioning wiring diagrams, ductwork basic layout and design, blueprint reading, Rooftop HVAC/R Systems, Heating systems, retrofitting, and preparation for the ACCA exam. Incorporated into the student's year round instruction will be workplace safety, Green Awareness, workplace terminology and a refinement & understanding of construction building codes as applies to the HVAC/R industry.

Proficiencies
Review of safety skills with regards to industry standards
Review of Refrigerant recovery processes
Review & enhancement of basic electricity concepts
Demonstrate enhanced knowledge of Semi-hermetic Compressors
Explain commercial refrigeration systems & wiring practices
Explain commercial low pressure control use
Show central air conditioning systems & Applicable Codes
Clarify Ductwork & Applicable Codes for HVAC/R systems
Give explanation f Rooftop HVAC/R systems
Demonstrate knowledge of Heating systems technology & Applicable Codes
Prepare for The ACCA exam
Clarify Overall workplace readiness standards
Prepare for Green Technology & Safety Testing