COURSE OUTLINE

REFRIGERATION TOOLS AND EQUIPMENT — COURSE TITLE

AC 112 — Dept & Course No.

I. COURSE DESCRIPTION:

This course provides instruction in air conditioning and refrigeration shop safety and regulations, uses and care of the tools and equipment of the trade.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK: 2 LECTURE | 3 LAB | 5 TOTAL

IV. PREREQUISITE: NONE

V. STUDENT LEARNING OUTCOME:

Upon completion of the course, the student will be able with 65% accuracy to:

1. Match the seven colors of the safety color code to the correct applications
2. Lists rules for working safely
3. Select steps to be followed in case of accident in Refrigeration shop
4. Lists and identify the various types of tubing used in Refrigeration
5. Cut an fit tubing using approved methods

VI. COURSE CONTENT

A. Colors and application of the safety color code

B. Safety

1. Terms associated with safety and correct definitions

C. Rescue procedure in electrical accidents

D. Kinds of tubing

1. Applications
2. Color coding of tubing cartons
3. Tube and flexible hose fittings

E. Tubing operations

1. Measurement and cutting tubing
2. Bending tubing Connecting tubing

6. Demonstrate soldering and brazing techniques

F. Steps for setting up oxyacetylene torch

1. Soldering tubing
2. Brazing tubing
3. Testing soldered or brazed tubing for leaks
4. Leak repair

7. Select the proper tools for servicing and maintaining domestic refrigerators

G. Basic hand tools for Refrigeration service

1. Names and uses of refrigeration tools
2. Proper care of tools

9. Use and maintain gauges

H. Instruments and gauges

1. Pressure gauges
2. Compound gauges
3. Components of manifolds sets
4. Rules for care of gauges

10. Use calibrate and maintain multimeters

I. Multimeters

1. V.O.M. testers
2. Clampmeter
3. Wattmeter
4. Proper care of tester

11. Discuss the evacuation of a systems

J. Steps and procedures of system evacuation

12. Demonstrate standard procedures for basic mechanical service and repair operations

K. Basic mechanical service and repair operation

1. Service an air conditioner
2. Service a Refrigerator/freezer and water cooler

VII. EQUIPMENT AND MATERIALS:

A. Refrigeration Basic Hand Tools
B. Refrigeration and AC units which uses Refrigerant number 11, 12, 22, 134a, 410A and 502
C. Programmable Weighing Scale

D. DOT approve Cylinders
E. Refrigerant Recovery Station
F. Ultrasonic Leak Detector
G. Portable Refrigerant Recovery and Recycling Unit
H. Refrigerant Recovery Equipment Designed for Automotive AC
I. Electronic Thermometer
    1. Glass Stem Thermometer with range form 40 to 210 'F and 40 to 100 Celsius
    2. Kelvin and Rankine Thermometer
J. Tape Rule: US standard and Standard International
K. Pressure Gauge
L. Compound Gauge
M. Fundamentals of Refrigeration Trainer
N. Microcomputer with DVD Player
O. Electronic Vacuum Gauge
P. Bourdon Spring Gauge
Q. Air Conditioners
R. Air Conditioning Simulator
S. Refrigeration Simulator
T. Routine Classroom Materials

VIII. TEXT AND REFERENCES:

A. Text:

Althouse, A. D. , et. al. Modern Refrigeration and Air Conditioning. South Holland, Ill.: Good Heart Wilcox Publishing Co., Inc., 2004.

B. References:

Miller, Rex. Rex. Refrigeration and Air Conditioning Technology. Peoria, Ill.: Bennett and McKnight Publishing Company, 1990.

Warren, Marsh and Olivo, C.T. Principles of Refrigeration, Albany, New York: Delmar Publishers 1985.

Kemp, J. L. Refrigeration and Air Conditioning Laboratory Manual. Toledo, Ohio: Thermal Engineering Co., 1980.

IX. METHOD OF INSTRUCTION:

A. Lecture
B. Discussion
C. Demonstration
D. Audio Visual
E. Performance
F. Field trips

X. METHOD OF EVALUATION:

Components with corresponding weight in percent included in the computation of the final grades are:

Components		Weight
Participation	.....	15%
Quizzes	.....	10%
Mid Term and Final	.....	20%
Projects	.....	55%
	Total =	100%

The transmutation of total percent to letter grade is as follows:

Weight				Letter Grade
90%	-	100%	.....	A
80%	-	89%	.....	B
70%	-	79%	.....	C
65%	-	69%	.....	D
0%	-	64%	.....	F

TASK LIST 112

TASK	TIME
Student Learning Outcome 3	3 hrs
1. Apply safety rules in the shop.	
Student Learning Outcome 6	10 hrs
1. Measure inside and outside diameter of the tubing. 2. Make a single flare using the generating type flaring tools. 3. Make a single thickness flare using compression type flaring tool. 4. Make a double thickness flare. 5. Make a swage joint. 6. Make a 90- degree bend. 7. Make a 180-degree bend. 8. Make a 75-degree offset bend. 9. Construct a tubing project.	
Student Learning Outcome 7 & 8	7 hrs.
1. Solder the tubing project 2. Braze the tubing project 3. Test leaks.	
Student Learning Outcome 10	3 hrs.
1. Adjust and calibrate gauges.	
Student Learning Outcome 11	5 hrs.
1. Zero ohm adjust VOM meter 2. Measure resistance. 3. Measure voltage. 4. Measure current. 5. Measure watts.	
Student Learning Outcome 12	5 hrs.
1. Evacuate a refrigeration system. 2. Remove moisture from the system.	
Student Learning Outcome 13	15 hrs.
1. Service and repair air conditioners, freezers, water coolers and refrigerators.	
Total Hours	48 hrs.

Course Level Achievement
Form A
(Used for all shop course as well as other program courses)

AC 112 - Refrigeration Tools and Equipment

Student Name: _____ Semester/Year: _____

Instructor's Name (Print): _____

Directions: Evaluate the student using the rating scale below and check the appropriate numbers to indicate the degree of competency. The numerical ratings of 5, 4, 3, 2, and 1 are not intended to represent the traditional school grading system of A, B, C, D, and F. the descriptions associated with each of the numbers focus on the level of student performance for each of the competencies listed below.

Rating Scale:
5 Excellent
4 Above average
3 Average
2 Below average
1 Unacceptable

- Passing Achievement: A student must achieve at least a numerical value level of 3 in all the course competencies in order to pass this course. Through weekly progress report, students who are barely passing or failing the course are referred to Counseling Services for assistance

	COMPETENCIES	RATINGS
A.	Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques	5 4 3 2 1
B.	Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners.	5 4 3 2 1
C.	Identify thread types and screw fasteners and demonstrate the procedures for threading pipes	5 4 3 2 1
D.	Maintain, calibrate and use vacuum and compound gauges.	5 4 3 2 1
E.	Replace the oil, purge air and evacuate and recharge the refrigerating system	5 4 3 2 1

I certify that the student has completed all the competencies in this program and has achieved an average rating as shown on the right.

Instructor's Signature _____ Date _____

AC 112 - Refrigeration Tools and Equipment

A Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques.

5 Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques with 90-100% accuracy.

4 Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques with 80-89% accuracy.

3 Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques with 70-79% accuracy.

2 Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques with 65-69% accuracy

1 Cut, flare, swage, bend, solder and braze tubing using approved methods and techniques with below 65 accuracy.

B. Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners.

5 Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners with 90- 100% accuracy.

4 Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners with 80-89% accuracy.

3 Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners with 70-79% accuracy.

2 Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners with 65-69% accuracy.

1 Demonstrate how to use various hand tools and select the proper tools for servicing and maintaining domestic refrigerators and air conditioners with below 65% accuracy.

C. Identify thread types and screw fasteners and demonstrate the procedures for threading pipes.

5 Identify thread types and screw fasteners and demonstrate the procedures for threading pipes with 90-100% accuracy.

4 Identify thread types and screw fasteners and demonstrate the procedures for threading pipes with 80-89% accuracy.

3. Identify thread types and screw fasteners and demonstrate the procedures for threading pipes with 70-79% accuracy.

2 Identify thread types and screw fasteners and demonstrate the procedures for threading pipes with 65-69% accuracy.

1 Identify thread types and screw fasteners and demonstrate the procedures for threading pipes with below 65% accuracy.

D. Maintain, calibrate and use vacuum and compound gauges.

5 Maintain, calibrate and use vacuum and compound gauges with 90-100% accuracy.

4 Maintain, calibrate and use vacuum and compound gauges with 80- 89% accuracy.

3 Maintain, calibrate and use vacuum and compound gauges with 70-79% accuracy.

2 Maintain, calibrate and use vacuum and compound gauges with 65-69% accuracy.

1 Maintain, calibrate and use vacuum and compound gauges with below 65% accuracy.

E. Replace the oil, purge air and evacuate and recharge the refrigerating system.

5 Replace the oil, purge air and evacuate and recharge the refrigerating system with 90-100% accuracy.

4 Replace the oil, purge air and evacuate and recharge the refrigerating system with 80-89% accuracy.

3 Replace the oil, purge air and evacuate and recharge the refrigerating system with 70-79% accuracy.

2 Replace the oil, purge air and evacuate and recharge the refrigerating system with 65-69% accuracy.

1 Replace the oil, purge air and evacuate and recharge the refrigerating system with below 65% accuracy.