

COURSE OUTLINE

REFRIGERANT RECOVERY, RECLAIMING AND RECYCLING
COURSE TITLE

AC 221
DEPT. & COURSE NO.

I. COURSE DESCRIPTION:

This course enable the learner to understand the effects of CFC (choroflourocharbons) in the ozone layer in the atmosphere and to apply the EPA rules/regulation in the handling of refrigerants.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK: 3 0 3
Lecture Lab Total

IV. PREREQUISITE: None.

V. STUDENT LEARNING OUTCOME:

VI. COURSE CONTENT:

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

1. Describe the effect of CFC refrigerants on the ozone layer in the atmosphere
 2. Explain the environmental protection agency rules and regulation regarding the use of CFC's
 3. Describe the methods and functions of the different recovery equipment
- A. Effects of CFC on the Ozone layer
 1. Understanding ozone
 2. Choroflourocharbons
 - B. EPA Rules and Regulations regarding the use of CFC's
 1. International Backgrounds
 2. U.S. Regulation
 3. Regulation in European Community
 4. Standards
 - C. Recovery Equipments and Methods
 1. The specific industry definitions
 2. The recovery container
 3. Equipment for recovery in Liquid Phase
 4. Recovery equipment for Gaseous Phase
 5. Auxiliary Equipment

4. Follow the procedures for efficient recovery
5. Demonstrate the proper method of recycling and reclaiming of refrigerants

- D. Procedures for efficient Recovery
 1. Procedures for the operation
 2. Corrections to the circuit
 3. Choice of method
 4. Checks, Measurement, and Calculation
- E. Recycling, Reclaiming and Destruction
 1. Containers of refrigerants
 2. Separation and Filtration Methods
 3. Quality control
 4. Recycling and Reclaiming
 5. Destruction of CFC's

VII. EQUIPMENT AND MATERIALS:

- A. Refrigeration Basic Hand Tools
- B. Refrigeration and AC units which uses Refrigerant number 11, 12, 22, 134a, 500 and 502
- C. Programmable Weighing Scale
- D. DOT approve Cylinders
- E. Refrigerant Recovery Station
- F. Portable Refrigerant Recovery and Recycling Unit
- G. Refrigerant Recovery Equipment Designed for Automotive AC
- H. Electronic Thermometer
 1. Glass Stem Thermometer with range form 40 to 210 'F and 40 to 100 Celsius
 2. Kelvin and Rankine Thermometer
- I. Pressure Gauge
- J. Compound Gauge
- K. Fundamentals of Refrigeration Trainer
- L. Microcomputer with Dvd Player
- M. Electronic Vacuum Gauge
- N. Bourdon Spring Gauge
- O. Air Conditioners
- P. Air Conditioning Simulator
- Q. Refrigeration Simulator
- R. Routine Classroom Materials
- S. Assorted fittings
- T. ACR tubing's
- U. Refrigerants. 12, 22, 134a
- V. Evaporator repair kit
- W. Oxy acetylene gas
- X. Brazing rods; silver, bronze
- Y. Machine bolts and cap screws
- Z. Refrigeration oil

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.

X. METHOD OF EVALUATION:

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

<u>Components</u>	<u>Weight</u>
Attendance and Participation	..... 10%
Homework and Assignments	..... 10%
Quizzes	..... 15%
Mid Term Grade	..... 25%
Final Exams (Theory/Practical)	..... 40%

	Total = 100%

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

<u>Weight</u>	<u>Letter Grade</u>
90% - 100%	..... A
80% - 89%	..... B
70% - 79%	..... C
65% - 69%	..... D
Below 65%	..... F

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

AC 221- Refrigerant Recovery and Recycling

Student Name: _____

Semester/Year: _____

Instructor's Name (Print): _____

Direction: Asses the student using the rating scale below and check the appropriate numbers to indicate the degree of competency. The numerical rating 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 description 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. Demonstrate the ability to list the environmental protection agency rules and regulations and the effect of CFC's on the ozone layer in the atmosphere.	5 4 3 2 1
B. Demonstrate the ability to lists the functions of different types of recovery equipments and perform appropriate methods of recovery.	5 4 3 2 1
C. Perform recycling of refrigerants, safety measures are in accordance with the industry requirements in line with the Montreal Protocol	5 4 3 2 1
D. Demonstrate the ability to recover and recycle refrigerant in compliance with the industry standards and safety regulations.	5 4 3 2 1

E. Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturers recommendations. 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- 221 Refrigerant Recovery and Recycling

A. Demonstrate the ability to list the environmental protection agency rules and regulations and the effect of CFC's on the ozone layer in the atmosphere.

- 5 List environmental protection agency rules and regulations and the effect of CFCs on the ozone layer in the atmosphere with 90-100% accuracy.
- 4 List environmental protection agency rules and regulations and the effect of CFCs on the ozone layer in the atmosphere with 80-89% accuracy.
- 3 List environmental protection agency rules and regulations and the effect of CFCs on the ozone layer in the atmosphere with 70-79% accuracy.
- 2 List environmental protection agency rules and regulations and the effect of CFCs on the ozone layer in the atmosphere with 65-69% accuracy.
- 1 List environmental protection agency rules and regulations and the effect of CFCs on the ozone layer in the atmosphere with below 65% accuracy

B. Demonstrate the ability to lists the functions of different types of recovery equipments and perform appropriate methods of recovery.

- 5 Lists the functions of different types of recovery equipments and perform appropriate methods of recovery with 90-100% accuracy.
- 4 Lists the functions of different types of recovery equipments and perform appropriate methods of recovery with 80-89% accuracy.
- 3 Lists the functions of different types of recovery equipments and perform appropriate methods of recovery with 70-79 accuracy.
- 2 Lists the functions of different types of recovery equipments and perform appropriate methods of recovery with 65-69% accuracy.
- 1 Lists the functions of different types of recovery equipments and perform appropriate methods of recovery with below 65% accuracy.

C. Perform recycling of refrigerants and safety measures are followed in accordance with the industry requirements in line with the Montreal Protocol.

- 5 Perform recycling of refrigerants and safety measures are observed and followed in accordance with the industry requirements in line with the Montreal Protocol with 90-100% accuracy.
- 4 Perform recycling of refrigerants and safety measures are observed and followed in accordance with the industry requirements in line with the Montreal Protocol with 80-89% accuracy.
- 3 Perform recycling of refrigerants and safety measures are observed and followed in accordance with the industry requirements in line with the Montreal Protocol with 70-79% accuracy.
- 2 Perform recycling of refrigerants and safety measures are observed and followed in accordance with the industry requirements in line with the Montreal Protocol with 65-69% accuracy.
- 1 Perform recycling of refrigerants and safety measures are not observed and followed in accordance with the industry requirements in line with the Montreal Protocol with below 65% accuracy.

D. Demonstrate the ability to recover and recycle refrigerant in compliance with the industry standards and safety regulations

- 5 Recovered and recycled refrigerant is placed in the tank, identified and labeled prior to storage, shipment or reuse in compliance with the industry standards and safety regulations with 90-100% accuracy.
- 4 Recovered and recycled refrigerant is placed in the tank, identified and labeled prior to storage, shipment or reuse in compliance with the industry standards and safety regulations with 80-89% accuracy.
- 3 Recovered and recycled refrigerant is placed in the tank, identified and labeled prior to storage, shipment or reuse in compliance with the industry standards and safety regulations with 70-79% accuracy.
- 2 Recovered and recycled refrigerant is placed in the tank, identified and labeled prior to storage, shipment or reuse in compliance with the industry standards and safety regulations with 65-69% accuracy.
- 1 Recovered and recycled refrigerant is placed in the tank, identified and labeled prior to storage, shipment or reuse in compliance with the industry standards and safety regulations with below 65% accuracy.

E. Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations.

- 5 Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations with 90-100% accuracy.
- 4 Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations with 80-89% accuracy.
- 3 Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations with 70-79% accuracy.
- 2 Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations 65-69% accuracy.
- 1 Demonstrate the ability to maintain recovery instruments and equipments in accordance to the manufacturer's recommendations with below 65% accuracy.