

COURSE OUTLINE

AIR CONDITIONING SYSTEMS
COOLING AND DEHUMIDIFYING
Course Title

AC 212
Dept. & Course No.

I. COURSE DESCRIPTION:

This course provides the students practical knowledge and skills necessary to service and repair air conditioning systems using the latest computer air conditioner simulator.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK: $\frac{1}{\text{(Lecture)}}$ $\frac{6}{\text{(Lab.)}}$ $\frac{7}{\text{(Total)}}$

IV. PREREQUISITE: AC 121

V. STUDENT LEARNING OUTCOME:

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

1. Discuss the design of the different air conditioning systems.
2. List various types of systems and explain their applications.
3. Explain the principles of Air Conditioning System.
4. Classify types of comfort cooling system and recognize variations between them.

VI. COURSE CONTENT:

- A. Air Conditioner Cooling
 1. Window or Through the Wall
 2. Central Air Conditioner
 3. Room Humidifier and Dehumidifier
 4. Automobile Air Conditioner
- B. Types of Systems
 1. Steam Jet Cooling
 2. Vortex Tube Cooling
 3. Evaporative Cooling
- C. Principles of Atmosphere Cooling
- D. Comfort Cooling Systems
 1. Unit Comfort Coolers
 2. Window Units
 3. Cooling Equipment

5. Properly install and service window air conditioners.
 6. Properly install and service console air conditioners.
 7. Demonstrate the ability to check and repair an electrical system on a room unit.
 8. Check and clean filters.
 9. Troubleshoot air conditioning systems.
- E. Installing and Servicing Window Units
 - F. Installing and Servicing Console Air Conditioners
 - G. Electrical Parts
 1. Wiring Diagram
 2. Test Use to Check the System
 3. Causes of Malfunction and Remedial Action
 4. Safety Precaution
 - H. Classes of Impurities in the Air
 1. Ways of Removing Dust Particles in Air
 2. Precautions Used in Cleaning Filters
 - I. Locating Trouble in Air Conditioner
 1. Window Type
 2. Self Contained

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
- U. Assorted fittings
- V. ACR tubing's
- w. Refrigerants. 12, 22, 134a
- X. Evaporator repair kit
- Y. Oxy acetylene gas
- Z. Brazing rods; silver, bronze
- AA. Abrasives
- BB. Cleaning solvents
- CC. Machine bolts and cap screws
- DD. Refrigeration oil
- EE Vacuum pump
- FF. Pressure washer
- GG. Air compressor
- HH. Spray gun
- II. Paints
- JJ. Electrical supplies

VIII. TEXT AND REFERENCES:

A. Text:

Althouse, A. D. , et. al. Modern Refrigeration and Air Conditioning. South Holland, Ill.: Goodhearted Wilcox Publishing Company, Inc., 2000.

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.

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

IX. METHOD OF INSTRUCTION:

- A. Lecture
- B. Demonstration
- C. Group discussion
- D. Audio visual presentation
- E. Field trips
- F. Performance

X. METHOD OF EVALUATION:

Four criteria considered in evaluating projects and performance of operation are:

- A. Accuracy
- B. Techniques
- C. Appearance
- D. Completion

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

<u>Components</u>	<u>Weight</u>
Participation	15%
Quizzes	10%
Mid Term And Final Exams...	20%
Projects.....	55%

	Total = 100%

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

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

TASK LISTS

<u>TASK</u>	<u>TIME</u>
Student Learning Outcome No. 1	6 hrs.
1. Complete the window type air conditioning operational analysis sheet.	
Student Learning Outcome Nos. 5 & 6	15 hrs.
1. Uncrate the unit and check it for damage.	
2. Prepare the unit for installation.	
3. Mount the base.	
4. Hook up the power source.	
5. Test run the unit.	
Student Learning Outcome Nos. 7 & 9	40 hrs.
1. Determine problem in air conditioning electrical system.	
2. Measure voltage in electrical circuit.	
3. Measure amperage in electrical circuit.	
4. Measure resistance in electrical circuit.	
5. Test electrical circuit for continuity.	
6. Measure capacitance of capacitor.	
7. Test equipment for ground.	
8. Make electrical connection.	
9. Connect single phase motor.	
10. Reverse the rotation of a single phase motor.	
11. Install a hard start kit on hermetic compressor.	
12. Install a magnetic coil on motor starter.	
13. Install relay.	
14. Install thermostat control.	
15. Install primary control unit.	
16. Check manufacturer's wiring guide of a unit.	
17. Replace motor overload protector.	
18. Replace solid state control board.	
19. Install crankcase heater.	
20. Measure temperature in AC system.	
21. Locate a leak.	
22. Test refrigeration system.	
23. Evacuate refrigeration unit.	
24. Transfer refrigerant from storage bottle to a charging cylinder.	
25. Check system operating conditions.	
26. Remove test equipment.	
Student Learning Outcome No. 8	36
1. Service air conditioner.	
2. Replace filter.	
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Total	96 hrs.

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

AC 212- Conditioning Systems Cooling and Dehumidifying

Student Name: _____ **Semester/Year:** _____

Instructor's Name (Print): _____

Directions: Asses 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. Demonstrate the ability to determine electrical requirements and prepare cavity and properly install window type air conditioning unit following the manufacturer's specification.	5 4 3 2 1
B. Demonstrate the ability to properly select the appropriate location, make a hole, follow wiring and piping connection instruction, mount the cooling unit, install the condensing unit and test run the split type air conditioning system. According to manufacturer's specifications.	5 4 3 2 1
C. Perform preventive maintenance procedures to maintain the normal performance and increase the lifespan of air conditioning unit.	5 4 3 2 1
D. Use air conditioner simulator to identify, simulate and repair common customer complaints encountered by technicians in the field.	5 4 3 2 1
E. Prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit for proper and safe operation.	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 212 - Air Conditioning Systems Cooling and Dehumidifying

A. Demonstrate the ability to determine electrical requirements and prepare cavity and properly install window type air conditioning unit following the manufacturer's specification.

- 5 Determine electrical requirements, prepare cavity and properly install window type air conditioning unit following manufactures specification and standard with 90-100% accuracy.
- 4 Determine electrical requirements, prepare cavity and properly install window type air conditioning unit following manufacturer's specification and standard with 80-79% accuracy.
- 3 Determine electrical requirements, prepare cavity and properly install window type air conditioning unit following manufacturer's specification and standard with 70-79% accuracy.
- 1 Determine electrical requirements, prepare cavity and properly install window type air conditioning unit following manufacturer's specification and standard with 65-79% accuracy.
- 1 Determine electrical requirements, prepare cavity and properly install window type air conditioning unit following manufacturer's specification and standard with below 65% accuracy.

B. Demonstrate the ability to properly select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, and follow wiring and piping connection instruction according to manufacturer's specifications and test run the split type air conditioning system.

- 5 Select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, and connect wiring and piping following the manufacturer's standard and specifications and test run the split type air conditioning system with 90-100% accuracy.
- 4 Select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, and connect wiring and piping following the manufacturer's standard and specifications and test run the split type air conditioning system with 80-89% accuracy.
- 2 Select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, and connect wiring and piping following the manufacturer's standard and specifications and test run the split type air conditioning system with 70-79% accuracy.
- 2 Select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, and connect wiring and piping following the manufacturer's standard and specifications and test run the split type air conditioning system with 65-69% accuracy.
- 1 Select the appropriate location, make a hole, mount the cooling unit, install the condensing unit, connect wiring and piping

following the manufacturer's standard and specifications and test run the split type air conditioning system with below 65% accuracy.

C. Perform preventive maintenance procedures to maintain the normal performance and increase the life span of air conditioner.

- 5 Inspect refrigerant circuit, clean air filter, evaporator and condenser to maintain the normal performance and increase the life span of air conditioning unit with 90-100% accuracy.
- 4 Inspect refrigerant circuit, clean air filter, evaporator and condenser to maintain the normal performance and increase the life span of air conditioning unit with 80-89% accuracy.
- 3 Inspect refrigerant circuit, clean air filter, evaporator and condenser to maintain the normal performance and increase the life span of air conditioning with 70-79% accuracy.
- 2 Inspect refrigerant circuit, clean air filter, evaporator and condenser to maintain the normal performance and increase the life span of air conditioning unit with 65-69% accuracy.
- 1 Inspect refrigerant circuit, clean air filter, evaporator and condenser to maintain the normal performance and increase the life span of air conditioning unit with below 65% accuracy.

D. Use air conditioner simulator to identify, simulate and repair procedures for common customer complaints encountered by technicians in the field

- 5 Simulate and identify possible causes and effective remedies of the common customer complaints encountered in the field with 90-100% accuracy.
- 4 Simulate and identify possible causes and effective remedies of the common customer complaints encountered in the field with 80-89% accuracy.
- 3 Simulate and identify possible causes and effective remedies of the common customer complaints encountered in the field with 70-79% accuracy.
- 2 Simulate and identify possible causes and effective remedies of the common customer complaints encountered in the field with 65-69% accuracy.
- 1 Simulate and identify possible causes and effective remedies of the common customer complaints encountered in the field with below 65% accuracy.

E. **Prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit for proper and safe operation.**

- 5 Demonstrate the ability to prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit with 90-100% accuracy.
- 4 Demonstrate the ability to prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit with 80-89% accuracy.
- 3 Demonstrate the ability to prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit with 70-79% accuracy.
- 2 Demonstrate the ability to prepare proper tools, identify faults and problems, rectify troubles, but was not able to make necessary repair of air conditioning unit with 65-69% accuracy.
- 1 Demonstrate the ability to prepare proper tools, identify faults and problems, rectify troubles, make necessary repair and test the air conditioning unit with below 65% accuracy.