

COURSE OUTLINE

FUNDAMENTALS OF REFRIGERATION
COURSE TITLE

AC 111
Dept. & Course No.

I. COURSE DESCRIPTION:

This introductory course provides instruction in basic physical, chemical, and engineering principles applicable to refrigeration. This also covers the physical laws, which apply to refrigeration.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK: 3 0 3
 LECTURE LAB TOTAL

IV. PRE-REQUISITES: N O N E

V. STUDENT LEARNING OUTCOME:

VI. COURSE CONTENT:

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

1. Describe the early development of Refrigeration

A. Development of refrigeration.

1. Brief historical sketch of "man-made" cold
2. Early experiments with food preservation

2. Discuss the basic physical, chemical, and engineering principles applicable to refrigeration

B. How a mechanical refrigeration operate

1. Heat
2. Heat flow
3. Cold

3. Explain how cold preserves food

C. Cold preservation

4. Define the basic refrigeration terms

D. Refrigeration Cycle

1. Motor compressor
2. Condenser
3. Metering device
4. Evaporator
5. Connecting Tubing

5. Explain the principles of heat of energy in Refrigeration
 - E. 1. Nature and effect
 2. Application of heat and heat energy in Refrigeration
 3. Methods of heat transfer

6. Compare Fahrenheit, Celsius, Kelvin and rankine temperature
 - G.1. Thermometer scales, Fahrenheit and Celsius
 2. Absolute temperature scales, Kelvin and rankine

7. Use temperature conversion formulas to convert from one temperature scale to another
 - H. Temperature conversion formulas

8. Determine the area and volume of cabinets
 - I.1. Dimensions
 2. Angular measurement
 3. Weight and mass

9. Explain the difference between PSIA (absolute pressure) and PSIG (gauge pressure)
 - J.1. Pascal's Law
 2. Pressure-atmospheric, gauge, and absolute

10. Explain physical laws which apply to refrigeration
 - K.1. Laws of Thermodynamics
 2. Laws of Refrigeration

11. Discuss the differences between sensible heat, specific heat, and describe their application
 - L.1. Sensible heat
 2. Latent heat
 3. Refrigerating effect of ice
 4. Ton of Refrigeration effect
 5. Ambient temperature

12. Demonstrate and explain the relationship for S/I metric and US conventional measurement
 - M. S/I metric measurement and US conventional measurement

13. Calculate the enthalpy of water at various temperatures
 - N. Daltons Law

14. Define the principles of air Conditioning and other terms important to air conditioning systems
 - O. Definition of Air conditioning

15. Discuss the physical principles of air movement and humidity
 - P. Physical properties of air

- | | |
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| 16. List the important factors involved in the operation of an Air conditioning systems | Q. Factors involved in the operation of an Air conditioning Systems |
| 17. List and explain the factors Air Conditioning which affect comfort, health, and methods conditioning air for these purpose | R. Factors of Air Conditioning which affect comfort, health, and methods of conditioning air |
| 18. Read and interpret Psychometric charts and scales | S. Psychometric chart and scales |

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. 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 tubings
- w. Refrigerants. 12, 22, 134a
- X. Evaporator repair kit
- Y. Oxy acetylene welding equipment
- Z. Brazing rods; silver, bronze
- AA. Abrasives
- BB. Cleaning solvents
- CC. Machine bolts and cap screws
- DD. Refrigeration oil

VIII. TEXT AND REFERENCES:

A. TEXT:

Althouse, A.D., et al. Modern Refrigeration and Air Conditioning. South Holland, ILL.: Goodhearted Wilcox Publishing Company, Inc., 2004.

B. REFERENCES:

Miller, Rex. Refrigeration and Air Conditioning Technology. Peoria, ILL.: Benett 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 Condtoning 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 Trip

X. METHOD OF EVALUATION:

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

Components	Weight
Participation	..... 10%
Homework and Assignments	..... 10%
Quizzes	..... 15%
Mid Term Grade	..... 25%
Final Exams	..... 40%

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

**Course Level Achievement
Form A**

(Used for all shop courses as well as other program courses)

AC 111 - Fundamentals of Refrigeration

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. Explain the principles of heat transfer and how cold preserves food.	5 4 3 2 1
B. Compare Fahrenheit, Celsius, Kelvin, and Rankine temperatures and use temperature conversion formulas to convert from one temperature scale to another.	5 4 3 2 1
C. Name and explain the physical law of thermodynamics applied to refrigeration.	5 4 3 2 1
D. Identify and describe the functions of the component parts of refrigerating system.	5 4 3 2 1
E. List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose.	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

AC111 - Fundamentals of Refrigeration

A. Explain the principles of heat transfer and how cold preserves food.

- 5 Explain the principles of heat transfer and how cold preserves food with 90-100% accuracy.
- 4 Explain the principles of heat transfer and how cold preserves food with 80-89% accuracy.
- 3 Explain the principles of heat transfer and how cold preserves food with 70-79% accuracy.
- 2 Explain the principles of heat transfer and how cold preserves food with 65-69% accuracy.
- 1 Explain the principles of heat transfer and how cold preserves food with below 65% accuracy.

B. Compare Fahrenheit, Celsius, Kelvin, and Rankine temperatures and use temperature conversion formulas to convert from one temperature scale to another.

- 5 Compare and use temperature conversion formulas in converting from one temperature scale to another with 90-100% accuracy.
- 4 Compare and use temperature conversion formulas in converting from one temperature scale to another with 80-89% accuracy.
- 3 Compare and use temperature conversion formulas in converting from one temperature scale to another with 70-79% accuracy.
- 2 Compare and use temperature conversion formulas in converting from one temperature scale to another with 65-69% accuracy.
- 1 Compare and use temperature conversion formulas in converting from one temperature scale to another with below 65% accuracy.

C. Name and discuss the physical laws of thermodynamics applied to refrigeration.

- 5 Name and explain the physical laws of thermodynamic applied to refrigeration with 90-100% accuracy.
- 4 Name and explain the physical laws of thermodynamic applied to refrigeration with 80-89% accuracy.

- 3 Name and explain the physical laws of thermodynamic applied to refrigeration with 70-79% accuracy.
- 2 Name and explain the physical laws of thermodynamic applied to refrigeration with 65-69% accuracy.
- 1 Name and explain the physical laws of thermodynamics applied to refrigeration with below 65% accuracy.

D. Identify and describe the functions of the component parts of refrigerating system.

- 5 Identify and describe the functions of the component parts of refrigerating system with 90-100% accuracy.
4. Identify and describe the functions of the component parts of refrigerating system with 80-89% accuracy.
- 3 Identify and describe the functions of the component parts of refrigerating system with 70-79% accuracy.
- 2 Identify and describe the functions of the component parts of refrigerating system with 65-69% accuracy.
- 1 Identify and describe the functions of the component parts of refrigerating system with below 65% accuracy.

E. List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose.

5. List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose with 90-100% accuracy.
- 4 List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose with 80-89% accuracy.
- 3 List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose with 70-79% accuracy.
- 2 List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose with 65-69% accuracy.
- 1 List and explain the factors of air conditioning that affect comfort and health and the methods of conditioning air for this purpose with below 65% accuracy.