

## COURSE OUTLINE

### PSYCHROMETRY AND COOLING LOAD

Course Title

AC213

Dept. & Course No.

#### I. COURSE DESCRIPTION:

This course covers the chemistry of air, air and human comfort, psychrometric properties of air, the psychrometric chart, problems for the conditioned air supply, conduction, solar transmission, occupancy and equipment heat gains and losses, coil load and total air supply.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK:  $\frac{3}{\text{Lec}}$        $\frac{0}{\text{Lab}}$        $\frac{3}{\text{Total}}$

IV. PRE REQUISITE: AC 122

V. STUDENT LEARNING OUTCOME :

VI. COURSE CONTENT:

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

1. Explain the principles of air conditioning.

2. Discuss the physical principles of air movement and humidity.

3. List and discuss important factors involved in the operation of an air conditioning system.

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

A. Definition

1. Air Conditioning.
2. Air- Atmosphere.

B. Physical Properties of Air.

1. Humidity
2. Air Temperature

C. Vapor Barriers

1. Air Movement
2. Climate
3. Heat Insulation

5. Describe the use for various psychrometry instruments.

6. Read and interpret psychrometric charts and scales.

7. Explain and calculate heat loads.

8. Demonstrate the proper use of tables in computing heat loads.

#### D. Air Quality

1. Outdoor Air and Contaminants.
2. Indoor Air Quality
3. Indoor Air Contaminants.

#### E. Psychrometry Instruments

1. Psychrometer
2. Dry Bulb Thermometer
3. Hygrometer
4. Pilot tubes
5. Recorders
6. Manometers
7. Barometer

#### F. Psychrometric Properties of Air.

1. Psychrometric Charts.
2. Dew Point

#### G. Heat Loads

1. K, R, and U Factors
2. Air Change Heat Loads
3. Product Heat Loads.
4. Miscellaneous Heat Loads.
5. Cabinet Areas
6. Cabinet Volume

#### H. Total Heat Loads

1. Heat Leakage Using Tables.
2. Usage Load Using Tables.

9. Correctly size system components using manufacturers table.

I. Thermodynamics of the Refrigeration Cycle.

1. Pressure Heat Diagram
2. Constant Value Lines of Pressure-heat Chart.
3. Effect of Pressure on Latent Heat.
4. Evaporator and Condensing Unit Capacities.
5. System Capacity.
6. Compressor Capacity
7. Refrigerant Line Capacities.

10. Discuss and calculate seasonal energy efficiency ratio(SEER)

J. Energy Efficiency Ratio and Coefficient of Ratio.

11. Determine heat load through the use of U or R valves, square footage, and design temperature chart.

K. Heat loads for cooling

1. Infiltration Chart
2. Heat Transfer Rate.
4. U Valve for Computing Heat Leakage.
5. R Valve for Heat Leakage.
6. Wall Heat Leakage Areas
7. Whole House Worksheet

## 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. Electronic Thermometer
  1. Glass Stem Thermometer with range form 40 to 210 °F and 40 to 100 Celsius

- 2. Kelvin and Rankine Thermometer
- E. Tape Rule: US standard and Standard International
- F. Pressure Gauge
- G. Compound Gauge
- H. Fundamentals of Refrigeration Trainer
- I. Microcomputer with Dvd Player
- J. Electronic Vacuum Gauge
- K. Bourdon Spring Gauge
- L. Air Conditioners
- M. Air Conditioning Simulator
- N. Refrigeration Simulator
- O. Routine Classroom Materials
- P. Assorted fittings
- Q. Refrigerants. 12, 22, 134a
- R. Evaporator repair kit
- S. Abrasives
- T. Cleaning solvents
- U. Machine bolts and cap screws

#### VIII. TEXT AND REFERENCES:

##### A. TEXT:

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

##### B. REFERENCES:

Miller, Rex. Refrigeration and Air Conditioning Technology. Peoria, ILL.: Bennett and McNight, 2000.

Warren, Marsh and Olivo, C.T. Principles of Refrigeration. Albany, New York: Del Mar Publisher, 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 Trip

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 .....	25%
Final Exams .....	40%
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	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
0 - 64% .....	F

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

AC 213 – Psychrometry and Cooling Load

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. Explain the principles of air conditioning, air movement and humidity.	5 4 3 2 1
B. List and explain important factors involved in the operation of and air conditioning system.	5 4 3 2 1
C. Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments.	5 4 3 2 1
D. Calculate heat load and identify its sources for Both heating and cooling space.	5 4 3 2 1
E. Explain and calculate seasonal energy efficiency Ratio and determine heat load through the use of U or R Values, square footage and design temperature chart	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.

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Instructor's Signature

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Date

## AC 213 – Psychrometry and Cooling Load

### **A. Explain the principles of air conditioning, air movement and humidity.**

- 5 Explain the principles of air conditioning, air movement and humidity with 90-100 accuracy.
- 4 Explain the principles of air conditioning, air movement and humidity with 80-89 % accuracy.
- 3 Explain the principles of air conditioning, air movement and humidity with 70-79 % accuracy.
- 2 Explain the principles of air conditioning, air movement and humidity with 65-69 % accuracy.
- 1 Explain the principles of air conditioning, air movement and humidity with below 65% accuracy.

### **B. List and explain important factors involved in the operation of and air conditioning system.**

- 5 List and explain important factors involved in the operation of and air conditioning system with 90-100 % accuracy.
- 4 List and explain important factors involved in the operation of and air conditioning system with 80-89 % accuracy.
- 3 List and explain important factors involved in the operation of and air conditioning system with 70-79 % accuracy.
- 2 List and explain important factors involved in the operation of and air conditioning system with 65-69 % accuracy.
- 1 List and explain important factors involved in the operation of and air conditioning system with below 65% accuracy

### **C. Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments.**

- 5 Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments with 90-100 % accuracy.
- 4 Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments with 80-89 % accuracy.



- 3 Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments with 70-79 % accuracy.
- 2 Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments with 65-69 % accuracy.
- 1 Read and interpret psychrometric chart and scales, calculate heat loads using heat load table and relate the uses of various psychrometry instruments with below 65 % accuracy.

**D Calculate heat load and identify its sources for both heating and cooling space.**

- 5 Calculate heat load and identify its sources for both heating and cooling space with 90 – 100% accuracy.
- 4 Calculate heat load and identify its sources for both heating and cooling space with 80 –89% accuracy.
- 3 Calculate heat load and identify its sources for both heating and cooling space with 70 – 79 % accuracy.
- 2 Calculate heat load and identify its sources for both heating and cooling space with 65 –69 % accuracy.
- 1 Calculate heat load and identify its sources for both heating and cooling space with below 65 % accuracy.

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**E. Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart**

- 5 Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart with 90-100% accuracy
- 4 Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart with 80-89 % accuracy.
- 3 Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart with 70-79 % accuracy.

- 2 Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart with 65-69 % accuracy
- 1 Explain and calculate seasonal energy efficiency ratio and determine heat load through the use of U or R Values, square footage and design temperature chart with below 65% accuracy.