



COURSE OUTLINE

Course Number HRA 101	Course Title Principles of Refrigeration / Air Conditioning I	Credits 2
Hours: Lecture/Lab/Other 1 Lecture/2 Lab	Pre-requisite MAT 037 or equivalent	Implementation Semester & Year Spring 2022

Catalog description:

Fundamental principles of pressure and temperature relationships, heat transfer, and heating and cooling concepts. Specific topics include leak detection, types of refrigerants, piping materials, and connections.

General Education Category:

Not GenEd

Course coordinator:

Harry Bittner, 609-570-3751, bittnerh@mccc.edu

Required texts & Other materials:

Refrigeration & Air Conditioning Technology by Whitman, Johnson, Tomczyk, 5th Edition, Thompson Learning ISBN: 1-4018-3765-4.

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. Explain the various fundamental scientific principles involved in heat flow and heat transfer including pressure and temperature relationships. [ILG # 1, 3; PLO # 1, 6, 8, 10]
2. Explain the difference between various types of refrigerants and determine the proper application of each. [ILG # 1, 3; PLO # 1, 6, 8, 10]
3. Safely perform the mechanical tasks that are fundamental to a career in Refrigeration and Air Conditioning. [ILG # 4, 10, 11; PLO # 2, 3, 10]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.

Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Heating, Refrigeration and Air Conditioning (PLO)

1. Explain the basic theories and fundamental principles of heat transfer.
2. Service, troubleshoot, and repair domestic and commercial refrigeration and air conditioning systems and components.
3. Use electrical and mechanical test equipment and metering devices.
6. Communicate effectively by oral, written, or graphic means.
8. Understand the laws of physics as they apply to the subject field.
10. Apply the fundamental laws of thermodynamics and the basic principles of heat flow as they apply to HRAC.

Units of study in detail – Unit Student Learning Outcomes:

Unit I **Pressure / Temperature Relationships of Heat and Heat Flow** [Supports Course SLO # 1, 3]

Learning Objectives

The student will be able to:

1. Perform various pressure and temperature measurements in the system and relate to pressure temperature charts.
2. Explain the basic concepts of heat and heat flow in reference to comfort cooling and refrigerating.
3. Clearly define and explain the types of heat necessary to understand the air conditioning or refrigeration circuit.

Unit II **Refrigerant Use** [Supports Course SLOs # 1, 2, 3]

Learning Objectives

The student will be able to:

1. Explain the characteristics and application of the most common refrigerants used today and be able to recognize the chemical name of each.
2. Describe the different operating pressures of the common refrigerants.
3. Identify the type leak detection device to be used with each type of refrigerant and be able to utilize the devices to locate refrigerant leaks.

Unit III **Mechanical Components and Related Skills** [Supports Course SLOs # 3]

Learning Objectives

The student will be able to:

1. Determine the types of materials, pipe fittings and tubing used with various refrigerants.
2. Extract various pipe, tubing material and fitting data from reference books, manuals, charts, etc.
3. Determine the types of joints which should be used for various applications and be able to safely and competently use the tools and equipment required to make them.
4. Select the proper solders and brazing materials to be used for various connections and perform the fundamental joining tasks that are basic to the industry.
5. Use the various leak detection devices and methods which are available and troubleshoot various fluid systems for leaks.

Evaluation of student learning: [Evaluates SLOs # 1, 2, 3]

Students' achievement of the course objectives will be evaluated through the use of the following:

- Results of a comprehensive final exam.
- Test results (a minimum of two tests, other than the final examination)
- Laboratory Performance
 - A laboratory evaluation of each student's ability to perform basic tubing, fitting and tool identifications, and basic swaging, faring, soldering and brazing procedures will be performed.
 - A performance evaluation of leak detection procedures will be conducted utilizing various methods and fluid system components.
- Attendance.

Evaluation Tools	Percentage Of Grade
Unit Tests and Exam	25%
Laboratory Performance	25%
Attendance	50%
Total	100%