

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**HRA105**

**PRINCIPLES OF REFRIGERATION**

5 Credit Hours

Prepared by  
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## HRA105 Principles of Refrigeration

### I. CATALOGUE DESCRIPTION

- A. Prerequisite or Co-Requisite: None
- B. 5 Hour Semester Course
- C. Principle of Refrigeration is a lecture/laboratory course including study of basic refrigeration theory, use of hand tools and test equipment, soldering and brazing, and evacuating and charging systems.

### II. EXPECTED LEARNING OUTCOMES / ASSESSMENT MEASURES

Students will be able to identify common terms in refrigeration theory	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to convert temperature scales and explain (3) types of heat	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to determine lengths, areas, and volumes	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to cut, bend, and identify various types and sizes of tubing	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to identify and perform four methods of connecting tubing	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to identify and use air acetylene and oxy/acetylene sets	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects
Students will be able to explain basic refrigeration systems	In Class Exam as well as Homework and/or Quizzes and/or in Class Projects

### III. OUTLINE OF TOPICS

#### SECTION1: THEORY OF HEAT

- A. Fundamentals of Refrigeration
  - 1) Discuss the basic physical, chemical and engineering principles applicable to refrigeration
  - 2) Explain how cold preserves food
  - 3) Define basic refrigeration terms
  - 4) Explain the principles
  - 5) Compare Fahrenheit to Celsius temperature scales.

- 6) Determine area and volume of cabinets
- 7) Discuss the difference between sensible heat, specific heat and latent heat

B. Refrigeration Tools and Materials

Upon Completion of this unit the student will be able to:

- 1) List and discuss the various types of tubing used in refrigeration work
- 2) Cut and fit tubing using approved methods
- 3) Demonstrate soldering and brazing techniques
- 4) Select proper tools for servicing domestic refrigerators
- 5) Demonstrate standard procedures for basic mechanical service and repair operations
- 6) Explain how to maintain and calibrate gauges
- 7) Explain the use of vacuum and compound gauges
- 8) Define various types of service valves
- 9) Discuss the importance of oil in the system
- 10) Discuss the evaluation of a system

C. Basic Refrigeration Systems

Upon completion of this unit the student will be able to:

- 1) Explain the operation of a simple ice refrigerator
- 2) Explain how evaporation provides a cooling effect
- 3) Name the basic mechanical refrigeration systems
- 4) Explain various applications for mechanical refrigeration systems
- 5) Describe the operation of various mechanical refrigeration systems
- 6) Compare compression and absorption type systems
- 7) Discuss refrigeration systems using ice makers and water coolers
- 8) Explain how a system using an expendable type of refrigerant works
- 9) Discuss and compare domestic and commercial refrigeration systems
- 10) Compare the difference between hot gas and electric defrost systems

D. Compression systems and compressors

Upon completion of this unit the student will be able to:

- 1) State five thermal laws relating to refrigeration
- 2) List the components of a refrigeration compression system
- 3) Explain the operation of each component of a compression system
- 4) Trace the flow of refrigerant through a complete refrigeration system
- 5) Name the two types of motor control and discuss their operation and purpose.

- 6) Describe the five principal types of refrigerant controls and their operation
- 7) Name four different types of compressors
- 8) Explain how compressors operate
- 9) Identify the internal part of a compressor

E. Refrigerant Controls

- 1) Explain the purpose and operation of refrigerant control devices
- 2) Name the five main types of controls and explain their operation
- 3) Define terms related to refrigerant control operations
- 4) Compare the various charging elements used on refrigerant controls
- 5) Determine the proper size capillary tube to be used for specific applications
- 6) Explain the operation of special refrigerant controls
- 7) Define the purpose and function of three types of solenoid valves

IV. METHOD OF INSTRUCTION

- A. Classroom Lecture
- B. Lab Demonstrations
- C. Specialty Lectures by Industry Personnel

V. REQUIRED TEXTBOOK WITH PUBLICATION INFORMATION

Whitman, Johnson, Tomzyk, Silberteinn; *Refrigeration and Air Conditioning Technology*, (Current Edition); Delmar Publications; ISBN-1-4283-1936-0

VI. REQUIRED MATERIALS (STUDENT)

Basic Hand Tools (As outline on attached tool list)

VII. METHOD OF EVALUATION (BASIS FOR DETERMINING GRADE)

- |                                      |     |
|--------------------------------------|-----|
| A. Theory – Tests, Quizzes, Homework | 45% |
| B. Shop/Lab                          | 45% |
| C. Instructor Evaluation, Attendance | 10% |

VIII. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

IX. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website, <http://www.jeffco.edu>).

X. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

XI. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.

## Heating, Refrigeration, and Air Conditioning Hand Tool List

All of the tools on the following list will be used in the first and second years of training. All tools and equipment should be marked for identification. Any used tools or similar equipment is acceptable provided they are safe to use and are adequate for the program. The tools marked with an \* may be purchased through different suppliers at a student discount.

- ! Padlock with keys or combination lock
- ! Tool pouch with belt or small tool box
- ! VOM Fieldpiece SC76
- ! Pump (multi-pliers) pliers – insulated handle only – 10”
- ! Screwdriver pocket size – square tip
- ! Screwdriver 6” blade – square tip – insulated handle only
- ! Screwdriver 6” blade – Phillip’s-tip – insulated handle only or multi-bit or combination set
- ! Long-nose (needle-nose) pliers #6 – insulated handle only
- ! Slip-joint (wire pliers) pliers #6 – insulated handle only
- ! Diagonal (side cutters) pliers #6 – insulated handle only
- ! Protective (safety) glasses, clear glass w/side shields only (students must have and use safety glasses in the shop area at all times)
- ! Center punch
- ! Hammer ball being 8 oz. (no claw hammer)
- ! \* Allen Screw Wrench set #TL16 or equal (must have 6” shafts)
- ! Nut Driver Set 3/16” to 1/2” (or socket set)
- ! 6-piece open-end wrench set 3/8” to 11/16” (or box-end wrench set)
- ! 8” adjustable wrench
- ! Steel-tape rule 6”
- ! Robinair gauge manifold set #40153 or equal
- ! 10” adjustable wrench
- ! Tool box with tray
- ! \*Flaring tool set 3/16” to 5/8”
- ! \*Tube cutter 3/16” to 5/8”
- ! \*Swaging tool set 3/16” to 5/8” (5pc)
- ! \*Tubing reamer #208F
- ! \*Thermometer pocket -20<sup>0</sup> to 220<sup>0</sup> F (no glass)
- ! \*Reversible ratchet wrench 1/4", 3/8", 3.16", 5/16"
- ! \*Tubing cutter small (Imp) TC1050
- ! \*Constrictor wheel #76637

### **Shop Work Schedule**

All shop work assignments are in Lab Manual Refrigeration and Air Conditioning Technology Sixth Edition, Delmar Cengage Learning. Assignments in lab manual will follow scheduled theory lecture chapters. Chapter one In Theory Textbook Refrigeration & Air Conditioning Technology by Bill Whitman, Bill Johnson, John Tomczk, and Eugene Silberstein will be chapter one in lab manual Refrigeration and Air conditioning Technology.