

I. CATALOG DESCRIPTION:

- A. Department Information:
- Division: Technology
 - Department: Refrigeration and Air Conditioning
 - Course ID: REFRIG 105x3
 - Course Title: Refrigeration Electricity II
 - Units: 4
 - Lecture: 3 Hours
 - Lab: 3 Hours
 - Prerequisite: REFRIG 104x3 or equivalent

B. Course and Schedule Description: A study of solid state control systems, emphasizing schematic reading and electrical troubleshooting pertaining to refrigeration equipment. Includes practical lab work with electrical refrigeration trainers and projects.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: Three (3)

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon completion of the first repetition of the course, students will be able to:

- A. Distinguish between different electrical systems used in refrigeration, heating, and air conditioning circuits.
- B. Interpret schematics and diagrams.
- C. Describe the electrical sequence of operation in refrigeration, heating, and air conditioning systems.
- D. Apply troubleshooting techniques to the electrical systems of refrigeration, heating, and air conditioning circuits.
- E. Categorize any of the four basic compressor-starting circuits (without notes).
- F. Select safe safety practices.

Upon completion of the second repetition of the course, students will be able to:

- A. Illustrate skill and knowledge by identifying and categorizing electrical components common to refrigeration heating and air conditioning circuits.
- B. Demonstrate schematic analysis skills by identifying electrical symbols common to refrigeration heating and air conditioning.
- C. Develop skill and confidence helping first-time students.

Upon completion of the third repetition of the course, students will be able to:

- A. Explain the purpose and operation of electrical components common to refrigeration heating and air conditioning.
- B. Demonstrate troubleshooting skills by troubleshooting circuits common to refrigeration heating and air conditioning.
- C. Use their improved knowledge, skills and confidence to help first-time students.

IV. CONTENT:

- A. Schematic Reading
 - 1. Schematics and wiring diagrams
 - 2. Developing wiring diagrams
- B. Component Identification
 - 1. Control components
 - 2. Refrigeration components
- C. Troubleshooting
 - 1. Troubleshooting components

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2. Control circuit analysis
3. Control circuit development
- D. Power Distribution Systems
 1. Line voltage identification
- E. Motor Theory
 1. Motor application analysis
 2. Three-phase system analysis
 3. Three-phase motor principles
- F. National Electrical Code
 1. Electrical requirements for Environmental Protection Agency 604 certification
- G. Industry Equipment Upgrades

V. METHODS OF INSTRUCTION:

Methods of instruction will vary from instructor to instructor but may include:

- A. Lectures and discussions about electrical schematics, HVAC electrical systems/circuits, their purpose, applications and troubleshooting.
- B. Lectures and discussions are complemented with practical laboratory projects emphasizing system properties, methods of analysis and troubleshooting.
- C. Dynamics are accented with the use of show and tell demonstrations and videos.
- D. Homework is assigned to promote expertise, vocabulary, and writing skills.

VI. TYPICAL ASSIGNMENTS:

Typical assignments will vary from instructor to instructor but may include:

- A. Draw the ladder diagram for a chiller control system.
- B. What are the two types of motor controls?
- C. Design and construct a control system for a multiple compressor system.
- D. Assemble a project portfolio including: pictorial diagrams, assembly procedures, pictures, and a project term paper (graded on content and spelling).

VII. EVALUATION:

A. Methods of evaluation will vary from instructor to instructor but shall include:

1. Written tests
2. Final exam
Typical Questions:
 - a. What purpose does the thermistor connected in parallel with the capacitor serve?
 - b. What is a legend?
3. Practical evaluations, including a student lab notebook consisting of no less than ten, lab project reports.

B. Frequency of evaluation will vary from instructor to instructor but may include:

1. Three written tests
2. One final exam.

C. Levels of evaluation upon repetition:

1. First enrollment:
Students have a good understanding of the operation of electrical components common to refrigeration heating and air conditioning.
2. Second enrollment:
Students must show growth in their knowledge, skill and confidence and are expected to have a thorough understanding of electrical circuits common to refrigeration heating and air conditioning.
3. Third enrollment:
Students will use their improved skills and confidence in working as group leaders and assisting the instructor.

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VIII. TYPICAL TEXT:

Smith, Electricity for Refrigeration, Heating, and Air Conditioning, 5th Edition, Delmar, Albany, New York, 1997
Herman, S., Electricity and Controls for HVAC/R, Delmar, New York, 2001
Mahoney, E., Electricity for Air Conditioning and Refrigeration Technicians, Prentice Hall, 2000

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: None

**Content Review Form
PREREQUISITE COURSE**

Target Course: REFRIG 105x3: Refrigeration Electricity II

Prerequisite Course: REFRIG 104x3: Refrigeration Electricity I

Instructions:

1. List exit competencies (skills) from Prerequisite Course. These skills are listed in the "Student Outcomes" section of the Course Outline ("upon completion of the course, the student should be able to...")
2. Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.
3. Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:

1=Critical

2=Very Helpful

3=Desirable

Skills Analysis

Exit Skills in Prerequisite Course

Entry Skills Needed for
Success in Target Course
(Mark with an X if needed.)

Degree of
Importance
(Rate 1 - 3)

1. Distinguish between common electrical components used in the refrigeration field.		
2. Demonstrate an understanding of how the components function and knowledge of each component purpose.	X	
3. Measure ohms, amps, and volts using a multi-meter.	X	1
4. Select troubleshooting techniques on an electrically malfunctioning refrigeration system using a ladder diagram.	X	1
5. Test compressor terminals for shorts and grounds.	X	1
6. Practice safety procedures.	X	1
	X	1
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