

COURSE SYLLABUS

LAST REVIEW	Fall 2022
COURSE TITLE	HVAC Systems
COURSE NUMBER	ELET 0240
DIVISION	Career and Technical Education
DEPARTMENT	ELET
CIP CODE	46.0302
CREDIT HOURS	2
CONTACT HOURS/WEEK	Class: 2 Lab: 0
PREREQUISITES	None
COREQUISITES	None

COURSE DESCRIPTION

This is a beginning course in heating, ventilation and air conditioning technology that is appropriate for HVAC majors and other interested students. Upon successful completion of this course, the student should be able to identify the function of the basic components of an air-conditioning system. Topics will include heat laws, refrigerants, oils, and refrigeration cycles of residential and light commercial systems. In the lab, students will design, assemble, and operate a working refrigeration system. Competencies will include brazing, wiring, evacuating, and charging a system. The student will be required to provide ANSI Z87 safety glasses and may be expected to provide other basic hand tools and/or equipment.

PROGRAM ALIGNMENT

This course is part of a program aligned through the Kansas Board of Regents and Technical Education Authority. For more information, please visit:

https://kansasregents.org/workforce_development/program-alignment

PROGRAM LEARNING OUTCOMES

1. The Student will be able to identify workplace safety issues in accordance with OSHA standards.
2. Upon successful completion of this course, the student should be able to identify the job skills necessary to have a successful career in the Electrical Profession.
3. Inspect electrical circuit connections in accordance with the N.E.C. standards of compliance.

TEXTBOOKS

<http://kckccbookstore.com/>

METHOD OF INSTRUCTION

A variety of instructional methods may be used depending on content area. These include but are not limited to lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE

- I. Fundamentals of Refrigeration Theory
 - A. Define temperature.
 - B. Make conversions between Fahrenheit and Celsius scales.
 - C. Describe molecular motion at absolute zero.
 - D. Define the British thermal unit.
 - E. Describe heat flow between substances of different temperatures.
 - F. Explain the transfer of heat by conduction, convection, and radiation.
 - G. Define sensible heat, latent heat, and specific heat.
 - H. State atmospheric pressure at sea level and explain why it varies at different elevations.
 - I. Describe two different types of barometers.
 - J. Explain Psig and Pisa as they apply to pressure gages.
- II. Matter and Energy
 - A. Define matter.
 - B. List the three states in which matter is commonly found.
 - C. State two forms of energy important to the air conditioning (heating and cooling) and refrigeration industry.
 - D. Define horsepower.
 - E. Convert horsepower to watts.
 - F. Convert watts to British thermal units.
- III. Refrigeration and Refrigerants
 - A. State three reasons why ice melts in ice boxes
 - B. Describe the term "a ton of refrigeration"
 - C. Describe the basic refrigeration cycle
 - D. Explain the relationship between pressure and the boiling point of water or other liquids.
 - E. Describe the function of the evaporator or cooling coil.
 - F. Explain the purpose of the compressor.
 - G. Describe the function of the condensing coil.
 - H. State the purpose of the metering device.
 - I. List refrigerants commonly used in residential and light commercial refrigeration and air conditioning systems.

- J. List four characteristics to consider when choosing a refrigerant for a system.
- IV. System Charging
 - A. Describe how refrigerant is charged into systems in the vapor and the liquid states.
 - B. Describe system charging using two different weighing methods.
 - C. State the advantage of using electronic scales for weighing refrigerant into a system.
 - D. Describe two types of charging devices.
- V. Evaporators and the Refrigeration Systems
 - A. Define high-, medium-, and low-temperature refrigeration
 - B. Determine the boiling temperature in an evaporator
 - C. Identify different types of evaporators
- VI. Condensers
 - A. Explain the purpose of the condenser in a refrigeration system
 - B. Describe the differences in operating characteristics between water-cooled and air-cooled systems
 - C. Describe the basics of exchanging heat in a condenser
 - D. Explain the difference between a tube within a tube-coil type condenser and a tube within a tube-serviceable condenser
 - E. Describe a cooling tower
 - F. Explain the relationship between the condensing refrigerant and the condensing medium
- VII. Compressors
 - A. Explain the function of the compressor in a refrigeration system.
 - B. Describe compression ratio.
 - C. Explain the difference between a hermetic compressor and semi-hermetic compressor.
 - D. Describe the various working parts of reciprocating and rotary compressors
- VIII. Expansion Devices
 - A. Describe the three most popular types of expansion devices
 - B. Describe the operating characteristics of the three most popular expansion devices.
 - C. Describe how the three expansion devices respond to load changes

COURSE LEARNING OUTCOMES AND COMPETENCIES

Upon successful completion of this course, the student will:

- A. Draw the basic refrigerant system, labeling components, pipes, and wires.
 1. Identify each major component of the refrigeration system.
 2. Explain the function of each component.
 3. Explain the high and low side cycle.
 4. Explain the power requirements.

- B. Demonstrate an understanding for simple and complex electrical circuits using basic electrician's math, commonly used electrical terms and ohm's law.
 - 5. Explain power needs for the compressor.
 - 6. Explain power needs for the condenser fan motor.
 - 7. Explain low voltage control circuit.
- C. Measure and calculate system/compressor efficiency.
 - 8. Determine high pressure with gauges.
 - 9. Determine low pressure with gauges.
 - 10. Determine adequate pressure with gauges.
- D. Fabricate a soldering and brazed tubing project using Cu and Al tubing.
 - 11. Use silver solder for brazing.
 - 12. Use propane cylinder for heating.
 - 13. Use a torch for brazing.
- E. Examine tubing project joints at 300 psi and test for leaks.
 - 14. Inspect tubing for restrictions.
 - 15. Inspect tubing for severe bends.
 - 16. Pressurize tubing for leaks.
 - 17. Inspect tubing for moisture.
- F. Test and evaluate temperatures, pressures, and superheat of an operating refrigeration trainer.
 - 18. Analyze pressure and temperature reading.
 - 19. Determine superheat differential.
- G. Wire different electrical circuits to compressors.
 - 20. Wire according to manufacturer's schematic.
- H. Evacuate and charge basic refrigeration systems with refrigerant.
 - 21. Use a vacuum pump.
 - 22. Recover the refrigerant.

ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES

Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES

Student Handbook

<https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf>

College Catalog

<https://www.kckcc.edu/academics/catalog/index.html>

College Policies and Statements

<https://www.kckcc.edu/about/policies-statements/index.html>

Accessibility and Accommodations

<https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html>.