

## COURSE SYLLABUS

<b>LAST REVIEW</b>	Fall 2022
<b>COURSE TITLE</b>	Heating Geothermal (Green Technology)
<b>COURSE NUMBER</b>	HVAC 0235
<b>DIVISION</b>	Career and Technical Education
<b>DEPARTMENT</b>	HVAC
<b>CIP CODE</b>	47.0201
<b>CREDIT HOURS</b>	1
<b>CONTACT HOURS/WEEK</b>	Class: 1                      Lab: 2
<b>PREREQUISITES</b>	HVAC 0100, HVAC 0203

### COURSE DESCRIPTION

This course will cover the Geothermal heat pumps which are refrigeration machines. Geothermal heat pumps use the earth, or water in the earth, for their heat source and heat sink. Energy is transferred daily to and from the earth by the sun's radiation, rain, and wind. Each year, more than 6000 times the amount of energy currently used by humans is striking the earth from the sun. This is the study of how we can use this energy.

### 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](https://kansasregents.org/workforce_development/program-alignment)

### PROGRAM LEARNING OUTCOMES

1. The student will be able to demonstrate the ability to perform HVAC procedures in a safe manner
2. The student will be able to classify the different needs of equipment and summarize a solution.
3. The student will be able to exhibit a high level of professionalism including appropriate dress, attendance, communication skills and other soft skills necessary.

### TEXTBOOKS

<http://kckccbookstore.com/>

### METHODS 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. Geothermal Heat Pump Classifications
  - A. Closed-loop
  - B. Open-loop
- II. Water Quality
- III. Ground Loop Configurations and Flows
  - A. Parallel-Vertical
  - B. Single-layer, horizontal
  - C. Two-layer, horizontal
  - D. Four-pipe, horizontal
  - E. Slinky, ground
  - F. Pond or lake loop
- IV. System Materials and Heat Exchange Fluids
- V. Geothermal Wells and Water Sources

## **COURSE LEARNING OUTCOMES AND COMPETENCIES**

Upon successful completion of this course, the student will:

- A. Describe an open and closed loop geothermal heat pump system.
  - 1. Describe how the open loop system uses water from the earth as the heat transfer medium and then expels the water back to the earth.
  - 2. Describe how the closed loop system reuses the same heat transfer fluid, which is circulated in buried plastic pipes within the earth or within a lake or pond.
- B. Explain how water quality affects an open loop geothermal heat pump.
  - 3. Explain will the well deliver enough water in gallons per minute (gpm) to the heat pump.
  - 4. Describe what is the temperature of the well water.
  - 5. Explain is the well water clean and low in minerals.
- C. Describe different ground loop configurations for closed loop geothermal heat pump systems.
  - 6. Describe the ground parallel-vertical loop.
  - 7. Describe the single-layer, horizontal ground loop.
  - 8. Describe the two-layer, horizontal ground loop.
  - 9. Describe the four-pipe, horizontal ground loop.
  - 10. Describe the slinky ground loop.
  - 11. Describe the pond or lake loop.
- D. Demonstrate the different system fluids and heat exchanger pipe materials.

12. Explain the advantages of polyethylene pipe.
13. Explain the advantages of polybutylene pipe.
14. Explain the use of salts - Calcium chloride and sodium chloride.
15. Explain the use of glycols – Ethylene glycol and propylene glycol.
16. Explain the use of alcohols – Methyl, isopropyl, and ethyl.

### **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>.