COURSE INFORMATION FORM

DISCIPLINE
HVAC

COURSE TITLE
Geo-Thermal & Air Source Heat Pump

CR.HR 3
LECT HR. 2
LAB HR. 2
CLIN/INTERN HR. ________
CLOCK HR. ________

CATALOG DESCRIPTION
Operation, servicing and troubleshooting of Geo-Thermal and Air Source heat pump systems.

PREREQUISITES
HVAC 136

EXPECTED STUDENT OUTCOMES IN THE COURSE (ESO)
Upon completion of this course, the student will be able to:

1. Demonstrate an understanding of heat pump principles.
2. Define geo-thermal heat pumps.
3. Define air source heat pumps.
4. Explain the flow of the refrigerant circuit in both the heating and cooling cycle.
5. Demonstrate an understanding of and describe the defrost sequence.
6. Calculate the BTU output of both the heating and cooling cycle.
7. Draw the circuit for the heat pump thermostat.
8. Explain the function of the reversing value and how to troubleshoot it.
9. Describe the different loop designs for a Geo-Thermal System.
10. Demonstrate the proper fusion techniques for polyethylene pipe.
11. Explain the purpose and procedure for flushing the ground loop heat exchanger.
12. Calculate the heat rejection or extraction from the ground loop.
13. Calculate the fuel cost comparison for the different types of heating and cooling systems.
14. Demonstrate an understanding of the business community.
GENERAL EDUCATION OUTCOMES (ESO)
Specify which general education outcomes, if any, are substantially addressed by the course. Numbers in parentheses identify the Expected Student Outcomes linked to the specific General Education Outcome.

<table>
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<tr>
<th>Outcomes</th>
<th>ESO</th>
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PROGRAM-LEVEL OUTCOMES

CAREER AND TECHNICAL EDUCATION PROGRAM OUTCOMES
Specify which Career and Technical program outcomes, if any, are substantially addressed by the course by completing the “Career and Technical Education template” to show the relationship between course and program outcomes to assessment measures.

1. Student will demonstrate the ability to apply foundational skills in an industrial setting safely, and to industry guidelines.
2. Student will demonstrate professional oral and written communication skills.
3. Student will think critically and apply problem-solving skills.

CLASS-LEVEL ASSESSMENT MEASURES
Student accomplishment of expected student outcomes may be assessed using the following measures. (Identify which measures are used to assess which outcomes.)

1. Quizzes and written examinations (1-13)
2. Homework and classroom exercises (1-13)
3. Lab projects (1-13)
4. Student participation and in-class discussions (1-14)
Individual instructors may order this outline as fits the needs of their individual courses. In addition, they may place more emphasis on some areas than on others. What is assured is that this particular list is covered in the course. Other topics may be added to a course as the instructor sees fit, and as time and interest allow. An *asterisk can be used to mark an item as optional.

I. Heat Pump Principles
   A. Refrigeration and Heat transfer in heat pumps
   B. Comfort and heat transfer
   C. Analysis of heat pump theory

II. Geo-Thermal Heat Pumps
   A. Open flow systems
   B. Closed loop systems
   C. Pond loop

III. Air Source Heat Pumps
   A. Application criteria
   B. Balance point
   C. Defrost Cycle

IV. Refrigerant Circuit
   A. Cooling Mode
   B. Heating Mode

V. Defrost Sequence
   A. Defrost initiation
   B. Defrost termination
   C. Types of defrost detection circuits

VI. BTU output heating and cooling

VII. Heat Pump thermostats
   A. Electrical schematics
   B. Functions of the thermostat
   C. Troubleshooting thermostats

VIII. Reversing Valves
   A. Operation
   B. Heating mode
   C. Cooling mode
   D. Troubleshooting the reversing valve
IX. Geo-Thermal Loop Designs
   A. Vertical Loops
   B. Horizontal Loops
   C. Pond Loops
X. Fusion Techniques for type PE Pipe
   A. Socket fusion
   B. Butt fusion
XI. Flushing the ground loop heat exchanger
XII. Heat rejection and extraction of the ground loop heat exchanger
XIII. Fuel cost comparison
   A. KWH cost
   B. Gas cost
   C. Other fuels