COURSE OUTLINE
AREA 340 GEOTHERMAL ENERGY

Prepared By: Michael J. Newtown, P.E.
Updated By: Michael J. Newtown, P.E.

Canino School of Engineering Technology
Mechanical & Energy Technology
May 2015
A. **TITLE:** Geothermal Energy

B. **COURSE NUMBER:** AREA 340

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Fall or Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:** 3- one hour lectures per week

H. **CATALOGUE DESCRIPTION:**

Applications of thermodynamics and heat transfer principles will explain how energy is transformed from geothermal energy to useable energy for large and small scale systems. Students will determine heating and cooling loads leading to the selection of the correct system installation to meet the demand. Correct system sizing and installation procedures will be explored along with the environmental issues related to geothermal energy production.

I. **PRE-REQUISITES/CO-COURSES:**
   a. Pre-requisite: AREA 110, Intro to Alternative Energy, or ENGS 101, Intro to Engineering

J. **STUDENT LEARNING OUTCOMES:**
   By the end of this course will be able to:

<table>
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<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tr>
<td>a. Analyze soil and rock conditions leading to design of ground loop</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<td>b. Determine whether a site is suitable for geothermal development.</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<td>c. Determine the heating/cooling load for various sized buildings.</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<td>d. Select and size a heat pump</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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<tr>
<td>e. Determine the size of the earth component of a geothermal system for vertical shaft closed loop, open loop water well, horizontal closed loop, or closed loop immersion system for a surface water resource.</td>
<td>2. Crit. Thinking 3. Prof. Competence</td>
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L. **REFERENCES:**


M. **EQUIPMENT:** Technological enhance classroom

N. **GRADING METHOD** (P/F, A-F, etc.): A - F

O. **MEASUREMENT CRITERIA:** Test, Quizzes, Homework, Research Papers

P. **DETAILED TOPICAL OUTLINE:**

I. **Geology**
   a. Field geology
   b. Maps and photographic reading
   c. Structure analysis
   d. Hydrogeology

II. **Heating and cooling**
   a. Heat and cooling load calculations
   b. Psychrometrics and sensible heat
   c. Types of building construction

III. **Equipment sizing and selection**
   a. Sizing of heat pumps based on heating/cooling loads
   b. Fluid selection for geothermal systems
   c. Vertical open and closed loop systems
   d. Horizontal open and closed loop systems
   e. Below earth grade and immersion piping systems sizing.

IV. **Installation procedures**
a. Design Considerations  
b. Drilling and digging of site  
c. Mechanical systems  
d. Piping connections  
e. Testing of system  
f. Initial start-up operation

V. Cost Analysis  
a. Cost of large and small scale geothermal systems.  
b. Cost comparisons between traditional fuels and other alternative energy

VI. Environmental Studies and Assessment  
a. Biological and chemical monitoring of large scale systems  
b. Re-vegetation of geothermal heat transfer sites  
c. Health and safety concerns
Core Competency Course Evaluation Form

Course No.____ AREA 340 ______
Course Name ___GEOTHERMAL ENERGY ________________
Evaluator:____ Michael J. Newtown ____________
Date:______ 11/12/04 ______

Course Description:
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This course meets the following core competencies: (check all that apply and note exceptions)

- X I Mathematics (except_________________)
- X II Communication (except_________________)
- X III Problem Solving (except_________________)
- X IV Critical Thinking (except 6 _____________)
- X V Information Literacy (except_________________)
- VI Individual & Social Responsibility(except_________________)
- X VII Science (except_________________)
- X VIII Technology (except_________________)

The method of measurement is: (check all that apply)

- ___class participation ___written exams
- ___speeches ___research papers
- ___projects ___quizzes
- ___comprehensive final ___oral reports
- ___portfolio ___laboratory practicums
- ___standardized test ___laboratory reports
- ___P/F laboratory competency ___essays
- ___other (please specify)________________________________________

Comments: