MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
AREA 322 - PASSIVE SOLAR BUILDING

Created by: Michael Kingsley, Ph.D.
Updated by: Kibria Roman, Ph.D, P.E.

Canino School of Engineering Technology!
Department: Mechanical & Energy Technology!
Semester/Year: Fall/2018!
A. **TITLE:** Passive Solar Building

B. **COURSE NUMBER:** AREA 322

C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

- # Credit Hours: 3
- # Lecture Hours: 3 per week
- # Lab Hours: per week
- Other: per week

Course Length: 15 Weeks

D. **WRITING INTENSIVE COURSE:** Yes [ ] No [ ]

E. **GER CATEGORY:** None: [ ] Yes: GER !
   If course satisfies more than one: GER !

F. **SEMESTER(S) OFFERED:** Fall [ ] Spring [ ] Fall & Spring [ ]

G. **COURSE DESCRIPTION:**

   Passive Solar Building explores the use of solar energy to passively heat and cool buildings. Topics include solar radiation, building heating and cooling loads, energy efficient design and construction, passive solar heating, proper implementation of thermal mass, and passive cooling.

H. **PRE-REQUISITES:** None [ ] Yes [ ] If yes, list below:

   MECH 225, Introduction to Thermodynamics; ACHP 306, Energy Systems Technology, or permission of instructor

   **CO-REQUISITES:** None [ ] Yes [ ] If yes, list below:
I. **STUDENT LEARNING OUTCOMES:** *(see key below)*

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>Program Student Learning Outcome [PSLO]</th>
<th>GER [If Applicable]</th>
<th>ISLO &amp; SUBSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>determine insolation available to buildings.</td>
<td>SO # 6 An ability to identify, analyze and solve technical problems.</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>CA Subsets Subsets Subsets</td>
</tr>
<tr>
<td>calculate heating and cooling loads for a building.</td>
<td>SO #2 An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology by applying these areas to renewable energy systems</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>PS Subsets Subsets Subsets</td>
</tr>
<tr>
<td>design fenestration and thermal storage mass for a passive solar building</td>
<td>SO # 7 An ability to communicate effectively through written, oral, and graphic methods related to renewable energy systems</td>
<td>1-Comm Skills 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>W Subsets Subsets Subsets</td>
</tr>
<tr>
<td>estimate hourly and annual solar energy input.</td>
<td>SO # 6 An ability to identify, analyze and solve technical problems.</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>IA Subsets Subsets Subsets</td>
</tr>
<tr>
<td>size building backup heating and cooling systems.</td>
<td>SO #1 An appropriate mastery of the knowledge, techniques, and skills, and modern tools of their disciplines utilizing renewable energy systems and design parameters</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>CA Subsets Subsets Subsets</td>
</tr>
</tbody>
</table>

**KEY**  
Institutional Student Learning Outcomes [ISLO 1 – 5]

<table>
<thead>
<tr>
<th>ISLO #</th>
<th>ISLO &amp; Subsets</th>
</tr>
</thead>
</table>
| 1      | Communication Skills  
Oral [O], Written [W] |
| 2      | Critical Thinking  
Critical Analysis [CA], Inquiry & Analysis [IA], Problem Solving [PS] |
| 3      | Foundational Skills  
Information Management [IM], Quantitative Lit./Reasoning [QTR] |
| 4      | Social Responsibility  
Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T] |
| 5      | Industry, Professional, Discipline Specific Knowledge and Skills |

*Include program objectives if applicable. Please consult with Program Coordinator!
J. **APPLIED LEARNING COMPONENT:**  Yes ☒ No ☐  
If YES, select one or more of the following categories:

- ☒ Classroom/Lab  
- ☐ Internship  
- ☐ Clinical Placement  
- ☐ Practicum  
- ☐ Service Learning  
- ☐ Community Service  
- ☐ Civic Engagement  
- ☐ Creative Works/Senior Project  
- ☐ Research  
- ☐ Entrepreneurship  
  (program, class, project)

K. **TEXTS:**


L. **REFERENCES:**

Mastering Energy-10 by J. D. Balcomb (National Renewable Energy Laboratory) July 2002

M. **EQUIPMENT:** None ☐ Needed: Energy-10 software

N. **GRADING METHOD:**  A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

Grading may include homework, quizzes, exams, and a design project.

P. **DETAILED COURSE OUTLINE:**

1. Passive Solar Fundamentals  
   i. Systems approach to building design  
   ii. Passive solar principles and strategies  
   iii. Passive solar design

2. Building Heating Load Calculation  
   i. Heat transfer  
   ii. Thermal resistance and heat transfer coefficient  
   iii. Heat transfer losses  
   iv. Infiltration and ventilation

3. Building Cooling Load Calculation  
   i. Solar radiation through glass  
   ii. Cooling loads from people and equipment
4. Direct Gain
   i. Heating and cooling operation
   ii. Collectors
   iii. Storage iv. Control

5. Indirect Gain (Thermal Storage Wall)
   i. Heating and cooling operation
   ii. Collectors
   iii. Storage
   iv. Control

6. Isolated Gain
   i. Heating and cooling operation
   ii. Collectors
   iii. Storage iv. Control

7. Convective Loop
   i. Heating and cooling operation
   ii. Collectors iii. Absorbers iv. Storage
   v. Distribution
   vi. Control

8. Materials
   i. Glazings
   ii. Absorbers
   iii. Thermal storage materials

   i. Using Energy-10 software ii. Cost-benefit analysis

Q. **LABORATORY OUTLINE: None ☒ Yes ☐**