A. **TITLE:** Passive Solar Building

B. **COURSE NUMBER:** AREA 322  
   **SHORT TITLE:** Passive Solar Building

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE (OPTIONAL):** No

E. **LENGTH OF COURSE:** 15 weeks or equivalent

F. **SEMESTER(S) OFFERED:** Spring Semester

G. **HOURS OF LECTURE:** 3 one hours of lecture per week

H. **CATALOG 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.

I. **PRE-REQUISITES:** MECH 225, Introduction to Thermodynamics; ACHP 306, Energy Systems Technology, or permission of instructor  
   **CO-REQUISITES:**

J. **STUDENT LEARNING OUTCOMES:** Upon completion of this course, the student should be able to:
   1. determine insolation available to buildings.
   2. calculate heating and cooling loads for a building.
   3. design fenestration and thermal storage mass for a passive solar building.
   4. estimate hourly and annual solar energy input.
   5. size building backup heating and cooling systems.

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<th>Course Objective</th>
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| a. determine insolation available to buildings.                                 | 2. Crit. Thinking  
|                                                                                | 3. Prof. Competence               |
| b. calculate heating and cooling loads for a building.                           | 2. Crit. Thinking  
|                                                                                | 3. Prof. Competence               |
| c. design fenestration and thermal storage mass for a passive solar building.    | 2. Crit. Thinking  
|                                                                                | 3. Prof. Competence               |
| d. estimate hourly and annual solar energy input.                               | 2. Crit. Thinking  
|                                                                                | 3. Prof. Competence               |
e. size building backup heating and cooling systems.


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

M. EQUIPMENT: Energy-10 software

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

O. MEASUREMENT CRITERIA/METHODS: Grading may include homework, quizzes, exams, and a design project.

P. DETAILED TOPICAL OUTLINE:

Q. LABORATORY OUTLINE: N/A

DETAILED TOPICAL OUTLINE
AREA 322 – Passive Solar Building

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