STATE UNIVERSITY OF NEW YORK !
COLLEGE OF TECHNOLOGY !
CANTON, NEW YORK !

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:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
determine insolation available to buildings.	SO # 6 An ability to identify, analyze and solve technical problems.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets
calculate heating and cooling loads for a building.	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		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	PS Subsets Subsets Subsets
design fenestration and thermal storage mass for a passive solar building	SO # 7 An ability to communicate effectively through written, oral, and graphic methods related to renewable energy systems.		1-Comm Skills 5-Ind, Prof, Disc, Know Skills ISLO	W Subsets Subsets Subsets
estimate hourly and annual solar energy input.	SO # 6 An ability to identify, analyze and solve technical problems.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	IA Subsets Subsets Subsets
size building backup heating and cooling systems.	SO #1 An appropriate mastery of the knowledge, techniques, and skills, and modern tools of their disciplines utilizing renewable energy systems and design parameters		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets

KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
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:

The Passive Solar Design and Construction Handbook by Michael J. Crosbie (Editor) (Wiley) 1997

L. REFERENCES:

Thermal Analysis and Design of Passive Solar Buildings by A. K. Athienitis and M. Santamouris (James and James) November 2002
Air Conditioning Principles and Systems (4th edition) by Edward J. Pita (Prentice Hall) 2002
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**

9. **Modeling Passive Solar Building Performance**
   - **i. Using Energy-10 software ii. Cost-benefit analysis**

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐