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

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
AREA 323 - PHOTOVOLTAIC SYSTEMS

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Canino School of Engineering Technology !

Department: Mechanical & Energy Technology !

Semester/Year: Fall/2018 !

A. **TITLE**: Photovoltaic Systems

B. **COURSE NUMBER:** AREA 323

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:**

Photovoltaic Systems examines the direct conversion of solar energy to electricity. Topics include photovoltaic (PV) cell physics, types of PV cells, PV system components, and PV energy storage.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

MECH 225, Introduction to Thermodynamics

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***	
calculate the size of battery bank, and array based on system requirement	SO # 6 An ability to identify, analyze and solve technical problems.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	PS Subsets Subsets Subsets
calculate expected hourly and annual array power output.	SO # 6 An ability to identify, analyze and solve technical problems.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	PS Subsets Subsets Subsets
evaluate the current state of array performance of various PV cell technologies.	SO # 8 A recognition of the need for, and an ability to engage in lifelong learning.		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA Subsets Subsets Subsets
design a stand-alone / utility interactive PV system.	SO # 7 An ability to communicate effectively through written, oral, and graphic methods related to renewable energy systems.		1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W CA Subsets Subsets
calculate life cycle cost of PV system and compare it with other competing technologies.	SO #1 An appropriate mastery of the knowledge, techniques, and skills, and modern tools of their disciplines utilizing renewable energy systems and design parameters		1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	W CA 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:

Photovoltaic Systems Engineering by R. A. Messenger and J. Ventre (CRC Press) 2004

L. REFERENCES:

Photovoltaics Design and Installation Manual by Solar Energy International (New Society Publishers) 2004

M. EQUIPMENT: None ☒ Needed:

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. The Sun
- **i. Solar radiation spectrum**
- **ii. Atmospheric effects on sunlight**
- **iii.Insolation and orientation**

2. PV System Components
- **i.PV cells, modules, and arrays**
- **ii.Energy storage**
- **iii.PV system loads**
- **iv.PV system availability**
- **v.Associated electronics (charge controllers, inverters, power trackers)**
- **vi.Wiring and code compliance**

3. PV System Examples
- **i.PV powered water pumping**
- **ii.PV powered lighting**
- **iii. Hybrid system**
- **iv.Utility interactive system**
- **v. Cathodic protection system**

vi. Portable PV applications

4. Stand-Alone PV Systems
- **i. Critical need system**
- **ii. Remote PV application**
- **iii. Hybrid system**
- **iv. Battery issues**

5. Utility Interactive PV Systems
- **i. System sizing and economics**
- **ii. Net metering**
- **iii. Small (<10 kW) utility interactive PV systems**
- **iv. Medium utility interactive PV systems**
- **v. Large utility interactive PV**

6. PV Cell Physics
- **i. Optical absorption**
- **ii. Extrinsic semiconductors and the pn junction**
- **iii. Maximizing PV cell performance**
- **iv. Exotic junctions**

7. Types of PV Cells
- **i. Single crystal silicon**
- **ii. Multicrystalline silicon**
- **iii. Amorphous silicon cells**
- **iv. Exotic cells**
- **v. Emerging technologies**

8. Additional topics as time permits
- **i. PV cell panel life span**
- **ii. PV cell panel costs**
- **iii. Maintenance issues**

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