MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
ECMR - 175 Photovoltaic Installer

CIP Code: 46.0399
For assistance determining CIP Code, please refer to this webpage
or reach out to Sarah Todd at todds@canton.edu

Created by: Michael J. Newtown, P.E.

Updated by:

Canino School of Engineering Technology
Department: Mechanical & Energy Technology
Semester/Year: Fall 2022
A. **TITLE:** Photovoltaic Installer

B. **COURSE NUMBER:** ECMR 175

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

- # Credit Hours: 3
- # Lecture Hours: 2 per week
- # Lab Hours: 2 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:**

This course is designed to instruct on the installation and maintenance of photovoltaic systems. The course includes installation of components and sub-systems based on the particular types of systems. As part of the course students will review permits requirements, alignment of arrays based on south orientation and building roof designs, mounting options, wind loading, aesthetic wiring that complies with NEC. Taught are the ways to verify the system is working, open circuit testing, short circuit testing, start-up and shutdown, and emergency response with proper labeling.

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

**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>
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<tr>
<th>ISLO #</th>
<th>Communication Skills</th>
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<tbody>
<tr>
<td></td>
<td>Oral [O], Written [W]</td>
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<tr>
<td>2</td>
<td>Critical Thinking</td>
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<tr>
<td></td>
<td>Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</td>
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<tr>
<td>3</td>
<td>Foundational Skills</td>
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|   | 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:**

Holt, Mike, Understanding NEC Requirements for Solar Photovoltaic Systems, Mike Holt Enterprises, Inc., 2011

M. **EQUIPMENT:** None Needed:

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

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

Exams
Homework
Lab Projects

P. **DETAILED COURSE OUTLINE:**

I. Solar Radiation
   a. Sun - Earth Relationship
   b. Solar Radiation Data Sets

II. Site Survey and Planning
    a. Site survey
    b. Preparing proposal
    c. Installation planning

III. System components
    a. Panels
    b. Inverters
    c. Charger controllers
    d. Balance of Systems

IV. Arrays
    a. Cells
    b. Modules
    c. Arrays

V. Batteries
   a. Types
   b. Battery systems
   c. Maintenance

VI. Charge Controller
    a. Features
    b. Types
    c. Setpoints

VII. Inverters
    a. AC Power
    b. Power conditioning units
    c. Features and specification
VIII. System Sizing
   a. Methodologies
   b. Calculations
IX. Mechanical Installation
   a. Array Mounting
   b. Roof penetrations
   c. Disconnect and service entrance mounting
X. Electrical Integration
   a. NEC
   b. Utilities
   c. Conductors
   d. Grounding
   e. Interconnection
   f. Permitting and inspection
XI. Commissioning, Maintenance, and Troubleshooting
XII. Economic Analysis

Q. LABORATORY OUTLINE: None ☐ Yes ☒

1. Cell voltage and current
2. Module Shading IV Curves
3. Solar Pathfinder and predictive tools to plan energy
4. Energy audit of building
5. Batteries parallel and series connections
6. Charge controllers
7. Wiring Inverters
8. Sizing the array
9. Roof mounting hardware
10. Box hanging and conduit installation
11. Mounting of panels
12. Proper wire connections and grounding