HIBBING COMMUNITY COLLEGE
COURSE OUTLINE

COURSE NUMBER & TITLE: ELM 2402: Photovoltaic Systems Installation, Maintenance and Troubleshooting
CREDITS: 4 (2 Lecture / 2 Lab)
PREREQUISITES: ELM 1101, 1201, 1005, 2401 classes or approval of instructor

CATALOG DESCRIPTION:
Photovoltaic (PV) Systems Installation and Maintenance covers the installation and commissioning of various photovoltaic systems and applicable National Electrical Code articles. This is the second of two courses to prepare students for the North American Board of Certified Energy Practitioners (NABCEP) Entry Level Certificate of Knowledge test.

OUTLINE OF MAJOR CONTENT AREAS:
I. Safety
II. System Components
III. PV System sizing
IV. PV System Electrical Design
V. PV Mechanical Design
VI. PV Performance, Maintenance and Troubleshooting

COURSE GOALS/OBJECTIVES/OUTCOMES:
Students will
1. Describe most common solar module mounting techniques (ground, roof, pole).
2. Compare features and benefits of different solar mounting techniques.
3. Explain the relationship between solar module cell temperature and environmental conditions, given mounting method.
4. Describe purpose and operation of main electrical components (inverter, charge controller, combiner, ground fault protection, battery, generator)
5. Identify key specifications of main electrical components (inverter, charge controller, combiner, battery, generator).
6. Illustrate interaction of typical loads with IV curve (battery, MPPT, dc motor).
7. Analyze load demand for stand-alone and grid interactive service.
8. Identify typical system electrical output derating factors.
9. Calculate estimated peak power output (dc and ac).
10. Calculate array and inverter size for grid-connected system.
11. Calculate estimated monthly and annual energy output of grid-connected system.
12. Explain relationship between array and battery size for stand-alone systems.
13. Calculate array, battery and inverter size for stand-alone system.
14. Determine series/parallel PV array arrangement based on module and inverter specifications.

15. Select BOS components appropriate for specific system requirements.
16. Determine voltage drop between major components.
17. Describe the relationship between row spacing of tilted modules and sun angle.
18. Describe the mechanical loads on a PV array (e.g., wind, snow, seismic).
19. Describe typical system design errors.
20. Describe typical system performance problems.
21. List equipment needed for typical system performance analysis.
22. Compare actual system power output to expected.
23. Identify typical locations for electrical/mechanical failure.

MNTC GOALS AND COMPETENCIES MET:
N/A

HCC COMPETENCIES MET:
Working Productively and Cooperatively
Communicating Clearly and Effectively
Thinking Creatively and Critically
Social/Civic Responsibility

STUDENT CONTRIBUTIONS:
The student is expected to read the required textbook, spend sufficient time outside of class to complete assignments, submit assignments when due, take tests on scheduled dates, and participate in class discussions.

STUDENT ASSESSMENT SHALL TAKE PLACE USING INSTRUMENTS SELECTED/DEVELOPED BY THE COURSE INSTRUCTOR.

SPECIAL INFORMATION: (SPECIAL FEES, DIRECTIVES ON HAZARDOUS MATERIALS, ETC.):

National Electrical Code (Current Edition) NFPA
Photovoltaic Systems, Jim Dunlop
Scientific calculator, and safety glasses

AASC APPROVAL DATE: February 10, 2016

REVIEW DATE: February 2021

ELM 2402:so
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