Mechanical Engineering Dept. Department

Syllabus
ME 442: Design of PV-Solar Systems (3-0-3)

Course Catalog Description:

Photovoltaic (PV) systems, solar radiation, site surveys and preplanning for photovoltaic systems, photovoltaic system components and configurations, cells, modules, and arrays for photovoltaic systems, batteries, charge controllers , and inverters, photovoltaic system sizing, photovoltaic systems mechanical integration, photovoltaic systems electrical integration, installation, commissioning, maintenance, and troubleshooting, photovoltaic systems economic analysis. PV Systems Design Software will be used throughout the course.

Course Pre-requisites:

- EE 204: Funda. of Electrical Circuits
- EE 306: Electromechanical Devices

Course Objectives:

1. To teach students the fundamentals of solar radiation and its measurement.
2. To teach students how to do site surveys for an off-grid PV system.
3. To teach students configurations as well as all relevant components of a PV system.
4. To teach students how to design an off-grid PV system as well as post-design issues.
5. To teach students about the basic concepts related to financial analysis of off-grid PV systems.

Course Learning Outcomes:

CLO1. Identify PV system types, configurations and components.

CLO2. Understand the operation of a PV cell and module as well as their I-V characteristics.

CLO3. Understand the function of batteries, charge controller and inverter in a PV system.

CLO4. Understand basic concepts in the financial analysis of off-grid PV systems

CLO5. Work as a team, dividing up tasks, setting deadlines, reviewing each other’s work, working under a leader with a common objective and resolving conflicts.

CLO6. Demonstrate ability to give a professional and well-organized presentation of their design.

Learning Resources:

- Solar Photovoltaic System Applications: A Guidebook for Off-Grid Electrification, P. Mohanty, T. Muneer and M. Kolhe (Editors), Springer, 2016.

- Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, 3rd Ed., PHI Learning, 2018. Photovoltaic Power System: Modeling, Design, and Control, W. Xiao, John Wiley & Sons Ltd, 2017. Solar Photovoltaics Technology: System Design, Reliability and Viability, N.D. Kaushika, A. Mishra and A. K. Rai, Springer, 2018. Solar Energy, A. Smets et al., UIT Cambridge., England, 2016.

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Special/IBL Assignments/Project	14	10.0%
Final Exam	16	35.0%
Midterm Exam	8	25.0%
Homework	Varies	10.0%
Quizzes	Varies	20.0%

Lecture Weekly Schedule:

Week#	Topics
1	Introduction to Photovoltaic Systems
2	Solar Radiation Fundamentals
3	Site Surveys and Preplanning
4	PV System Configurations and Components
5	Cells, Modules and Arrays
6	Batteries, Charge controllers, MPPT and Inverters
7	Batteries, Charge controllers, MPPT and Inverters (Continue)
8	PV System and Component Sizing
9	PV System and Component Sizing (Continue)
10	PV System and Component Sizing (Continue)
11	Mechanical and Electrical Integration
12	Installation and Commissioning
13	Maintenance and Troubleshooting
14	Economic Analysis
15	Economic Analysis (Continue)