This course provides a comprehensive introduction to solar photovoltaic (PV) energy systems, including cell design and manufacturing technologies. A range of PV applications will be presented including grid connections, rural electrification, transportation designs, stand-alone systems, consumer products, and the supply of electrical power to satellites in space. Career paths and opportunities within associated industries will be presented.
COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. explore career opportunities and paths within the associated industries
2. demonstrate knowledge of the process for conducting a site assessment and determining available solar resources for a PV installation
3. compare various PV systems, their applications and performances, and their predicted energy savings and economics
4. describe the functions and performance characteristics of each of the components of a photovoltaic power system.
5. explain the principles of solar cell designs and manufacturing technologies.
6. describe the safety, environmental, and social impacts of solar photovoltaic energy use

COURSE OBJECTIVES:

COURSE CONTENT:

LECTURE CONTENT:

A. Solar energy - Photovoltaic Energy
   1. Definition of photovoltaic power

B. Principal Types of Photovoltaic Materials
   1. Single Crystal Silicon
   2. Polycrystalline Silicon
   3. Amorphous Silicon
   4. Other materials Under Development, or in More Limited Use

C. Collection and Conversion Devices and Efficiencies
   1. Photovoltaic Effect Devices
   2. Single Crystal, Polycrystalline, and Amorphous types of silicon devices

D. Optical Concentrating versus Non-concentrating photovoltaic modules

E. Energy Storage
   1. Batteries
   2. Flywheels
   3. Capacitors

F. Tracking vs. Non-tracking photovoltaic modules
   1. Advantages
   2. Disadvantages

G. Photovoltaic Energy Devices as a Modular Technology

H. Systems
   1. PV Arrays
   2. System Component Balance
   3. Support Structures
   4. Inverters
   5. Wiring, Conduit, Connectors
   6. Charge Regulators
   7. Energy Storage (Batteries)
   8. Back-up Generators

I. Applications
   1. Electricity Generation
   2. Remote Applications
   3. Transportation
   4. Consumer Applications

J. Electricity Generation
   1. Residential-scale
   2. Utility-scale
   3. Simple or "Stand-alone" Systems

K. Remote Applications
   1. Rural Electrification / Village Power
2. Communications
3. Water Pumping
4. Grid Support
5. Military equipment
6. Emergency Power Supply
7. Traffic Signals
8. Street and Area Lighting
9. Refrigeration

L. Transportation
1. Ground Transportation
2. Boats
3. Airplanes

M. Consumer Applications
1. Watches, Calculators, Cameras
2. Garden Lights
3. Portable Battery Chargers

N. Benefits
1. Efficiency
2. Reliability
3. Modular nature

O. Economic Comparisons
1. Solar PV
2. On-grid installations
3. Off-grid installations
4. Public Utilities

P. Safety and Environmental Impacts
1. Negative impacts
   a. Land Use
   b. Materials Use
   c. Toxic Waste Generation
   d. Electrical Hazards
   e. Battery-related
   f. Acid Burns
   g. Explosion Hazard
2. Positive impacts
   a. Reduction of Pollution
   b. Job Creation
   c. Energy Independence

Q. Future trends in solar photovoltaic applications

R. Career paths
1. Industry
2. Government
3. Commercial
4. Individual

METHODS OF INSTRUCTION:

A. Lecture:
B. Independent Study:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:

Out-of-class Assignments
1. Attendance at topic-related lectures and trade shows as available. 2. Participation in Industry visitations.

Reading Assignments
Required readings are from the required text.
METHODS OF STUDENT EVALUATION:
Final Exam
Short Quizzes
Written Assignments
Report
Projects (ind/group)
Oral Presentations

Demonstration of Critical Thinking:
Problem-based learning activities (define, analyze, synthesize, communicate, report, evaluate) requiring independent research and group collaboration.

Required Writing, Problem Solving, Skills Demonstration:
Homework assignments dealing with topics in the course will require the exercise of all of these skills.

TEXTS, READINGS, AND RESOURCES:

Other:
1. Handouts from instructors.

LIBRARY:

Adequate library resources include: Non-Print Materials
Comments:

Attachments:

Attached Files