

Solar PV Electricity – PRGR 604 (2 credits)

Catalog description

A course that covers the principles of solar radiation and solar electricity using PhotoVoltaic (PV) technology. Solar Radiation: Components, Geometry of Earth and Sun, Geometry of collector and sun beam, Effect of Earth's atmosphere, Measurements of solar radiation. Semi-conductor basics, Photo-Voltaic (PV) module characteristics, Efficiency analysis; PV module types: mono-crystalline, Polycrystalline, Amorphous, Multilayer cells, Current research; PV module manufacture; Grid connection and grid codes, Remote (off-grid) connections; Economics and sustainability aspects.

Required or elective

Energy Specialization Course

Prerequisites by topic:

Basic Calculus, basic electric circuitry

Textbook and Reference Material

- Solar Engineering of Thermal Processes (3rd Edition), J.A. Duffie and W.A. Beckman, Wiley, New Jersey, 2006
- Fundamentals of photovoltaic modules and their applications, Gopal Nath Tiwari and Swapnil Dubey, Cambridge, 2010
- Solar Electricity Handbook, Michael Boxwell, Greenstream Publishing, 2013
- Lecture Notes

Course objectives

The objectives of this course are to give students:

1. To provide students with the principles, devices and systems used to harness solar energy.
2. To provide students with in-depth understanding of PV technology and systems
3. To use available and to partially develop software tools to carry out technical, economic and environmental analysis of practical PV systems and interpret the results provided by such tools.

Topics covered

Topics covered	60 min lectures
1. Components of solar radiation	1
2. Geometry of Earth and Sun	1
3. Geometry of collector and sun beam	1
4. Effect of Earth's atmosphere	1
5. Measurements of solar radiation	1
6. Semiconductor basics	1
7. PV module characteristics and efficiency analysis	1
8. PV module types	1

9. PV module manufacture	1
10. PV systems	2
11. Economical and sustainability analysis	1
12. Exercises and Case study	10

Course outcomes

At the end of the course, students will:

1. Have a clear understanding of solar radiation, its components, the geometry of earth and sun, collector geometry, effect of earth's atmosphere and measurement of solar radiation
2. Have a clear understanding of the basics of semiconductors and PV module manufacturing process
3. Can analyze the characteristics of a PV module and their efficiencies
4. Have a clear understanding and can differentiate between the different types of PV modules
5. Can analyze and design a practical system of photovoltaic system

Resources of the course

References, Research Papers, Lecture Notes Published on Moodle

Evaluation methods

Exam (40%), Case study (40%), Student contribution (20%)

Professional components

Technology: 50 %
Modeling: 10 %
Mathematics and basic sciences: 25 %
Sustainability and economics: 15%

Computer usage

MATLAB, HOMER

Person(s) who prepared this description and date of preparation

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