UNIVERSITY of NICOSIA

Course Code	Course Title	Credits (ECTS)
ECE-561	Photovoltaics	8
Department	**Semester**	**Prerequisites**
Engineering	Fall or Spring	PHYS-305
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
2nd Cycle	1st	Dr Antonis Hadjiantonis
Mode of Delivery	**Work Placement**	**Co-requisite**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- demonstrate the evolution of the photovoltaic (PV) industry; global penetration and economic issues
- investigate PV technologies, generations and manufacturing processes
- provide the theoretical and practical knowledge of the PV principle and the conversion of solar light to electricity using semiconductor devices.
- explain the basic operational aspects of PV cells, modules and systems,
- analyze system engineering issues (design, sizing and component specifications).

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Examine the key characteristics of the principles behind the operation of PV technologies (PV effect)
2. Discuss solar radiation principles
3. Evaluate the design of PV systems (grid-connected and stand-alone) using computer software; determine operational performance analysis
4. Identify the engineering constraints of PV systems
5. Discuss the upcoming solar technologies that are expected to penetrate the market
6. Illustrate the operation of semiconductor material under dark and illuminated conditions
7. Recite the impact of upcoming PV technologies and the economic issues associated with this renewable technology

Course Contents:

1. The potential of solar technologies. PV applications. Cypriot market and worldwide trends.
2. Solar radiation principles, properties and nature. Terrestrial solar irradiation. Solar radiation on an inclined surface. Solar irradiance measurements and

sensors. Typical meteorological data representation. Collection of sunlight on a surface. Shading.
3. The illuminated P-N junction. Operating conditions. The current-voltage characteristic curve. Generation and recombination.
4. Refining silicon. Basic design of PV technologies. PV manufacturing overview. Czochralsky and float-zone principle in manufacturing silicon wafers. PV cell technologies. Thin-film technologies. Third generation PV technologies.
5. Cell structure. Light absorption. Spectral response. Texturing. Reflection. Principle of operation and electrical parameters. Fill factor. Effect of parasitic resistance. Circuit model (one-diode model). Temperature and irradiance effects.
6. PV modules and arrays: Interconnecting PV cells. Cells in series-parallel arrangement. Mismatch. Hot spot. PV module structure. Bypass diodes. Module and array performance. Mismatch of modules. Nominal operating cell temperature. Degradation and failure modes.
7. PV system design and sizing. Grid-connected & standalone PV systems. PV system performance metrics and prediction.
8. PV economics.

Learning Activities and Teaching Methods:

Lectures, seminars, case studies and directed self-study

Assessment Methods:

Homework, Software Projects, Mid-Term, Final Exam.

Required Textbooks/Reading:

Authors	**Title**	**Publisher**	**Year**	**ISBN**
S.R. Wenham, M.A. Green and M.E. Watt	Applied Photovoltaics, 2nd Edition	Rutledge	2006	978-1844074013

Recommended Textbooks/Reading:

Authors	**Title**	**Publisher**	**Year**	**ISBN**
M.A. Green	Solar Cells Operating Principles, Technology & System Applications	Prentice-Hall	1982	978-0138222703

Further reading (journals): Solar Energy (Elsevier), Renewable Energy (Elsevier), International Journal of Sustainable Energy (Taylor & Francis), Progress in Photovoltaics (Wiley)