Course unit title:	**Thin Film Solar Cells**		
Course unit code:	AEEE463		
Type of course unit:	Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	2 (Spring)		
Number of ECTS credits allocated :	5		
Name of lecturer(s):	Dr. Antonis Papadakis		
Learning outcomes of the course unit:	1. Explain the basic concepts of solar cell generation. 2. Define the principles of pn junction, depletion region and intrinsic electric field. 3. Explain the principles and fundamentals of photovoltaic generation. 4. Describe 3rd generation solar cells. 5. Examine the basic concepts of thin film solar cells. 6. Analyze using simulation software the effects of fundamental properties on the performance of thin film cells.		
Mode of delivery:	Face-to-face		
Prerequisites:	AEEE362 Solar Energy	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Photovoltaics Generation:** Introduction to photovoltaic generation, Solar radiation, Silicon p–n junction, Photon absorption at the junction, Solar radiation absorption, Maximizing cell efficiency, Solar cell construction, Equivalent circuit of a solar cell, Types and adaptations of photovoltaics, Photovoltaic circuit properties, Applications and systems, Social and environmental aspects. • **Semiconductor Processes of Photovoltaics Technologies:** Introduction to the physics of the various photovoltaic technologies: Monocrystalline Silicon, Polycrystalline Silicon, Amorphous Silicon, GaAs, CIGS, CdTe and Multijunction (Tandem) solar cells including generation, recombination, carrier lifetimes, Debye length, energy band gaps, valence, conduction bands, Fermi-Level, p-n junction, depletion region and intrinsic electric field. • **Thin film solar cells:** Introduction and basic concepts of thin film solar cells, Photovoltaic solar energy conversion, Solar energy technologies, Electrochemical deposition of solar energy materials, CdTe solar cells, CIGS solar cells, GaAs solar cells, Effective harvesting of photons, Multi-layer graded bandgap solar cells, Solar cell behaviour in complete darkness, Effects of defects on the solar cell characteristics, and Future directions, Research and development of the above ground braking thin film photovoltaic technologies. • **Simulation of thin films:** Simulation exercises using the PC1D/WXAMPS program to reinforce an understanding of device physics and the different solar cell technologies, Mathematical models used for characterisation of solar cells, Spectral response, Temperature sensitivity, Resistive losses, Current-voltage generation, open-circuit voltages and short-circuit currents.		
Recommended and/or required reading:			

Textbooks:	• Advances in Thin-Film Solar Cells, 1st Edition, I. M. Dharmadasa, 2012, Pan Stanford Publishing, 9814316075/9789814316071. • The Physics of Solar Cells: Perovskites, Organics, and Photovoltaic Fundamentals 1st Edition, ISBN-13: 978-1138099968, CRC Press, November 2017. • The Physics of Solar Cells, J. Nelson, 2003, Imperial College Press, 1860943497/9781860943492.
References:	• Thin Film Solar Cells, K.L. Chopra, S.R. Das, 1983, Springer, 0306411415/978-0306411410. • Renewable Energy Resources, 3rd Edition, John Twidell and Tony Wier, Taylor & Francis, 2015, ISBN: 0419253300/9780419253303. • Fundamentals of Renewable Energy Processes, 3rd Edition, Aldo V. da Rosa, 2012, Elsevier Academic Press, 0123972191/9780123972194.
Planned learning activities and teaching methods:	Teaching is based on lectures. The course delivery will be based on theoretical lecturing, assignments and exercises solved in class. Exercises will be handed to students and their solutions shall be analysed at lecture periods. Additional tutorial time at the end of each lecture will be provided to students. Students are expected to demonstrate the necessary effort to become confident with the different concepts and topics of the course.
Assessment methods and criteria:	• Assignments 10% • Tests: 30% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No