<table>
<tr><td>Course unit title:</td><td colspan="6">Design of Electrical Photovoltaic Systems</td></tr>
<tr><td>Course unit code:</td><td colspan="6">AEEE460</td></tr>
<tr><td>Type of course unit:</td><td colspan="6">Compulsory</td></tr>
<tr><td>Level of course unit:</td><td colspan="6">Bachelor (1st Cycle)</td></tr>
<tr><td>Year of study:</td><td colspan="6">4</td></tr>
<tr><td>Semester when the unit is delivered:</td><td colspan="6">7 (Fall)</td></tr>
<tr><td>Number of ECTS credits allocated :</td><td>6</td><td>Lectures:</td><td>3</td><td>Labs:</td><td colspan="2">0</td></tr>
<tr><td>Name of lecturer(s):</td><td colspan="6">Dr Nicholas Christofides</td></tr>
<tr><td>Aim of the Course</td><td colspan="6">The course gives the opportunity to electrical engineering students to put together basic concepts previously taught in order to design and assess small scale and large scale grid-connected and off-grid photovoltaic systems. Students will also have the opportunity to visit photovoltaic systems and observe installation practices and principles in practice.</td></tr>
<tr><td>Learning outcomes of the course unit:</td><td colspan="6">• Identify the components and equipment associated with grid connected and off-grid photovoltaic systems
• Assess the technical characteristics of grid-connected photovoltaic system components and integrate them for small and large photovoltaic system design
• Assess the technical characteristics of off-grid photovoltaic system components and integrate them for the design of off-grid photovoltaic systems
• Design of grid connected photovoltaic systems
• Design of off-grid and hybrid photovoltaic systems</td></tr>
<tr><td>Mode of delivery:</td><td colspan="6">Face-to-face</td></tr>
<tr><td>Prerequisites:</td><td colspan="3">AEEE360</td><td>Co-requisites:</td><td colspan="2">None</td></tr>
<tr><td>Course contents:</td><td colspan="6">1. Components associated with grid-connected photovoltaic systems: definitions, principles and applications of grid-connected PV systems, photovoltaic modules, grid inverters, solar cables, protective devices

2. Components associated with off-grid photovoltaic systems: principles and applications of off-grid PV systems, photovoltaic modules, off-grid inverters, batteries, solar charging regulators, protective devices, cabling, generators

3. Photovoltaic module technical characteristics: module design, module mismatch effects, by-pass diodes, temperature effects, ageing, shading, hotspots, I-V characteristics, module efficiency

4. Inverter technical characteristics: conformity with standards, islanding, efficiency, open circuit voltage and short circuit currents, protection, conditions for connection and disconnection from the grid, inverter selection criteria, control of active and reactive power

5. Grid-connected PV system design: small scale PV systems for buildings, large scale PV systems, site survey, environmental conditions, performance ratio, considerations for proper plan, electrical circuit design, feasibility study, installation considerations, inspection requirements

6. Off- Grid PV system design: applications, hybrid PV systems, load characteristics and maximum demand, inverter selection criteria, battery types/selection and sizing, types of solar charging regulators and selection, sizing of photovoltaic system in kWp, electrical circuit design, feasibility study, installation considerations, inspection requirements

7. Simulation of grid-connected PV systems: design and simulation for performance assessment of grid-connected PV systems using software tools</td></tr>
<tr><td colspan="7">Recommended and/or required reading:</td></tr>
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Textbooks:	• M. Boxwell, Solar Electricity Handbook : A Simple Practical Guide to Solar Energy - Designing and Installing Photovoltaic Solar Electric Systems, 2017 edition, Greenstream Publishing, ISBN 978-1907670183 • Solar Energy International, Photovoltaics: Design and Installation Manual, New Society Publishers, ISBN 978-0865715202, 2004
References:	• E. Kissell, Introduction to Solar Principles, Prentice Hall, 2012 • Soteris Kalogirou, Solar energy engineering : processes and systems, 2nd ed., Academic Press, ISBN 978-0-12-374501-9, 2013 • P. Hurley, Solar II: How to Design, Build and Set Up Photovoltaic Components and Solar Electric Systems, 2012, Good Idea Creative Services, ISBN 978-0983784739, 2012 • G.N. Tiwari, Solar Energy: Fundamentals, design, modeling and applications, revised edition 2015, Alpha Science Intl Ltd, 2004
Planned learning activities and teaching methods:	Students are taught the course through lectures (3 hours per week) in classrooms via projector presentations and by the use of the whiteboard. Following major lecture topics and chapters, mathematical problems and examples are solved during class. Exercises for assessed homework are also a standard practice for this course as well as at least one assignment. Lecture presentations are available for students to download via the university e-learning platform. Students are advised to use the recommended course textbook or reference books for further reading and practice in solving related exercises. Further literature search is encouraged by assigning students to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem and report this information in written or orally. Students are assessed continuously and their knowledge is evaluated through tests with their assessment weight, date and time being set at the beginning of the semester via the course outline. Visits to photovoltaic systems are arranged where students have the opportunity to closely examine the installation and design details of gird-connected and off-grid PV systems. Students are prepared for the final exam by revision on the matter taught, problem solving and concept testing. Overall, the course assessment is both formative and summative and aims to comply with the subject's expected learning outcomes and the quality of the course.
Assessment methods and criteria:	• Assignments: 10% • Tests: 30% • Final Exam: 60%
Language of instruction:	English
Work placement(s):	No