AEEE460 - Design of Electrical Photovoltaic Systems

Course Title	Design of Electrical Photovoltaic Systems				
Course Code	AEEE460				
Course Type	Core				
Level	BSc (Level 1)				
Year / Semester	4 (Fall)				
Teacher's Name	Dr Nicholas Christofides				
ECTS	6	Lectures / week	3	Laboratories/week	-
Course Purpose	To apply related theory and circuit analysis techniques to assess and design and 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.				
Learning Outcomes	By the end of the course, students must be able to: 1. Identify the components and equipment associated with grid connected and off-grid photovoltaic systems 2. Assess the technical characteristics of grid-connected photovoltaic system components and integrate them for small and large photovoltaic system design 3. Assess the technical characteristics of off-grid photovoltaic system components and integrate them for the design of off-grid photovoltaic systems 4. Design of grid connected photovoltaic systems 5. Design of off-grid and hybrid photovoltaic systems				
Prerequisites	AEEE360	Co-requisites	none		
Course Content	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. The Department, through its Research Policy acknowledges the importance of the synergies between research and teaching. As a result, students can be assigned to investigate further on a topic in order to better interpret something or identify current/new methods and practices. Through such activities, students can enter in the research culture and environment with the overall aim being to make them aware and to trigger ideas for the master thesis and future postgraduate studies. Where just and fit, students are encouraged to participate in research projects that could complement their master thesis requirements.
Teaching Methodology	The course is taught through lectures (3 hours per week) in classrooms or lectures theatres supported by the whiteboard and the overhead projector. Examples on subject delivered during the lectures are solved and open-ended discussion is encouraged. Further exercises can be assigned for practise or as homework. The lecture presentations are available on the e-learning platform for students to download along with other peripheral material such as past tests and exams, links and guides. Students are expected to take in-class hand-written notes. Students are also advised to use the subject's main textbook or reference books for further reading and practice in solving related exercises. Further literature research is encouraged by assigning to students a specific problem related to some issue and they are expected to gather relevant scientific information about how others have addressed the problem and report this information in written or orally.
Bibliography	• Solar Electricity Handbook : A Simple Practical Guide to Solar Energy - Designing and Installing Photovoltaic Solar Electric Systems, M. Boxwell, 2019 edition, Greenstream Publishing, ISBN 978-1907670183 • Photovoltaics: Design and Installation Manual, Solar Energy International, , New Society Publishers, ISBN 978-0865715202, 2004 • Introduction to Solar Principles, E. Kissell, Prentice Hall, 2012

	• Soteris Kalogirou, Solar energy engineering : processes and systems, 2nd ed., Academic Press, ISBN 978-0-12-374501-9, 2013 • Solar II: How to Design, Build and Set Up Photovoltaic Components and Solar Electric Systems, P. Hurley, Good Idea Creative Services, ISBN 978-0983784739, 2012 • Solar Energy: Fundamentals, design, modeling and applications, G.N. Tiwari, revised edition 2015, Alpha Science Intl Ltd, 2004
Assessment	The assessment is continuously via mid-term tests and mini-assignments with the respective assessment weight, date and time being set at the beginning of the semester via the course outline or aurally discussed. Students are prepared for the final exam by revision and recapitulation and by solving exercises. The final assessment of the students is formative and summative and is in line with the subject's expected learning outcomes and course level. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written tests, oral presentations, quizzes, design assignments and design projects. An indicative weighted continuous assessment of the course is shown below (this is indicative and not supposed to add up to 100%): • Assignment 10-15% • Homework 10% • Mid-Term written exams 60-70% • Mini design project 15-20% • Presentation 10-15% The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems.
Language	**English**