AEEE360 - Solar Energy

<table>
<tr><td>Course Title</td><td colspan="5">Solar Energy</td></tr>
<tr><td>Course Code</td><td colspan="5">AEEE360</td></tr>
<tr><td>Course Type</td><td colspan="5">Core</td></tr>
<tr><td>Level</td><td colspan="5">BSc (Level 1)</td></tr>
<tr><td>Year / Semester</td><td colspan="5">3 (Fall)</td></tr>
<tr><td>Teacher’s Name</td><td colspan="5">Dr Nicholas Christofides</td></tr>
<tr><td>ECTS</td><td>6</td><td>Lectures / week</td><td>3</td><td>Laboratories/week</td><td>-</td></tr>
<tr><td>Course Purpose</td><td colspan="5">The course familiarizes students with the properties of sunlight and solar geometry and equips them with the basic knowledge necessary to appreciate the harnessing possibilities of solar energy. Solar PV and thermal technologies are analyzed.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="5">By the end of the course, students must be able to:
1. Identify and associate the properties of sunlight and solar geometry.
2. Describe the fundamental operating mechanisms by which PV cells generate electrical energy.
3. Assess and examine solar radiation data and measurements.
4. Describe and classify solar thermal technologies and systems.</td></tr>
<tr><td>Prerequisites</td><td colspan="2">none</td><td colspan="2">Co-requisites</td><td>none</td></tr>
<tr><td>Course Content</td><td colspan="5">1. Introduction to Solar Energy: solar energy, the greenhouse effect
2. Properties of sunlight: basics of light, photons, solar radiation in space and terrestrial solar radiation, motion of the sun, solar time, elevation angle, declination angle, azimuth angle, position of the sun
3. Solar radiation: solar radiation on a tilted surface, calculation of insolation (solar radiation energy on a surface), measurement and analysis of solar radiation
4. Photovoltaics: the PV phenomenon, semiconductor materials and structure, generation and recombination, diode equations for PV
5. Cells, modules and arrays: solar cell operation, IV characteristics and efficiency of cells, module design, interconnection effects, temperature effects, lifetime of PV modules
6. Solar collectors: description, flat plate, concentrating collectors, temperature effects, effects of dust and shading, performance, efficiency, characteristics, practical considerations
7. Solar thermal power systems: Parabolic troughs, Sterling engines, Solar towers, thermal storage
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</td></tr>
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	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	• Introduction to Solar Principles, T. Kissell, Pearson, 1st edition, 2012 • Solar Engineering of Thermal Processes, J.A. Duffie, W.A. Beckman, 4th edition, John Wiley & Sons Wiley, 2013 • Solar Energy: Principles of thermal collection and storage, S.P. Sukhatme, 3rd edition, Mc Graw Hill, 2009 • Solar Energy: Fundamentals, design, modeling and applications, G.N. Tiwari, , revised edition, Alpha Science Intl Ltd, 2013
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**