Topics in solar energy (001-2-4058)

3 credits

Teacher: Avi Niv, aviniv@bgu.ac.il, Room 014, Building 26 (solar energy)

Outline: Sunlight is characterized by its spectrum, angle, spatial dispersion, seasonal and geographical changes, and more. All these factors must be considered for a successful utilization of sunlight for illumination, heat, electricity, or any other form of power. In this introductory course we will study the different aspects that defines sunlight as a power source and the models that are used for its quantification.

- Sun-earth geometry
- Solar spectrum and atmospheric transmittance
- Basics of solar power conversion

Objectives - The course aims to familiarize a student with the following topics:

- Sun-earth geometry
- Solar spectrum and atmospheric transmittance
- Basics of solar power conversion

Prerequisites: Undergraduate Math and Physics

Grading: 25% homework, 75% final assignment

Schedule:

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<tr>
<th>Topic</th>
<th>Meeting</th>
<th>Covered matters</th>
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<tr>
<td>Sun-earth geometry</td>
<td>1-2</td>
<td>Sun-earth geometry, incident angles, tracking</td>
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<tr>
<td>The solar spectrum</td>
<td>3-4</td>
<td>Black body radiation and its relevance to solar applications, air-mass and atmospheric transmission</td>
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<tr>
<td>Optics of concentrators</td>
<td>5-6</td>
<td>Overview of solar concentrators, conservation of etendue, and the fundamental concentration bound</td>
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<td>Solar thermal power conversion</td>
<td>7-8</td>
<td>The operational principle of solar thermal systems</td>
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<td>Introduction to the PV effect</td>
<td>9-10</td>
<td>The diode model of a solar cell, the effect of spectrum, temperature, and light capture</td>
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<tr>
<td>Models and statistics of solar radiation</td>
<td>11-13</td>
<td>Statistical models of solar radiation</td>
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Recommended Books:

1. A. Rabl, Active Solar Collectors and Their Applications, Oxford Univ. press, 1985. (Textbook, TJ 812.R33; 4 copies in the library available for three days)