

DEE-53117 Solar Power Systems

Examination, 6.10.2015

Answers to each question 1, 2, 3 and 4 should fit into one page of a common writing paper.

1. a) What is the origin of the parasitic series resistance in a PV module and how does it affect to the $I-V$ curve of the module?
b) What is the equivalent interception surface (lightning collection area) of a 20 m high flat roof building with a rectangle basal area of 100 m times 40 m standing on an open flat field, when a sight line of slope 1:3 is applied?
2. Define the following quantities, concepts and phenomena (with one or two sentences).
 - a) Fill factor.
 - b) Depletion region.
 - c) Hot spot.
 - d) One-diode model.
3. a) How does the maximum power point voltage and current of a silicon PV cell depend on the received irradiance and cell temperature? What is the reason for the behaviour?
b) Explain the main differences of light absorption in direct and indirect band gap semiconductor materials. How do the differences affect to the light absorption coefficients of these semiconductors?
4. Two strings of twenty series connected silicon PV cells have short circuit currents of 2.0 A and 4.0 A.
 - a) Draw the current-voltage and power-voltage curves of the two PV strings.
 - b) Draw the current-voltage and power-voltage curves of a PV system, when the two PV strings are connected in parallel.
 - c) Draw the current-voltage and power-voltage curves of a PV system, when the two PV strings are connected in series.
 - d) Draw the current-voltage and power-voltage curves of a PV system, when the two PV strings are connected in series and each string is protected with a bypass diode connected in parallel with it.