List of practice exam questions for „Solar Energy“:

1. The sun as an energy source
   - Sketch the radiation of a black and a grey body with $\epsilon = 0.5$ for 1000°K and 6000°K
   - What is the meaning of Kirchhoff's radiation law?
   - What is meant by the term global radiation?
   - What are the units for spectral irradiance?
   - What height (of the sun in the sky) does the value of AM = 1.8 correspond to?
   - Sketch the spectrum of extraterrestrial radiation and the radiation measured at the earth surface.
2. Semiconductors
   - state 7 different materials which can be used in PV.
   - Why are metals not suitable as an absorber layer?
   - State three significant differences in the electronic properties of crystalline and amorphous silicon.
   - Sketch the maximum efficiency of a single layer solar cell as a function of the bandgap.
   - What is the cause for a drift current?
   - What is the cause for a diffusion current?
3. Crystalline p-n solar cell
   - What is the difference in the fabrication process of single and multi crystalline solar cells? State three differences!
   - Draw (and label) a diagram outlining the processing steps for fabricating a silicon solar cell
4. Electrical characterization
   - Sketch the structure of a crystalline solar cell.
   - What is the thickness of a crystalline solar cell?
   - Sketch the band diagram for a crystalline solar cell.
   - How does the diffusion length of minority charge carriers plays a role in the efficiency of a Si solar cell?
   - Label the following characteristic line for a Si solar cell.
   - Sketch the equivalent circuit of a real solar cell.
5. Optimization of Si solar cells
   - State three loss processes in a solar cell!
   - What is the lateral resistance?
   - Think of two strategies to minimize the reflection of a solar cell.
   - What is the meaning of surface passivation?
6. Inorganic thin film solar cells
   - State three advantages of thin film solar cells to crystalline Si solar cells.
   - State two coating methods which are used for the active layer in thin film solar cells.
   - State three semiconductor materials which are used in thin film solar cells.
   - Sketch a band diagram of a a-Si:H pin solar cell.
   - What is the difference between a superstrate and a substrate thin film solar cell?
   - What is the Staebler-Wronski-Effect?
   - Sketch the structure of a monolithic thin film solar cell!

- Label the process for a thin film solar cell.
- What is meant by the term current matching in a tandem solar cell?
- Sketch the beam path inside a concentrator solar cell.
- What is the reason for an increase in efficiency in a concentrator solar cell.

7. Organic PV
   - What is the thickness of the active absorber in an OPV device and how does this relate to carrier collection?
8. third generation PV
   - Sketch the structure of a tandem solar cell!
   - State a material combination with which a tandem solar cell can be realized!
   - state three concepts for a so called Third Gen PV!
9. PV system
   - Sketch the I-V curve for a silicon solar cell with the following radiation powers: 200, 500 and 1000 W/m²
   - Sketch the I-V curve for three different silicon solar cell operating temperatures (0, 20 and 75 °C)
   - Sketch the power of a solar cell as a function of the voltage.
   - What is a bypass diode?
   - Draw a block diagram for an off-grid AC power plant.
10. solar thermal power plant
    - State three different concepts for a solar thermal power plant!
    - Why does one have to concentrate the solar radiation for a solar thermal power plant?
    - Label the sketch for a parabola mirror power plant!
    - Which three heat transporting materials are used in solar thermal?
    - What are the advantages and disadvantages of those three materials?
    - State three fundamental processes of heat transport!
    - Explain the function of a selective absorber layer!