$Q = A_c F_r (S(\tau\alpha) - \frac{U_L}{C}(T_1 - T_0))$

2. half-exam (2. välikoe) 9 May 2012
Tfy-56.4323 Solar Energy Engineering (5 cr, L),

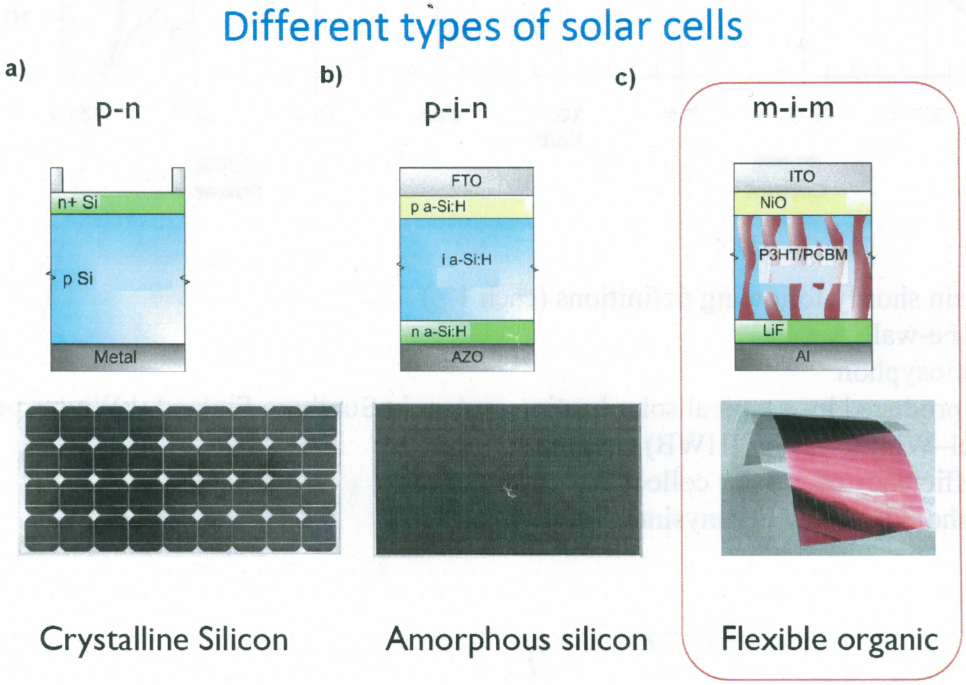
1. a) The concentration ratio of a parabolic dish is $C = 200$. How much solar radiation is received in the focal point of the concentrator if solar radiation on a plane is 800 W/m^2 direct radiation and 200 W/m^2 diffuse radiation? (2 p)

   b) How much heat (W/m^2) could the above concentrator deliver if its optical efficiency is 0.8 and the heat loss factor is 5 W/m^{2}K (per m^2 = per absorber area)? (2 p)

   c) How accurately needs the concentrator follow the movement of the sun in order to be able to concentrate the radiation to the focal point (choose A, B, C, or D; maximum misalignment error A = about 5°, B = about 2°; C = about 1°, D < 0.5°) (2 p)

2. Explain and compare with each other the structure (purpose and approximate thicknesses of the different material layers) and photovoltaic function (light absorption, charge separation, charge collection) of the following three solar cells types:

   a) Crystalline silicon solar cell
   b) Amorphous silicon solar cell
   c) Organic solar cell



3. Plan and sketch with components, and dimension key components for a stand-alone PV system in a village electrification application in Africa. Daily average solar radiation is 6 kWh/m^2 and the daily demand of electricity is 5000 Wh. (6 p)