Exercise Series 6

Exercise 1: Absorption

a) Which thickness of material do you need to absorb 90 % of the light with $\lambda = 500\,\text{nm}$ and 1000 nm in amorphous Si and in crystalline Si. Absorption coefficients are given in Tab. 1

Table 1: Absorption coefficients

$\lambda[nm]$	α for a-Si:H $[cm^{-1}]$	α for c-Si $[cm^{-1}]$
500	$2 \cdot 10^5$	10^4
1000	0.9	80

b) Draw the absorption profile for an intensity F_0 in a semi infinite wafer with a reflection of 10 % with $\lambda = 500\,\text{nm}$ and 1000 nm in amorphous Si and in crystalline Si.

c) Taking the results of a) & b) into account, what are options to increase the absorption to more than 99% in the films without making them thicker than what you calculated in a) ?

Exercise 2: Antireflection layer

Consider a multilayer stack with refractive indices n_1 ,n_2, and n_3. The Fresnel equation of reflection at normal incidence for two layers i and j is $r_{ij} = ((n_i - n_j)/(n_i + n_j))^2$. To achieve minimal reflection the second reflection r_{23}, should nullify r_{21}. Derive a condition linking n_1 , n_2, and n_3.