

ECEn 462 (Block 1)
Electromagnetic Radiation and Propagation
Homework #4

1. Book problem 7.1.3 (only part a and b)

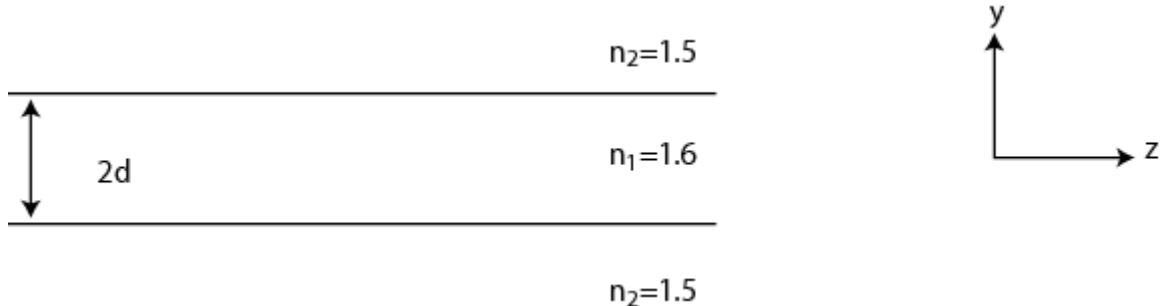


Figure 1: Dielectric slab waveguide.

2. Figure 1 shows a dielectric slab waveguide. The operating wavelength is $\lambda=1.5\mu\text{m}$ and the polarization is TE ($\vec{E} = E \hat{x}$).
- What is the waveguide thickness for single mode operation?
 - What is the approximate decay rate, α , for the existing mode (TE_1)?
 - What is the approximate propagation constant, k_z , for the existing mode?
 - How many TE modes exist if the wavelength is changed to red $\lambda=670\text{nm}$?
 - What is the range of propagation constants (k_z) for the various modes with this new wavelength?
3. The dielectric slab waveguide shown in Figure 1 has a dimension of $d=10\mu\text{m}$. What do you need to change the index of refraction of the cladding (n_2) to in order to have single mode operation at $\lambda=1.5 \mu\text{m}$? Assume that the incident mode has TE polarization?

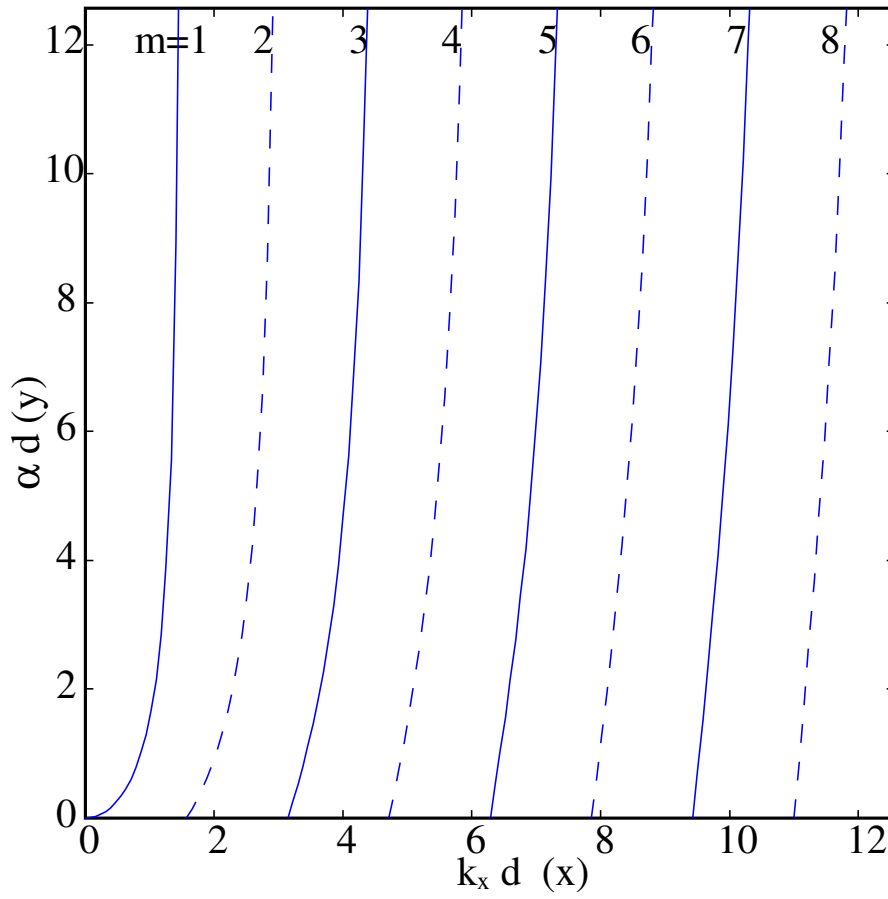


Figure 2: The plot of the guidance condition for TE modes in a dielectric waveguide.