PHY 712 – Problem Set # 22

Read Chapter 8 in Jackson.

Consider a TM wave propagating within a medium having, real dielectric constant $\varepsilon$ and permeability $\mu$, along the $z$ axis within an ideal rectangular waveguide with a cross section as shown in Fig. 8.5 and with $z$-component of electric field given by:

$$E_z(x, y, z, t) = E_0 \sin \left( \frac{m\pi x}{a} \right) \sin \left( \frac{n\pi y}{b} \right) e^{ikz-i\omega t}. $$

Here $m$ and $n$ are integers.

1. Determine the value of $k$.

2. Determine the other 5 components of electric and magnetic fields:
   (a) $E_x$.
   (b) $E_y$.
   (c) $H_x$.
   (d) $H_y$.
   (e) $H_z$. 