Tutorial 1 - Waveguides

**Question 1**  A waveguide filled with a material whose $\varepsilon_r = 2.25$ has dimensions $a = 2$ cm and $b = 1.4$ cm. If the guide is to transmit 10.5-GHz signals, what possible modes can be used for the transmission?

**Question 2**  A TE wave propagating in a dielectric-filled waveguide of unknown permittivity has dimensions $a = 5$ cm and $b = 3$ cm. If the $x$-component of its electric field is given by

$$E_x = -36 \cos(40\pi x) \sin(100\pi y)$$

$$\cdot \sin(2.4\pi \times 10^{10} t - 52.9\pi z), \quad (V/m)$$

determine:

(a) the mode number,
(b) $\varepsilon_r$ of the material in the guide,
(c) the cutoff frequency, and
(d) the expression for $H_y$.

**Question 3**  A narrow rectangular pulse superimposed on a carrier with a frequency of 9.5 GHz was used to excite all possible modes in a hollow guide with $a = 3$ cm and $b = 2.0$ cm. If the guide is 100 m in length, how long will it take each of the excited modes to arrive at the receiving end?