

ECEn 462 (Block 1)
Electromagnetic Radiation and Propagation
Homework #3

1. Book problem 7.3.1
2. For an air filled rectangular metallic waveguide of dimensions $a=3\text{cm}$ and $b=1\text{cm}$, compute the cutoff frequencies of the first 4 modes and give the operating bandwidth of the dominant mode.
3. For the waveguide of the previous problem, suppose that the operating frequency is $1.5 f_{c,10}$. An imperfect probe setup excites the TE_{11} mode. How far down the waveguide from the probe has the amplitude of this mode fallen by 100dB?
4. A rectangular metallic waveguide is to be designed to have the following design parameters:
 - Single mode operation for $f < 10\text{GHz}$
 - Air filled metallic waveguide
 - Choose the waveguide dimensions (a and b) to be as large as possible.
 - A. What are the dimensions of the waveguide?
 - B. What is the waveguide cutoff frequency (below which the waveguide does not support any modes)?
 - C. What is the electric field phasor of the lowest waveguide mode?
 - D. What is the time average power density, S_{av} of the lowest waveguide mode?
$$\left(\vec{S}_{av} = \frac{1}{2} \text{Re} \{ \vec{E} \times \vec{H}^* \} \right)$$
5. Sketch the location of a waveguide probe or probes that would excite the TE_{02} mode but not the TE_{01} mode. How would you drive each probe to accomplish this?