

hw

Homework Assignment 11 due Friday November 15

- 11-1. In physics, what is ether? And what is ethernet?
- 11-2. What are the frequencies used by your cell phone?
- 11-3. What are the frequencies used for WiFi communication?
- 11-4. Jackson Problem 8.2
- 11-5. What is the impedance of free space? *Explain.*

The next problems concern a rectangular waveguide with $\delta x = a = 5$ cm and $\delta y = b = 2.5$ cm; also, set $\mu = \mu_0$ and $\epsilon = \epsilon_0$.

- 11-6. Calculate the cutoff frequency and the corresponding wavelength for the TE_{10} mode.
- 11-7. Calculate the energy flux of the TE_{10} mode.
[Hint: the fields are the Real Parts of the complex functions in (8.46).
Take the real parts before you calculate the Poynting vector.]
- 11-8. Calculate the cutoff frequencies for the TM modes. Hand in a Table like the table below (8.46); the elements of the table should be $\omega_{\text{cutoff}}(TM_{mn}) / \omega_{\text{cutoff}}(TE_{10})$.
- 11-9. For the waveguide mode TE_{32} ...
hand in a sketch (better: a computer graphic) of the effective surface current density $\mathbf{K}(x,y)$ at the wall of the waveguide with $y = 0$, for $\omega = 2 \omega_{32}$.
- 11-10. Consider the TE_{mn} wave with $\omega > \omega_{mn}$.
 - (a) Calculate the phase velocity and show that it is greater than c .
 - (b) Calculate the group velocity and show that $v_{\text{group}} = c^2 / v_{\text{phase}}$.
- 11-11. Why is a waveguide sometimes better than a coaxial cable? Explain, and define "better".