Last Homework

Physics 462, Summer 2006 Due at the beginning of class August 9

1. Animate the EM wave before and in the conductor of problem 9.21. Assume unit amplitude incident on the conductor.

2. The derivation of the formula for the electromagnetic mode density assumes that the cavity dimensions are very large. $N(\nu)$ was found to be $N(\nu)$= number of electromagnetic modes between 0 and ν (per unit of volume of a cavity)

   $N(\nu) = \frac{8\pi\nu^3}{3c^3}$.

   Therefore the mode density (per unit of volume per unit of frequency) is

   $n(\nu) = \frac{dN}{d\nu} = \frac{8\pi\nu^2}{c^3}$

   When the dimensions of the cavity become comparable to a wavelength, the approximation is not accurate and one must count the modes. This problem is intended to give you confidence in the formula above and also to indicate the exact procedure. Plot the number of modes between 0 and 10 GHz as a function of frequency for a rectangular cavity of dimensions 2x5x6 cm using the approximate formula given above and by actually counting the allowed modes and plotting the resulting stair-step function. (CAUTION: Only the m or p index of the $TE_{m,p,q}$ mode may be zero, but not both, and only the q index may be zero for the TM mode.)

3. Explain in words how the angular spectrum solution to diffraction would lead to a solution of a grating moving along the z direction with a sinusoidal transmittance function.

4. From Fowles: Read 7.1-7.6 and 9.6

5. Fowles: Chapter 7: Problems 1, 2, 3, 6, 9. Chapter 9: Problems 7.