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| EE351 / Fall 2005 | Homework # 6 | Due: Monday 10/17/05 |
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Problems:

- An air filled rectangular waveguide has 5 GHz cutoff frequency for TE<sub>10</sub> mode whereas the cutoff frequency of the TE<sub>01</sub> mode is 10 GHz. Determine the following
  - dimensions of the waveguide
  - cutoff frequencies for the next three higher TE modes
  - The cutoff frequency of the TE<sub>11</sub> if the waveguide is filled with a lossless dielectric ( $\epsilon=2.56\epsilon_0, \mu=\mu_0$ ).
- An air filled rectangular waveguide has dimensions a=6 cm and b= 3cm. Given that::

$$E_z = 5 \sin\left(\frac{2\pi x}{a}\right) \sin\left(\frac{3\pi y}{b}\right) \cos(10^{12} t - \beta z)$$

Calculate the following:

- Mode of operation
  - Intrinsic impedance of the mode
  - Average power flow in the waveguide
  - H<sub>x</sub>
- An air filled cubical cavity operates at resonant frequency of 2 GHz when excited at the TE<sub>101</sub> mode. Determine the dimensions of the cavity.
  - In air filled rectangular waveguide with dimensions (a=10 cm, b=5 cm) operating at 5 Hz, the TE<sub>10</sub> mode is given by:

$$E_x = \frac{j\omega\mu\pi}{bh^2} H_o \sin\left(\frac{\pi y}{b}\right) e^{-j\beta z}$$

$$E_y = 0$$

$$h^2 = \left(\frac{m\pi}{a}\right)^2 + \left(\frac{n\pi}{b}\right)^2$$

Determine: (a) Time average Poynting vector  $P_{ave}$  (b) The total average power transmitted across the cross-section of the waveguide