EEL4436C/5437C Microwave Engineering

Homework #1

1. (15 pts) Derive the vector wave equation for magnetic field from Maxwell’s equations. (Hint: follow the procedure for E field vector wave equation)
2. (20 points) A uniform plane wave (UPW) in free space is given by:
   1. Find
   2. Find
   3. Find
   4. Find
   5. Find
   6. Find in phasor form (You can directly write the expression if otherwise stated)
   7. Find
3. (30 points) A UPW with a frequency of 150 MHz propagates in +x direction in free space. The E field vector is given by: .
   1. Find
   2. Find
   3. Find
   4. Find
   5. Find
   6. Find
   7. Use Maxwell equations to find . (Hint: follow the notes)
4. (15 points) The E field vector of a UPW propagating in +z direction in silicon () is given by:
   1. What type of polarization is this wave?
   2. Find in phasor form.
   3. Decompose this wave into a RHCP wave and a LHCP wave. (hint: first find a E field vector which corresponds to a RHCP/LHCP wave)
   4. Compare the amplitude of both the RHCP and the LHCP waves.
   5. What is the phase difference between the two circular polarized waves?
5. (20 points) The E field vector of a UPW propagating in +z direction in air is given by:
   1. What type of polarization is this wave?
   2. If there is a mirror made of perfect metal () at z=0, write the reflected E filed at z=0.
   3. Find the total H field at z=0.
   4. What type of polarization is the reflected wave?