Problem 1 (20 Points)

Two infinitely long transmission lines are connected together. One's characteristic impedance is 200 Ω and the other's is 50 Ω. If a wave at the 200 Ω line is propagating toward the junction, what are the reflection and the transmission coefficients? What percentage of the power has been transmitted across the junction? Design a transmission-line transformer to reduce the reflection to zero. What is the VSWR at this matching transmission-line section?

Problem 2 (20 Points)

A uniform plane wave propagating in air given by $\bar{E}_i(x) = 30e^{-j20\pi x}(\hat{y} + j\hat{z})$ *V/m* is normally incident on a perfectly conducting plane located at $x = 0$. (a) Find the frequency and wavelength of the wave. (b) Find the corresponding magnetic field $\bar{H}_i(x)$. (c) Find the electric and magnetic field vectors of the reflected waves [i.e., $\bar{E}_r(x)$ and $\bar{H}_r(x)$]. (d) Compare the polarizations of the incident and reflected waves.

Problem 3 (20 Points)

Calculate the dimensions of an air-filled rectangular waveguide for which the cutoff frequencies for TM_{11} and TE_{03} modes are both equal to 12 GHz. What is the dominant mode of this waveguide? At 6 GHz, determine whether the dominant mode will propagate or evanescent in the waveguide.

Problem 4 (20 Points)

(1) The current distributions of infinitesimal ($L<<\lambda$) dipole antenna A and B are given as $I_A = 4I_0(L/2 - |z|)/L$ and $I_B = I_0$, for $-(L/2) \le z \le (L/2)$. Find the ratio of the radiation resistance of these two antennas. (2) A linear array on the z axis, with four isotropic sources of equal amplitude and equal distance $d=\lambda/4$, such that the main beam is at $\theta=120^\circ$. Find the required progressive phase difference between the antenna elements.

(背面仍有題目,請繼續作答)

Problem 5 (20 Points)

A load of 100-j150Ω is connected to a 50Ω lossless line. Find: (a) VSWR, (b) The load admittance Y_L, (c) Z_{in} at 0.25λ from the load, (d) the line lengths d_1 and d_2 for a single short-circuited stub matching. (You MUST use Smith Chart to find all the answers and write down all steps of your reasoning)