

EE 481/581 Microwave Engineering (Fall 2025)

Homework 1

Friday, August 29, 2025

- 1) An RO3010 Rogers Corporation PCB datasheet gives that the relative permittivity is 11.2 and dissipation factor is 0.022 at 10 GHz at 23°C. Determine ϵ' , ϵ'' , and the effective conductivity σ of this RO3010 PCB.
- 2) Determine ϵ' , ϵ'' , and the effective conductivity σ of nylon (610) at 3 GHz at 25°C. [Hint: Appendices E, F, & G.]
- 3) 1.2
- 4) Region 1 ($z > 0$) is air (μ_0 , ϵ_0) while region 2 ($z < 0$) is a ferrite ($16\mu_0$, $10\epsilon_0$). The electric field is $100\hat{a}_x - 80\hat{a}_y - 90\hat{a}_z$ (V/m) at $z = 0^+$. a) Find the electric χ_e and magnetic χ_m susceptibilities in both regions. b) Find the electric flux density and polarization vectors in region 1 at $z = 0^+$. c) Determine the electric field, electric flux density, and polarization vectors in region 2 at $z = 0^-$.
- 5) **EE 481 only**- A 93.5 MHz plane wave propagates through free space in the -z-direction. a) Find the phase velocity, wavelength, phase constant, and intrinsic impedance. b) If the electric field has an amplitude of 12 V/m at $z = 0$ and is oriented in the x-direction, write the equation for the phasor vector electric field. c) Find the corresponding phasor vector magnetic field.
- 6) **EE 581 only**- A 3 GHz plane wave propagates through nylon (610) in the -z-direction. a) Find the phase velocity, wavelength, attenuation constant, phase constant, and intrinsic impedance. b) If the electric field has an amplitude of 9 V/m at $z = 0$ and is oriented in the x-direction, write the equation for the phasor vector electric field. c) Find the corresponding phasor vector magnetic field. d) Is nylon (610) a good conductor? Why or why not? Regardless, find the skin depth in nylon (610) at 3 GHz.

Due Friday, September 5, 2025.