

## **EE 481/581 Microwave Engineering (Fall 2024)**

### **Homework 1**

**Friday, August 29, 2024**

- 1) An FR-4 PCB datasheet gives that the relative permittivity is 4.80 and the loss tangent (AKA dissipation factor) is 0.022 at 1 MHz at 20°C. Determine  $\epsilon'$ ,  $\epsilon''$ , and the effective conductivity  $\sigma$  of this FR-4.
- 2) Determine  $\epsilon'$ ,  $\epsilon''$ , and the effective conductivity  $\sigma$  of rexolite at 3 GHz at 25°C. [Hint: Appendices E, F, & G.]
- 3) 1.2
- 4) EE 481 only- A 103.5 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 8 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.
- 5) EE 581 only- A 3 GHz plane wave propagates through rexolite 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 6 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 rexolite a good conductor? Why or why not? Regardless, find the skin depth in rexolite at 3 GHz.

**Due Friday, September 6, 2024.**