

Homework 2
EE 381 Electric & Magnetic Fields (Fall 2025)
Friday, September 12, 2025

- 1) 11.28 Also, find input Γ_{in} reflection coefficient and impedance Z_{in} if the line is 1.22λ long.
- 2) 11.49 Solve this problem analytically, don't use Smith chart.
- 3) A lossless coaxial transmission line ($Z_0 = 75 \Omega$, $u = 2.3 \times 10^8$ m/s) of length $\ell = 2.3\lambda$ is terminated with a load $Z_L = 40 - j20 \Omega$. The transmission line is connected to a 75Ω signal generator operating at 2.4 GHz with a phasor voltage $V_g = 6\angle 0^\circ$ V. First, sketch the transmission line circuit. Then, determine (a) the phase constant β , wavelength λ , and length ℓ (m) of the transmission line, (b) input impedance Z_{in} , and (c) input phasor current I_0 & voltage V_0 .
- 4) A lossless transmission line ($Z_0 = 40 \Omega$, $u = 2.4 \times 10^8$ m/s), terminated with an unknown load, has an input impedance of $20 + j80 \Omega$. The transmission line is connected to a 50Ω generator operating at 4.1 GHz with phasor voltage $V_g = 16\angle 0^\circ$ V. First, sketch the transmission line circuit. Then, determine (a) the phase constant β , (b) phasor input current I_0 & voltage V_0 , (c) phasor forward V_0^+ & backward V_0^- voltage waves, and (d) time-average power input and delivered to load.
- 5) An RG-11 coaxial transmission line ($Z_0 = 75 \Omega$, $u = 2.49 \times 10^8$ m/s, $\alpha = 4.35$ dB/100 ft) of length 14 m is terminated with a load. Using a vector network analyzer (VNA), a load reflection coefficient of $\Gamma_L = 0.42\angle 36^\circ$ is measured. The transmission line is connected to a generator with $V_g = 24\angle 0^\circ$ V and $Z_g = 80 \Omega$ operating at 1 GHz. First, sketch the transmission line circuit. Then, determine (a) the attenuation (Np/m), phase (rad/m), & propagation constants, (b) SWR & load impedance, (c) input reflection coefficient & impedance, (d) phasor input current & voltage, (e) phasor forward voltage wave amplitude, (f) phasor load current & voltage, and (g) time-average power input and delivered to load.

Due Wednesday, September 17, 2025.

Note: Express all phasor quantities, i.e., currents & voltages, and reflection coefficients in polar/phasor format with angles in degrees (e.g., $10\angle 30^\circ$ V, $12\angle 140^\circ$ mA). Express impedances & propagation constants in rectangular format (e.g., $Z_L = 10 + j30 \Omega$).