Homework 7
EE382 Applied Electromagnetics (Spring 2018)
Friday, March 02, 2018

1) PE11.7 Use an **open circuit stub**. Find both possible solutions, and sketch resulting circuits.
2) 11.59 Assume $\Gamma = \Gamma_L$.
3) At 1.6 GHz, match a load of $Z_L = 25 + j\,75\ \Omega$ to a lossless transmission line ($Z_0 = 50\ \Omega$, $u = 2 \times 10^8$ m/s) using a quarter-wave transformer (you may assume $u = 2 \times 10^8$ m/s). Find and sketch both possible solutions for smallest possible circuit. Use 50 Ω transmission lines for everything but the quarter-wave transformers.
4) A load of $Z_L = 420 + j\ 600\ \Omega$ is connected to a 300 Ω, 12 V_{RMS}, 500 MHz, sinusoidal generator by a 1 m long, lossless ($u = 2.1 \times 10^8$ m/s, $Z_0 = 300\ \Omega$) twin-lead, transmission line. With no matching, how much power is delivered to the load? Match the load to the generator by placing a single discrete capacitor in parallel with the transmission line as close to the load as possible. Sketch the resulting circuit with all relevant values. How much power is delivered to the load after matching?
5) A load of $Z_L = 15 - j\ 37.5\ \Omega$ is connected to a 75 Ω, $36\angle 0°$ V, 1 GHz, sinusoidal generator by a lossless, coaxial transmission line ($u = 2.4 \times 10^8$ m/s, $Z_0 = 75\ \Omega$) of length 1 m. With no matching, how much power is delivered to the load? Match the load to the generator by placing a single discrete capacitor in **series** with the transmission line as close to the load as possible. Sketch the resulting circuit with all relevant values. How much power is delivered to the load after matching?
6) Match a load of $Z_L = 20 + j\ 40\ \Omega$ connected to a 60 Ω, $10\angle 0°$ V, 2.4 GHz, sinusoidal generator with an 8 cm long, lossless transmission line ($Z_0 = 60\ \Omega$, $u = 2.25 \times 10^8$ m/s) and a **short circuit** single-stub tuner. Find and sketch both possible solutions. How much power is delivered to the load before matching? How much power is delivered to the load after matching? Use the 60 Ω transmission line for everything.

- Unless otherwise specified, use **Smith charts** to solve problems (one Smith chart per problem). Clearly label all work on Smith charts (e.g., label all points, arcs, problem number, distances, …).
- Write all complex quantities in phasor form (e.g., $A/\theta°$) except admittances, impedances and propagation constants which should be in rectangular form.

Due Wednesday, March 14, 2018.