University of California, Berkeley *Fall 2017*
EECS 142/242A *Prof. A. Niknejad*

Problem Set 5

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1. Find y for the following normalized impedance on Smith Chart.

   (a) $z_L = 1.4 + j2$

   (b) $z_L = 0.5 + j0.9$

   (c) $z_L = 1.6 - j0.3$

2. For the following problems, you may use the Smith Chart. For lumped component calculations, use equations and compare to the accuracy of using the Smith Chart.

   (a) Design a matching network to match load impedance $Z_L = 70 + j100$ ohm to a 50 ohm using lumped circuits.

   (b) Design a matching network to match load impedance $Z_L = 70 + j100$ ohm to a 50 ohm using transmission lines.

   (c) Design a matching network to match load impedance $Z_L = 160 - j30$ ohm to a 100 ohm using lumped circuits.

   (d) Design a matching network to match load impedance $Z_L = 160 - j30$ ohm to a 100 ohm using transmission lines.

   (e) Design a matching network to match 50 ohm to $Z_L = 25 + j90$ ohm using lumped circuits.

   (f) Design a matching network to match 50 ohm to $Z_L = 25 + j90$ ohm using transmission lines.

3. Matching Network Design

   (a) Design a π matching network between a 1000Ω load impedance and a 50Ω source impedance at 1 GHz. The inductor and capacitor quality factors are 20. The target bandwidth for $|S_{11}| <$ -10 dB is 5%. Calculate the insertion loss and verify your design using ADS or Cadence. Check in ADS if the relation $|S_{11}|^2 + |S_{21}|^2 = 1$ holds.

   (b) Design a matching network between a 1000Ω load impedance and a 50Ω source impedance at 1 GHz. The inductor and capacitor quality factors are 20. The design goal is to achieve the lowest insertion loss. Calculate the insertion loss and verify your design using ADS or Cadence.