HW6: Wien bridge derivation

STUDENT NAME

February 26, 2015

Introduction
Given is the Wien bridge that is used to measure the capacitance, and series resistance of a capacitor as shown in Figure 1. In addition, the frequency of the input signal can be determined. Here are the equations given that the bridge is in balance:

$$Z_2 = R_2 \tag{1}$$

$$Z_x = \frac{R_x \frac{1}{j\omega C_x}}{R_x + \frac{1}{j\omega C_x}} = \frac{R_x}{1 + j\omega R_x C_x} \tag{2}$$

$$Z_3 = R_3 \tag{3}$$

$$Z_1 = R_1 + \frac{1}{j\omega C_1} = \frac{1 + j\omega R_1 C_1}{j\omega C_1} \tag{4}$$

$$\tag{5}$$

Here is the answer: YOUR JOB IS TO DERIVE THESE EQUATIONS BASED ON THE ONES GIVEN ABOVE.

$$\omega^2 = \frac{1}{R_1 C_1 R_x C_x} \tag{6}$$

$$R_x = R_3 \left(\frac{1 + \omega^2 R_1^2 C_1^2}{\omega^2 R_1 R_2 C_1^2} \right) \tag{7}$$

$$C_x = \frac{R_2 C_1}{R_3 \left(1 + \omega^2 R_1^2 C_1^2\right)} \tag{8}$$

$$\tag{9}$$

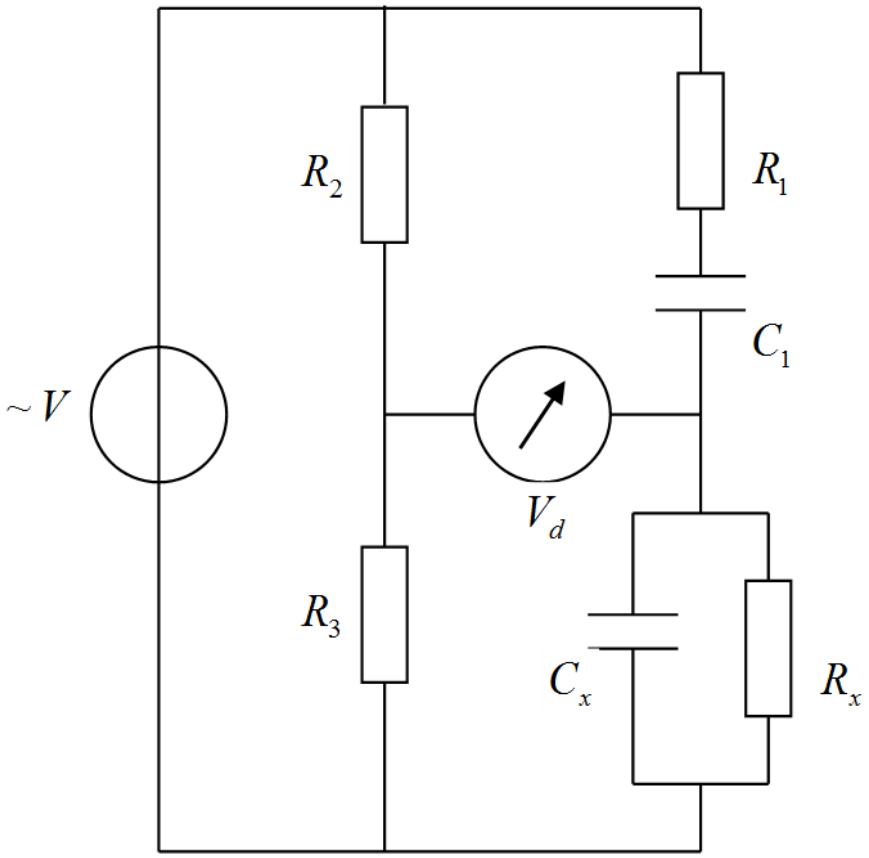

Figure 1: Wien bridge schematic.