

ECE 1356 Wireless Communication Circuits  
Midterm Examination Winter, 03

**Name:**\_\_\_\_\_ Duration: 1 hour, 5 minutes

**Directions:** Complete all 3 problems. Please use both sides of the sheets provided, and secure any additional sheets that you use.

**1.(Ch 4).** A  $50\Omega$  lossless transmission line of length  $23m$  is connected to a voltage source with phasor  $V_i = 5V$  at a frequency of  $28.2MHz$ . The impedance of this source is  $50\Omega$ . The voltage phasor measured at the transmission line input is  $2.5e^{j\frac{\pi}{9}}$ . What is the load resistance and reactance? (Use  $c = 2 \times 10^8 m/sec$ .)

2. (Ch 3). The equivalent circuit for a crystal is shown below. For the special case  $R_1 = 50\Omega$ ,  $R_s = 0.5\Omega$ ,  $L = 1\text{ nH}$ ,  $C_1 = 1\ \mu\text{F}$ , and  $C_2 = 1\ \text{nF}$ , what is the *approximate* frequency at which the voltage phasor magnitude is a maximum across  $R_1$ ? What is an *approximate* expression for the ratio of this voltage to the input voltage, at this frequency? Provide calculations for all answers.

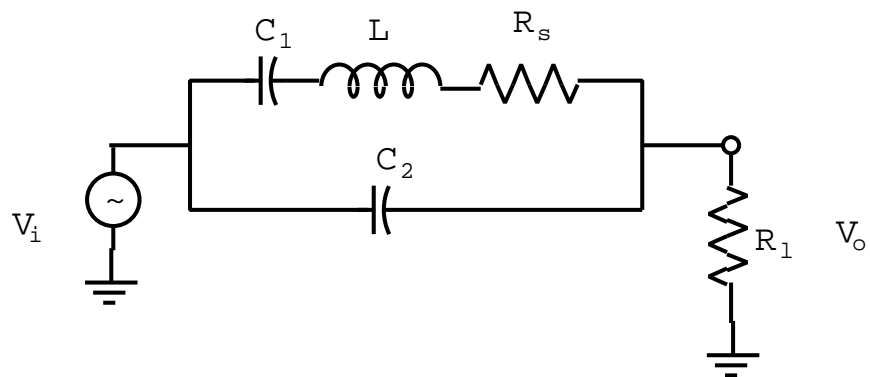


Figure 1: Resonance Circuit.

**3. (Ch 2.)** It is desired to modify the NorCal40A radio to receive signals in the novice band  $28.2MHz$ , rather than at  $7MHz$ , by only changing the antenna, the RF filter, the VFO and the RF mixer. Currently, the NorCal40A has an intermediate frequency of  $4.9MHz$ . It is desired that the new RF mixer translate the signal at  $28.2MHz$  to  $4.9MHz$ , and that the new RF filter reject the RF image.

Specify both options for the VFO frequency, and present the VFO image frequency for each case.