

HW #3 Phy 415/515

Prelab: Due at beginning of your lab section.

Show all work or receive no credit.

Late prelabs will not be accepted.

1. What is the cut off frequency (f_c not ω_c) for a high pass circuit using $R_1=1\text{ k}\Omega$ and $C_1=0.47\text{ }\mu\text{F}$?

2. What is the amplitude of the output for a 1 Volt amplitude input for the high pass circuit at $f=100\text{ Hz}$, 1 kHz and 10 kHz ?

3. What is the cut off frequency for a Low pass circuit using $R_2=5\text{ k}\Omega$ and $C_2=0.01\text{ }\mu\text{F}$?

4. What is the amplitude of the output for a 1 Volt amplitude input for the low pass circuit at $f=100\text{ Hz}$, 1 kHz , and 10 kHz ?

5. What is the amplitude of the output for a 1 Volt amplitude input for the band pass circuit at $f=100\text{ Hz}$, 1 kHz , and 10 kHz ? (hint: it is the product of the above ratios ($\frac{V_{out}}{V_{in}}$) if $R_1 \ll R_2$.)

6. At what frequency is the magnitude of the parallel impedance (reactance) of a 2.5 mH inductor and a $0.1\text{ }\mu\text{F}$ capacitor a maximum?

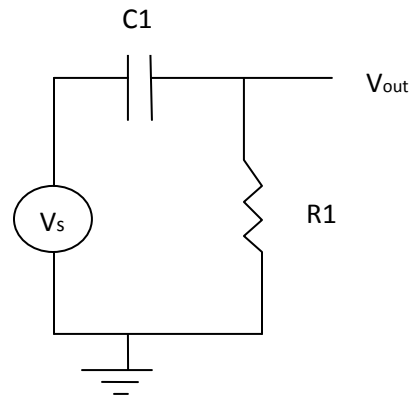


Figure 1. High Pass Filter

Some necessary equations:

High Pass Filter:

$$|V_{out}| = RV_s \left[\frac{1}{R^2 + \frac{1}{\omega^2 C^2}} \right]^{\frac{1}{2}}$$

Low Pass Filter:

$$|V_{out}| = V_s \left[\frac{1}{1 + (R\omega C)^2} \right]^{\frac{1}{2}}$$

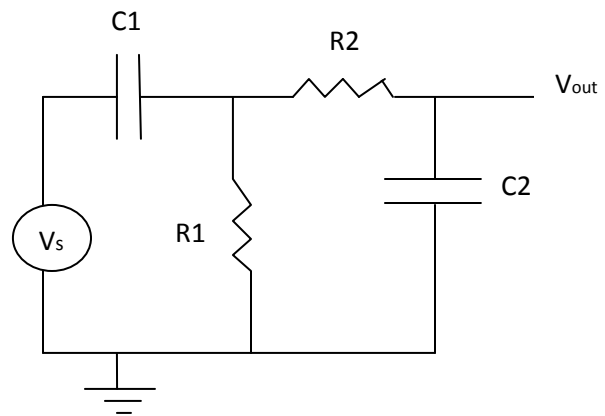


Figure 2. Band Pass Filter