EECE 2210 - Electrical Engineering
Quiz 11

Prof. Charles A. DiMarzio

22 November 2021

Student Name: _____

The figure shows an amplifier circuit with a feedback impedance that is a combination of a resistor and capacitor. In this circuit, $R_1 = 2\,\text{k}\Omega$, $R_2 = 20\,\text{k}\Omega$, $C = 100\,\text{pF}$. The op–amp is assumed to be an ideal one.

1. If V_{in} is some DC voltage, what is the gain of the amplifier?

Gain = _____ .

2. If V_{in} is a very high–frequency AC voltage, what is the gain? Is this a low–pass or high–pass amplifier?

Gain = _____ . ☐ Low–Pass ☐ High–Pass

3. Write an equation for the gain as a function of frequency.

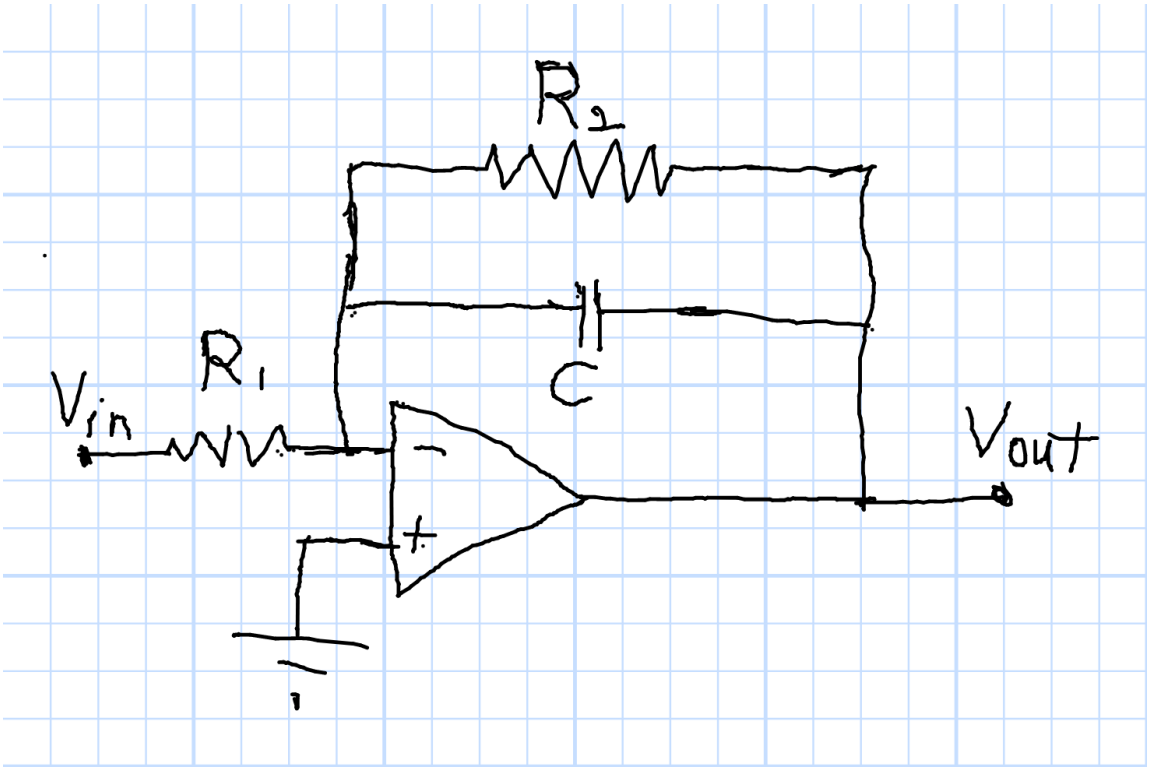
$A_V(f) =$ _____ .

4. At what frequency is the gain equal to the maximum (from part 1) divided by $\sqrt{2}$. In other words, what is the cutoff frequency?

Cutoff Frequency = _____ .

5. By what angle is the output voltage different from the input at the cutoff freqency?

Phase = _____ Degrees.


R_2
R_1
C
V_{in}
V_{out}
−
+

1. If V_{in} is some DC voltage, what is the gain of the amplifier?

Gain $= -R_2/R_1 = -10$

2. If V_{in} is a very high–frequency AC voltage, what is the gain? Is this a low–pass or high–pass amplifier?

Gain $= -Z_2/R_1 = 0/R_1 = 0$ X Low–Pass ☐ High–Pass

3. Write an equation for the gain as a function of frequency.

$$A_V(f) = \frac{-\left(R_2 \,||\, \frac{1}{j2\pi fC}\right)}{R_1}$$

4. At what frequency is the gain equal to the maximum (from part 1) divided by $\sqrt{2}$. In other words, what is the cutoff frequency? $R_2 = \left|\frac{1}{jC2\pi f}\right|$
$= \frac{1}{2\pi R_2 C}$

Cutoff Frequency = 79.6 Hz.

5. By what angle is the output voltage different from the input at the cutoff freqency?

$$A_V(f) = \frac{-\left(R_2 \,||\, \frac{1}{j2\pi fC}\right)}{R_1} = \frac{-\left(R_2 \,||\, -jR_2\right)}{R_1}$$

Phase = -45 Degrees