Group Members (Last Name, First Name)

Member #1: _____Algador, Vigomar Kim_____

Member #2: _____Chan, Casey_____

Member #3: _____Bon, Trinh_____

Pre-Lab #7 (Week II) – Low Pass Filters

Theoretical analyses and making predictions regarding the behavior of circuits is one of the most crucial, yet underrated and often ignored, jobs among young engineers. This includes the ability to carry out hand calculations in the abstract. Keep in mind that some of the calculations done here will be directly applicable to the worksheets that will be provided and the circuits you will be assembling and testing for the lab. You may use any technique of circuit analysis in order to obtain the solutions, but you must clearly state which technique of analysis you are using. If you are using a result from a book then you must include the references. You must show all work to receive credit. No credit will be given for answers with no justification. Your work should be neat and organized. If I can't follow your work or read your writing, then you will not get full credit. You may attach extra sheets if you need more space to show all your work. Remember that the ability to clearly explain what you are doing to other engineers is one of the most important skills you need to develop.

Total Score: /25

Work Breakdown Structure: It is important that every group member do their share of the work in these labs. Remember that you will receive no credit for the prelab if you did not contribute. Write in the Table provided below, which group member(s) contributed to the solution of each problem in the prelab. Also remember that only on prelab per group will be turned in to Canvas. If there was any group member that did not contribute, then write their name in the space provided below.

Problem Number	Group member(s) that worked on the problem.
Problem 1	Algador, Vigomar Kim Chan, Casey Trinh, Bon
Problem 2	Algador, Vigomar Kim Chan, Casey Trinh, Bon

Absent member(s):_____

Problem #1: Unloaded Active Low Pass Filter   Score: /15

In the circuit diagram shown below define all relevant circuit variables and calculate the transfer function in Laplace space, $H(s)$, using the technique of your choice. Make sure to show all your work and reasoning. For simplicity, assume $R_1 = R_2 \equiv R$. Your answer should be an equation written in terms of R, C, and s.
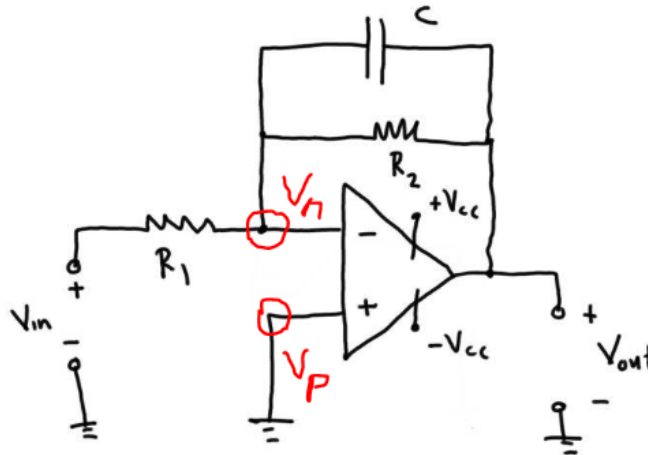
NODE V_n:

$$\frac{V_n - V_{in}}{R_1} + \frac{V_n - V_{out}}{R_2} + \frac{V_n - V_{out}}{1/sC} = 0 \qquad\qquad V_n = V_p = 0$$

$$-\frac{V_{in}}{R_1} - \frac{V_{out}}{R_2} - \frac{V_{out}}{1/sC} = 0 \qquad\qquad R_1 = R_2 = R$$

$$-\frac{V_{in}}{R} = V_{out}\left[\frac{1}{R} + sC\right]$$

$$-\frac{V_{in}}{R} = V_{out}\left[\frac{1 + sRC}{R}\right]$$

$$\frac{V_{out}}{V_{in}} = -\frac{1}{1 + sRC}$$
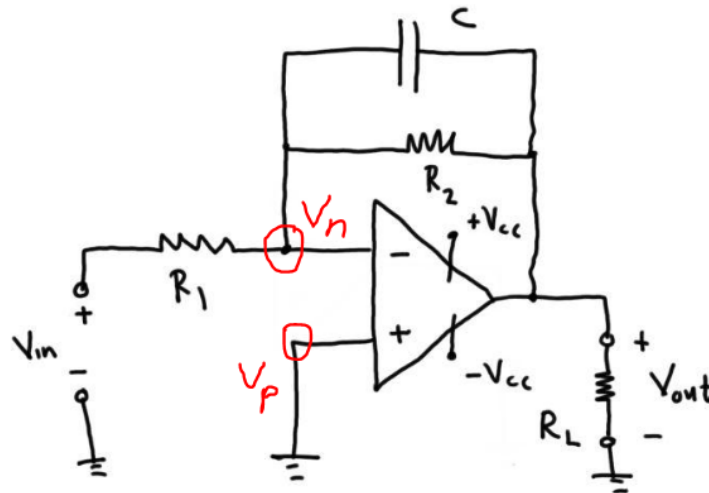
$$H(s) = -\frac{1}{1 + sRC}$$

Answer: $H(s) = -\dfrac{1}{1+sRC}$

Problem #2: Loaded Active Low Pass Filter   Score: /10

In the circuit diagram shown below define all relevant circuit variables and calculate the transfer function in Laplace space, $H(s)$, using the technique of your choice. Make sure to show all your work and reasoning. For simplicity, assume $R_1 = R_2 \equiv R$. Your answer should be an equation written in terms of R, R_L, C, and s.

NODE V_n:

$$\frac{V_n - V_{in}}{R_1} + \frac{V_n - V_{out}}{R_2} + \frac{V_n - V_{out}}{1/sC} = 0 \qquad\qquad V_n = V_p = 0$$

$$-\frac{V_{in}}{R_1} - \frac{V_{out}}{R_2} - \frac{V_{out}}{1/sC} = 0 \qquad\qquad R_1 = R_2 = R$$

$$-\frac{V_{in}}{R} = V_{out}\left[\frac{1}{R} + sC\right]$$

$$-\frac{V_{in}}{R} = V_{out}\left[\frac{1+sRC}{R}\right]$$

$$\frac{V_{out}}{V_{in}} = -\frac{1}{1+sRC}$$

$$H(s) = -\frac{1}{1+sRC}$$

Answer: $H(s) = -\dfrac{1}{1+sRC}$