# Homework 7

Due date: Jun.$6^{th}$

Turn in your homework online before the class

Rules:

- Please work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism!
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

# 1

[8 points]Find the transfer function $H(\omega)$ with the Bode magnitude plots shown in **Fig 1:a** and **Fig 1:b**. The phase of $H(\omega)$ is $90°$ at $\omega = 0$ in both figures.

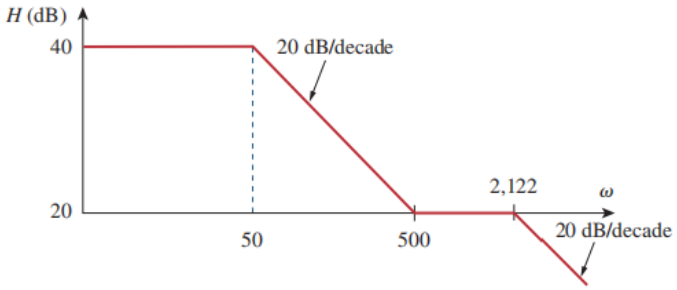


Figure 1: a

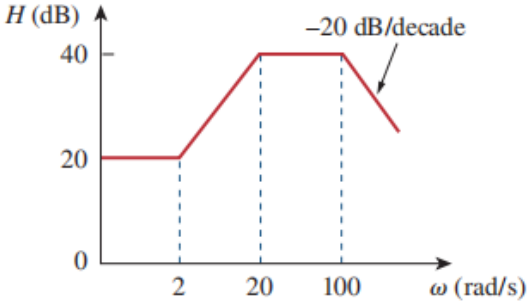


Figure 1: b

## 2

[12 points]For the circuit shown in **Fig 2**, find:
(a). The resonant frequency $\omega_0$
(b). $Z_{in}(\omega_0)$

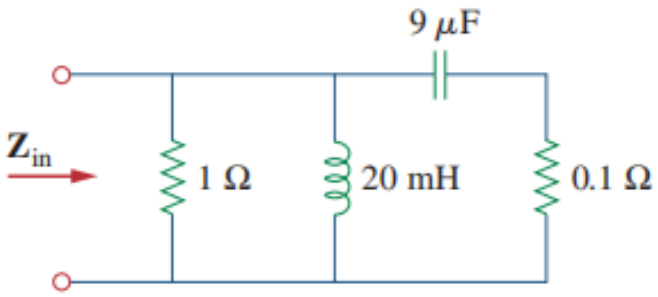


Figure 2:

# 3

[12 points]An example filter in **Fig 3** has the output of $v_o$ and the input of $v_s$. Find the transfer function and determine the type of the filter.(Hint:it depends on the parameters,you need to discuss particular cases)

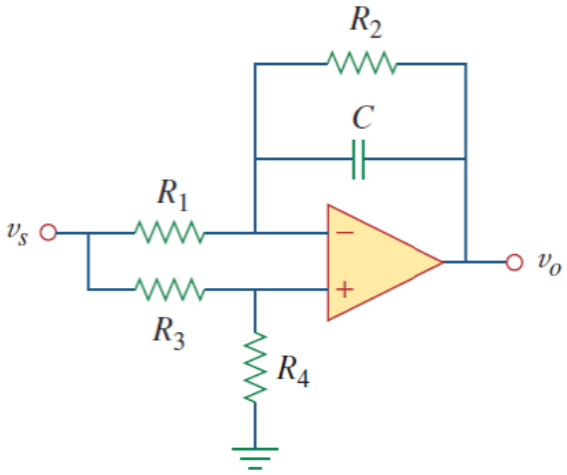


Figure 3:

# 4

[12 points]Find the transfer function of $\frac{V_o}{V_i}$ and determine the type of the filters shown in **Fig 4:a** and **Fig 4:b**.

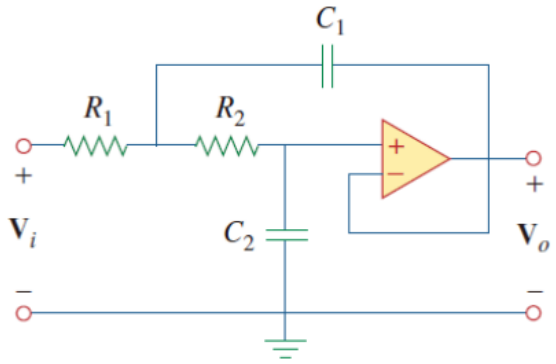


Figure 4: a

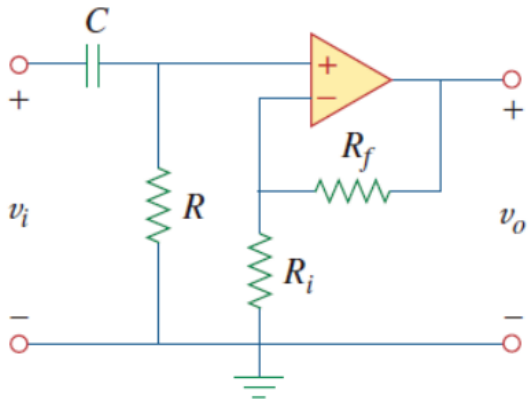


Figure 4: b

## 5

[14 points]
(a). Obtain an expression for the tranfer function.
(b). Sketch the Bode Plots for the magnitude and phase of $H(\omega)$,given that $R_1 = R_2 = 100\Omega$, and $C_1 = 10\mu$F, $C_2 = 0.4\mu$F.
(c). What type of filter is it? What is its maximum gain?

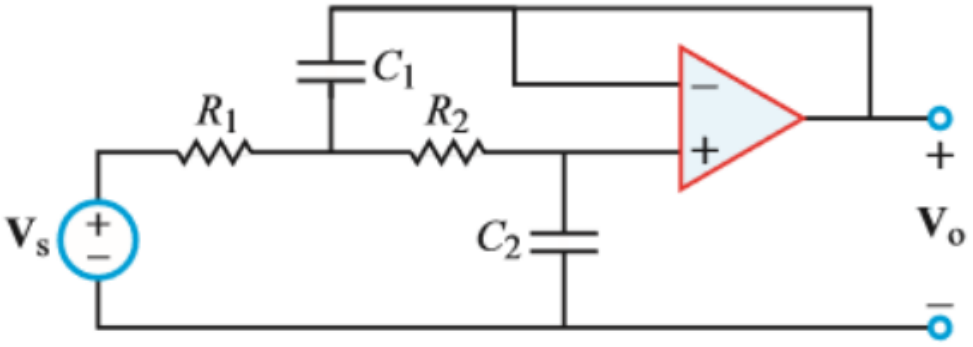


Figure 5:

# 6

[12 points] The AC circuit is as shown in **Fig 6**. Find:
(a). The transfer function $H(\omega) = \frac{\dot{V}_o}{\dot{V}_{in}}$,
(b). The type of the filter,
(c). The bandwidth of the filter.

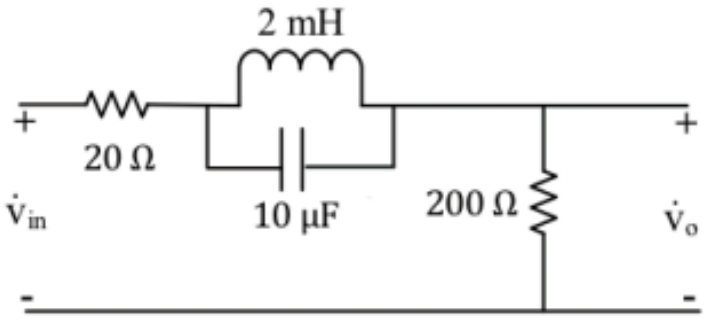


Figure 6:

# 7

[15points]In the following AC circuit, $R_1 = 10\text{k}\Omega, R_2 = 1\text{k}\Omega, R_3 = 10\text{k}\Omega, R_4 = 100\text{k}\Omega$, $R_5 = 5\text{k}\Omega, C_1 = 10\mu\text{F}, C_2 = 0.1\mu\text{F}, C_3 = 0.2\mu\text{F}$.

(a). Find $H(\omega) = \frac{\dot{V}_o}{\dot{V}_{in}}$,

(b). Sketch the Bode plots of $H(\omega)$. Please label the corner frequencies, the gains, phases and slopes of the plot.

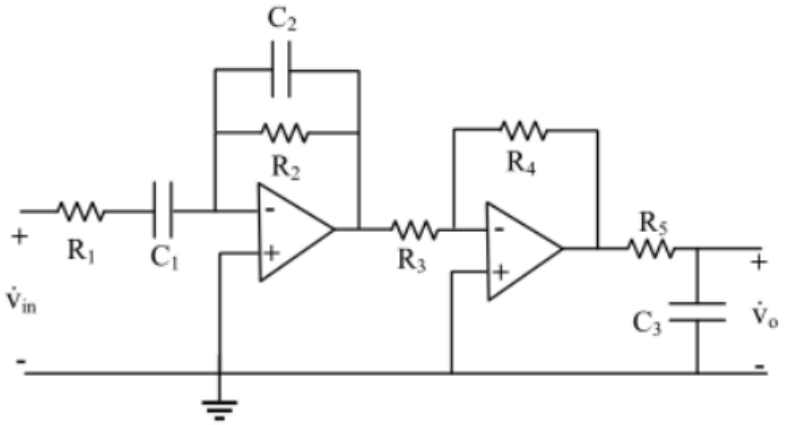


Figure 7:

# 8

[15 points]For the circuit shown in **Fig 8**
(a). Write the transfer function $H(\omega) = \frac{V_0}{V_i}$;
(b). Plot the Bode plots (including magnitude Bode plots and phase Bode plots) of H($\omega$), with proper notations on the Bode plots (such as cutoff frequencies, slope of the curves, etc.)
(c). Specify what type of filter it is.

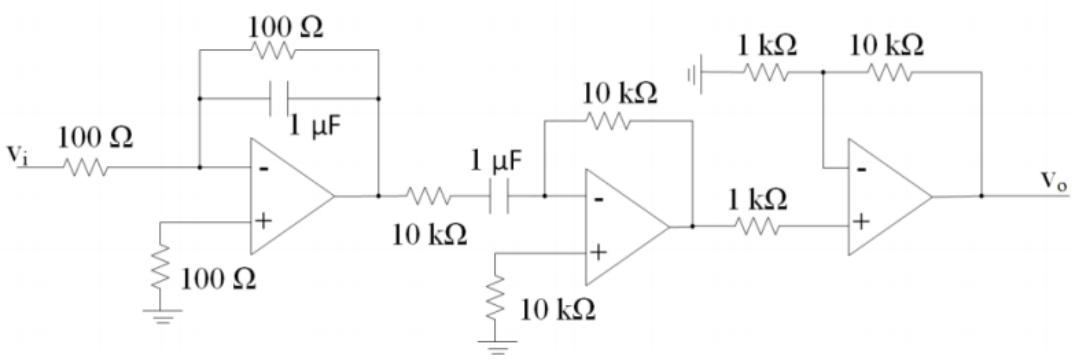


Figure 8: