EE 111 Homework 8

Due date: May. 29th, 2019

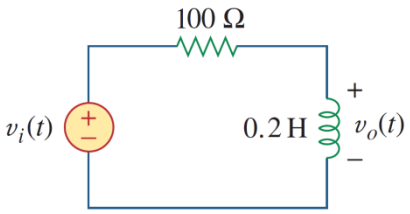
Turn in your homework in class

Rules:

- Work on your own. Discussion is permissible, but 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. First Order Passive Filter (10 points)

An example filter in the following figure has the output of $v_o(t)$ and the input of $v_i(t)$. Determine the type of filter in the following figure and calculate the cutoff frequency f_c.



2. General Passive Filter (15 + 15 + 15 = 45 points)

Determine the type of the following filters. Find the bandwidth and the center frequency of the following filters.

(2a) The transfer function of an example filter is

$$H(\omega) = \frac{j\omega K_1}{(j\omega)^2 + j\omega K_1 + K_2{}^2}$$

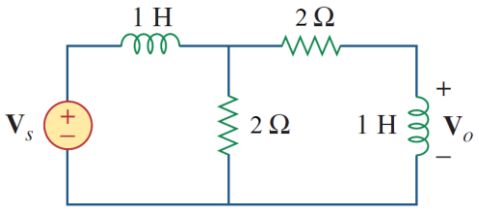
where $K_1 > 0$ and $K_2 > 0$.

(2b) The transfer function of an example filter is

$$H(\omega) = \frac{(j\omega)^2 + K_2{}^2}{(j\omega)^2 + j\omega K_1 + K_2{}^2}$$

where $K_1 > 0$ and $K_2 > 0$.

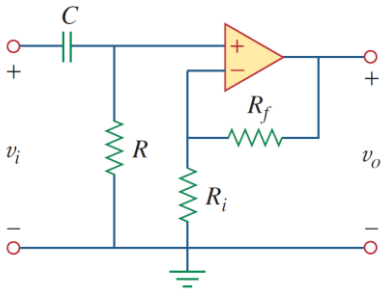
(2c) An example filter in the following figure has the output of $\mathbf{V}_o$ and the input of $\mathbf{V}_i$.



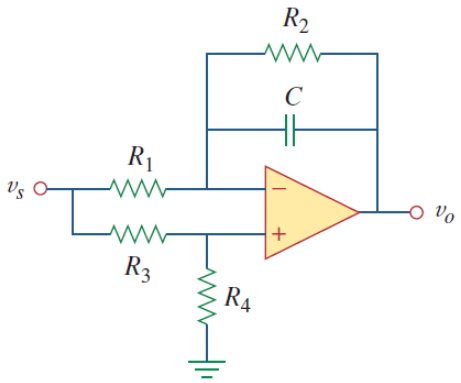
3. General Active Filters (15 + 15 + 15 = 45 points)

Find the transfer function of the filter and determine the type of the filter.

(3a) An example filter in the following figure has the output of v_o and the input of v_i.



(3b) An example filter in the following figure has the output of v_o and the input of v_S. (Hint: the filter can be either highpass or lowpass filter based on the actual parameters of the circuit. Determine the parameter condition for the filter to be highpass and lowpass filter, respectively.)



(3c) An example filter in the following figure has the output of $\mathbf{V}_o$ and the input of $\mathbf{V}_i$.