Homework 7

Due date:
May.26th , 2021
Turn in your homework in 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. [10%] In the phasor-domain circuit, $\boldsymbol{V} = 30\angle 60°$ V (rms), $R_1 = 5\ \Omega$, $R_2 = 20\ \Omega$, $R_3 = 10\ \Omega$, $\boldsymbol{Z_C} = -j4\ \Omega$, and $\boldsymbol{Z_L} = j6\ \Omega$. Choose the load impedance $\boldsymbol{Z_{load}}$ so that the average power dissipated in it is a maximum value. Find the values of load impedance $\boldsymbol{Z_{load}}$ and the maximum average power on $\boldsymbol{Z_{load}}$.

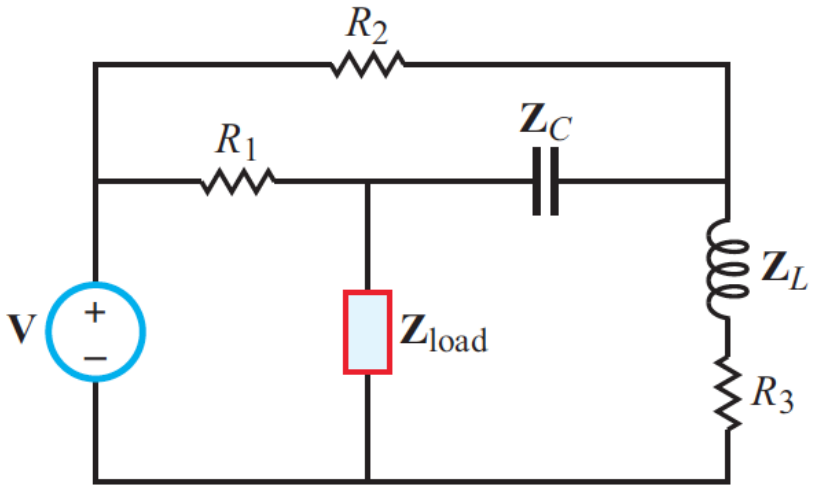

Fig. 1

2. [12%] Given the circuit below, find

a) The line current.

b) The total complex power absorbed by the load.

c) The total complex power dissipated on the line.

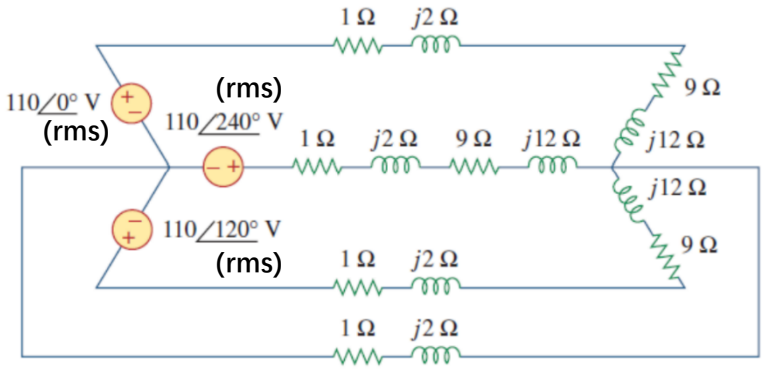

Fig. 2

3. [16%] The circuit is shown below, find

a) The average power absorbed by the 20Ω resistor.

b) The current $\boldsymbol{I_0}$.

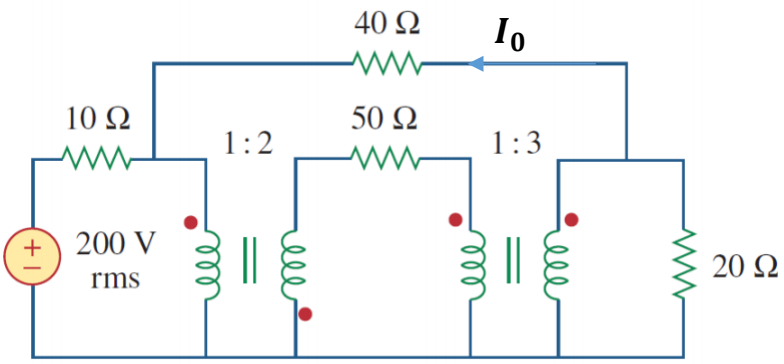

Fig. 3.

4. [10%] For the network circuit in Fig. 4, assume that 4Ω is the AC source resistor. Find out the input impedance $\boldsymbol{Z_{ab}}$ and the input current $\boldsymbol{I_o}$.

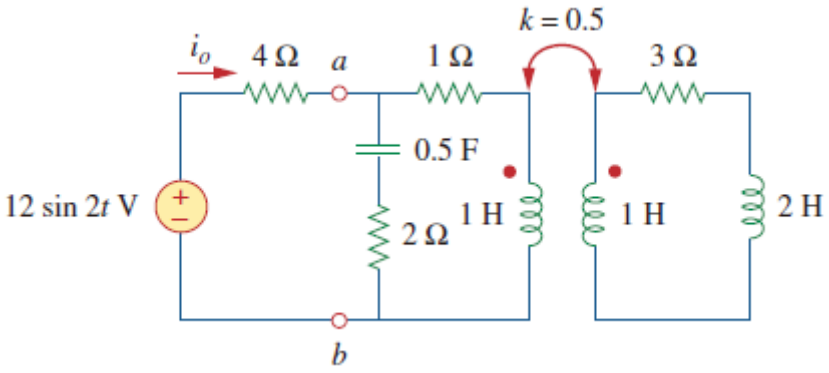

Fig. 4

5. [10%] For the circuit shown below, determine the transform function $\mathbf{H}(\boldsymbol{\omega}) = \mathbf{V_O}/\mathbf{V_i}$, and determine the frequency $\boldsymbol{\omega}$ at which $\mathbf{H}(\boldsymbol{\omega})$ is purely real.

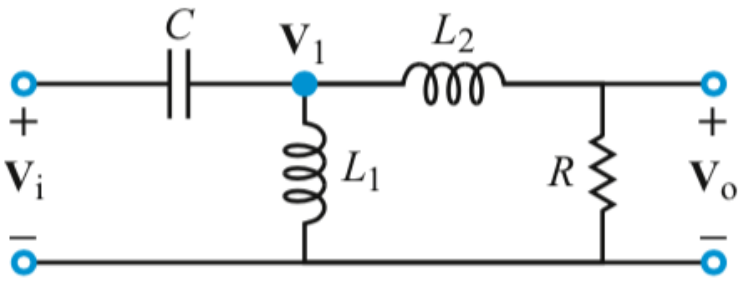

Fig. 5

6. [18%] Determine the voltage transfer function $\mathbf{H}(\boldsymbol{\omega})$ corresponding to the Bode magnitude plot shown in the Fig. 6

a) The phase of $\mathbf{H}(\boldsymbol{\omega})$ is $90°$ at $\omega = 0$.

b) The phase of $\mathbf{H}(\boldsymbol{\omega})$ is $-90°$ at $\omega = 0$.

c) The phase of $\mathbf{H}(\boldsymbol{\omega})$ is $0°$ at $\omega = 0$.

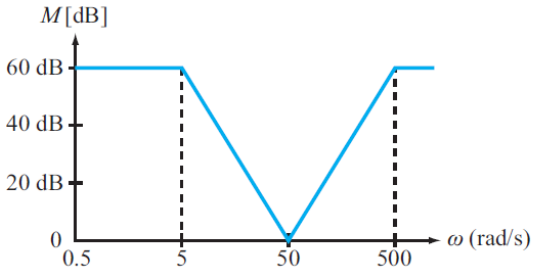

Fig. 6a

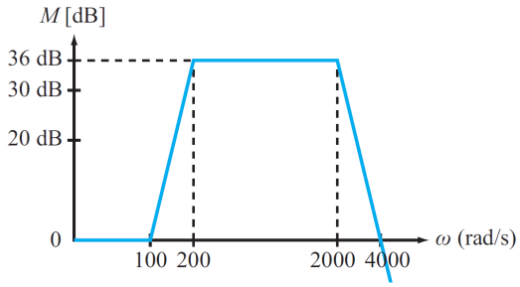

Fig. 6b

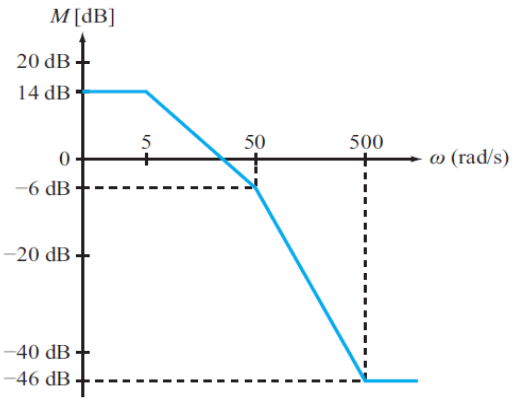

Fig. 6c

7. [12%] Determine the center frequency and bandwidth of the band-pass filters in Fig.7.

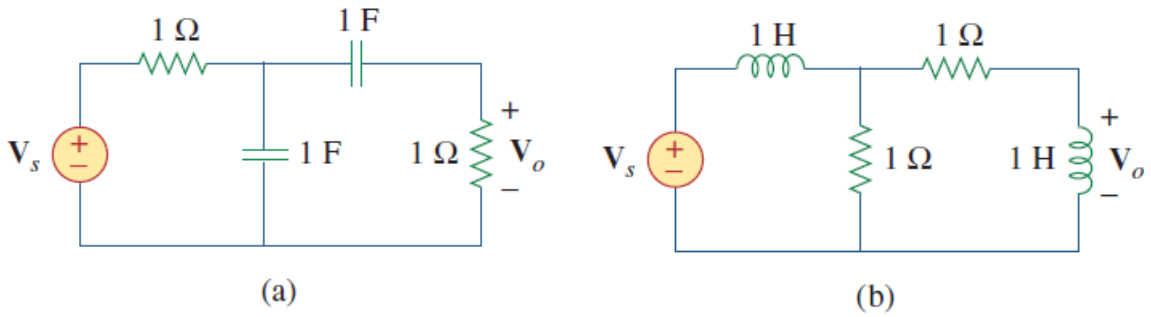

Fig. 7

8. For the op-amp circuit of Fig. 8:

a) Obtain an expression for $\mathbf{H}(\boldsymbol{\omega}) = \mathbf{V_o}/\mathbf{V_s}$ in standard form.

b) Generate Bode Plots for the magnitude and phase of $\mathbf{H}(\boldsymbol{\omega})$, 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?

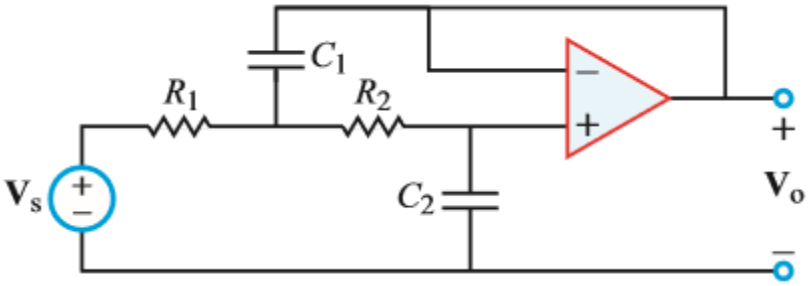

Fig. 8