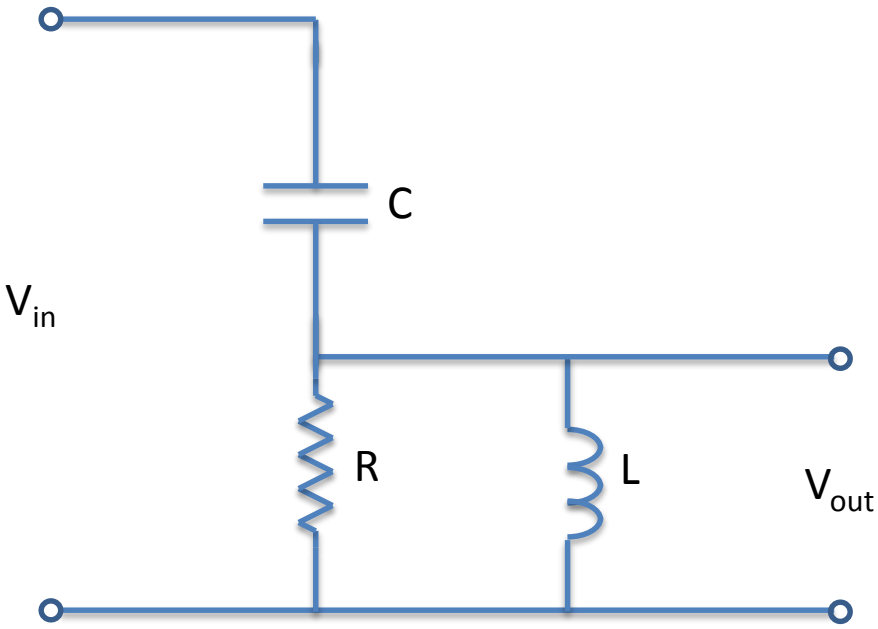
EECS 70A: Network Analysis

Homework #5

- The homework is due Friday 6/06/2014 at 5:30pm.
- You can choose either way to turn in your homework.
  - 1) Turn it in during discussions (Highly recommended)
  - 2) Turn it in during TA or Grader's office hour
  - 3) Slide it under TA's lab office door (Any time before deadline @EH5109)
- Note: lab location is different from office hour location.

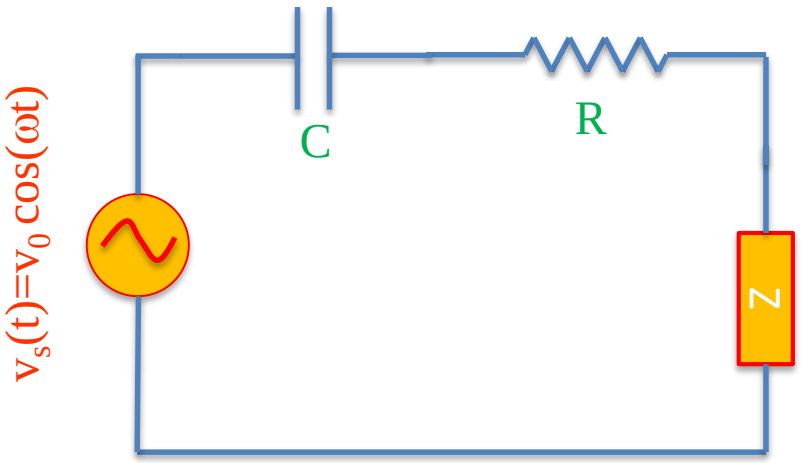
Problem 1: Find the transfer function of the circuit.



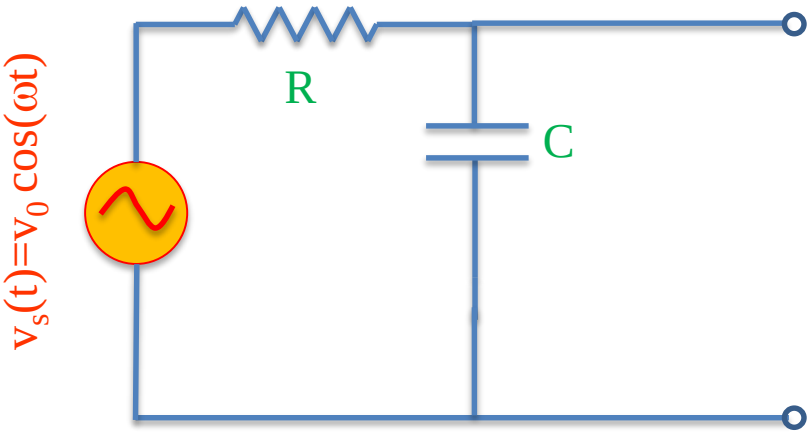
Problem 2: Given $H(\omega) = \frac{1}{1+j\omega\tau_1} \cdot \frac{j\omega\tau_2}{1+j\omega\tau_2}$, where $\tau_2 > \tau_1$,please draw the Bode plot (only magnitude) of the transfer function.

Extra credit: Try to design a circuit having such a transfer function.

Problem 3: Given R = 5 Ω, C = 2 mF, ω = 100 rad/s. Find the impedance of *Z* so as to maximize the power transfer.



Problem 4: Find $\mathbf{V_{th}}$ and $\mathbf{Z_{th}}$, and draw the Thevenin equivalent circuit for the following circuit.



Problem 5: Given the transfer function *H(ω)* of a system,

if the input is $V_{in}(t) = \mathrm{Re}(\sum_n a_n e^{j\omega_n t})$

then the output can be expressed as $V_{out}(t) = \mathrm{Re}\left[\sum_n a_n H(\omega_n) e^{j\omega_n t}\right]$

where $H(\omega) = |H(\omega)| e^{j\phi(\omega)}$

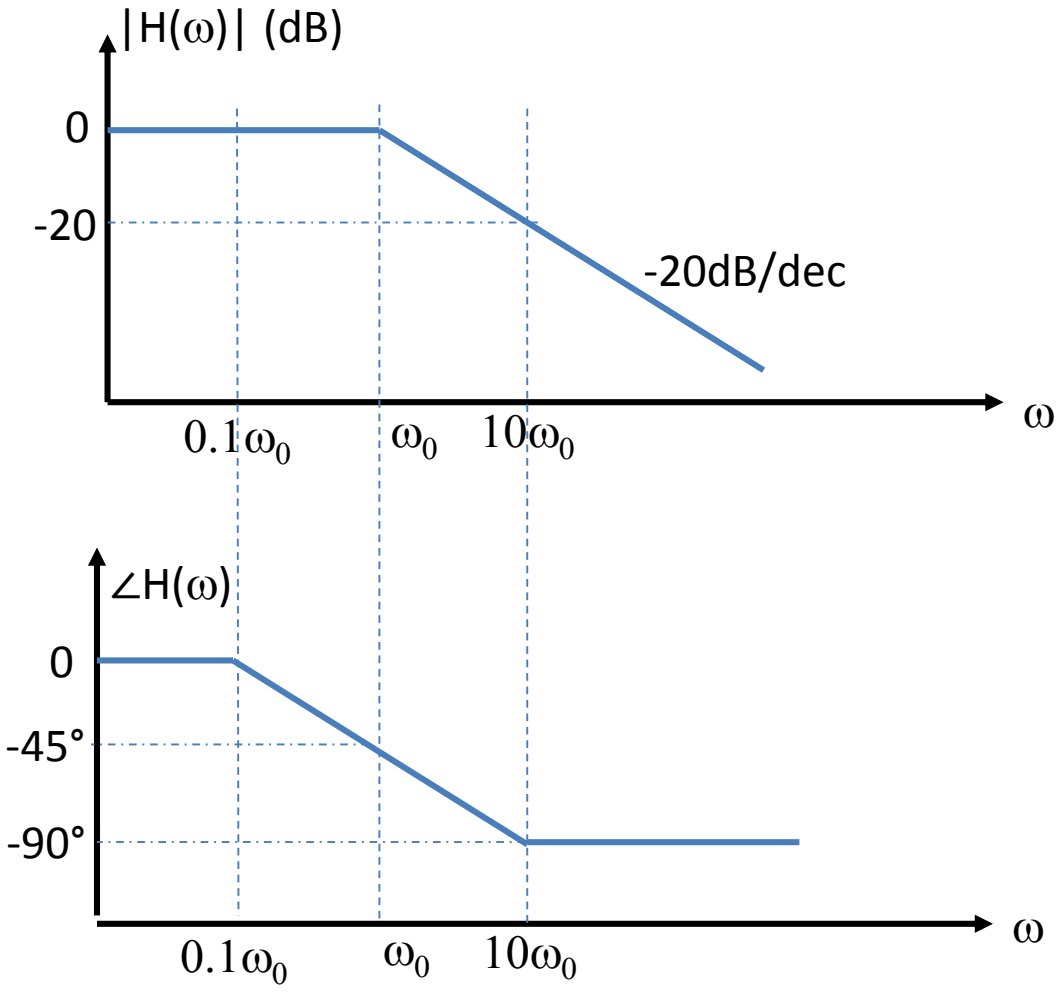
Now, for a system, the Bode plot of its transfer function is illustrated in the next page, and $\omega_0 \tau = 1$

If the input voltage is $V_{in}(t) = \mathrm{Re}\left(1V \cdot e^{j\omega_1 t} + 1V \cdot e^{j\omega_2 t}\right)$

Find the output voltage for the following cases:

a) $\omega_1 = 0.1\tau^{-1}$ $\omega_2 = 10\tau^{-1}$

b) $\omega_1 = 0.01\tau^{-1}$ $\omega_2 = 100\tau^{-1}$


|H(ω)| (dB)
0
-20
-20dB/dec
ω
0.1ω0
ω0
10ω0
∠H(ω)
0
-45°
-90°
ω
0.1ω0
ω0
10ω0