CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science

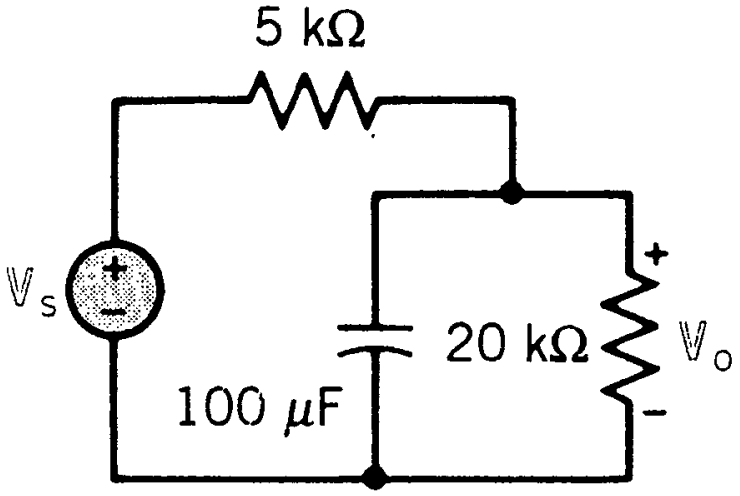
ENGR 210. Introduction to Circuits and Instruments (4)

Homework Set No. 12 Issued 4/6/05
References: [T&R4] sections 12-1, 12-2, 12-3. Due 4/13/05

1) (5 pts) Passive filter.

(a) Determine the transfer function $T_v(j\omega) = \dfrac{V_o(j\omega)}{V_s(j\omega)}$ for the circuit shown below.

(b) Plot $\left|T_v(j\omega)\right|$ in decibels on the vertical and using a logarithmic scale for ω.



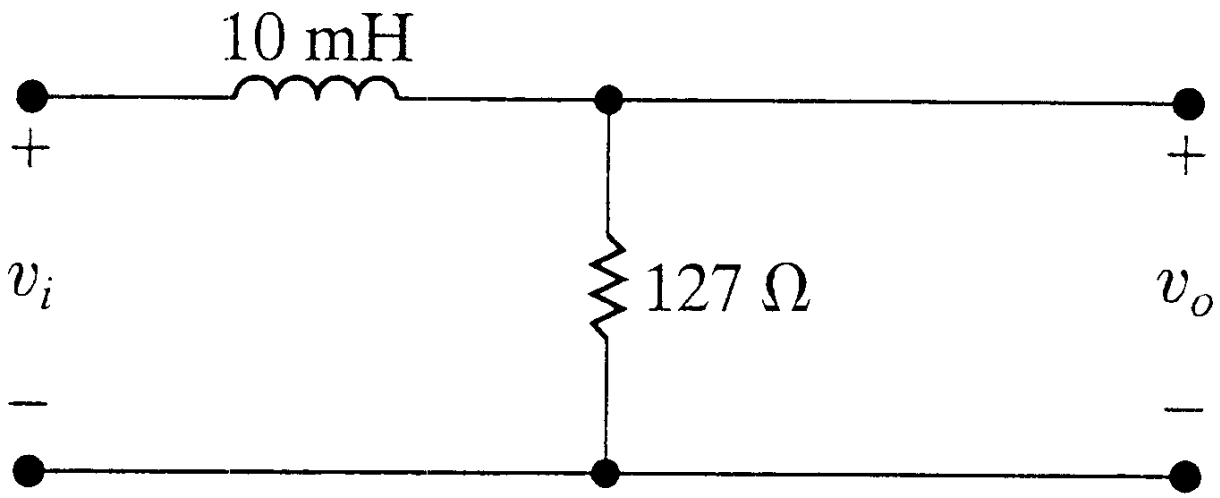
2) (5 pts) Passive filter.

Find the transfer function $T_v(j\omega) = \dfrac{V_o(j\omega)}{V_i(j\omega)}$ of the circuit shown below.

(a) Find the cutoff frequency in hertz for the RL filter shown below. What kind of filter is this?

(b) Calculate $T_v(j\omega) = \dfrac{V_o(j\omega)}{V_i(j\omega)}$ at $\omega=0.2\omega_c$, ω_c, and $5\omega_c$.

(c) If $v_i(t) = 10\cos(\omega t)$ write the steady state expression for v_o when $\omega=0.2\omega_c$, ω_c, and $5\omega_c$.



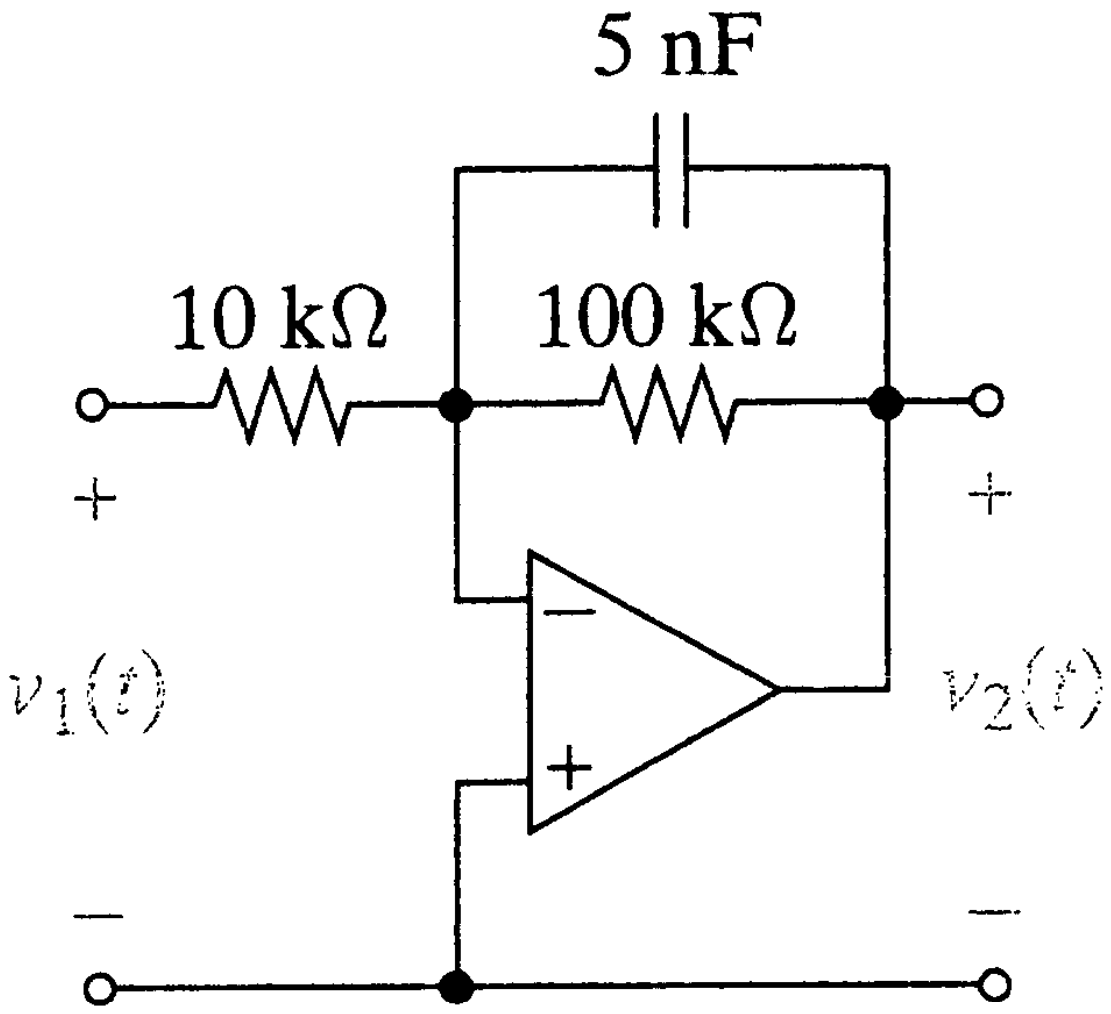
3) (5 pts) Active filter.

Find the transfer function $T_v(j\omega) = \dfrac{V_2(j\omega)}{V_1(j\omega)}$ of the circuit shown below.

(a) Find the dc gain and cutoff frequency. What kind of gain response is this?

(b) Draw the straight-line approximations of the gain of $T_v(j\omega)$

(c) Use the straight-line gain to estimate the amplitude of the steady state output for a 5 volt sinusoidal input with $\omega=0.5\omega_c$, ωc, and $2\omega_c$.

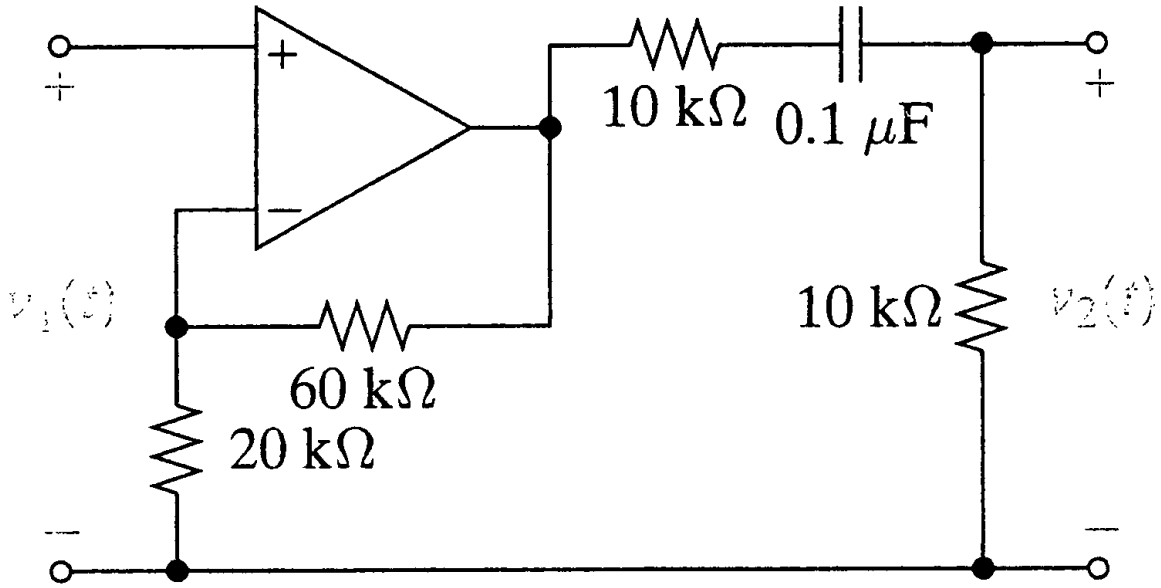


4) (5 pts) Active filter.

(a) Find the dc gain, infinite frequency gain, and cutoff frequency of the circuit shown below.

(b) What kind of gain response does this circuit have? High pass, low pass, other?

(c) Draw the straight-line approximation of the gain $T_v(j\omega)$.



5) (5 ptsGain response.

The transfer function of a first order circuit is $T(j\omega) = \dfrac{10}{10^2 + \dfrac{j\omega}{20}}$

(a) What type of gain response does this circuit have? What is the cutoff frequency and the passband gain?

(b) Draw the straight-line approximation of the gain response.

(c) Use the straight-line gain to estimate the gain at $\omega=0.5\omega_c$, ωc, and $2\omega_c$.

NOTE: Please put your section code AND your CWRU e-mail next to your name at the top of the page. Section codes are

MA (Monday Afternoon)
ME (Monday Evening)
TA (Tuesday Afternoon)
TE (Tuesday Evening)
WA (Wednesday Afternoon)
WE (Wednesday Evening)