

Write your name at the top right corner of every page (including this cover page).

Copy everything you want counted towards your grade onto the pages that I provided.

Write with a pen that cannot be erased!

No books or calculators are allowed!

Write down all the steps that lead to your result.

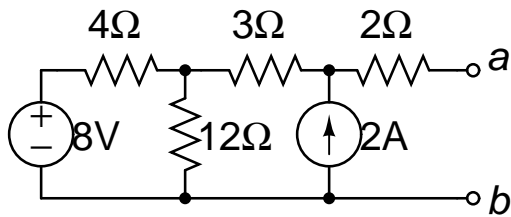
Identify new variables that you may introduce in the circuit diagrams that I provided or you draw yourself.

Read all the problems before you start so that you can begin with those that seem easiest to you.

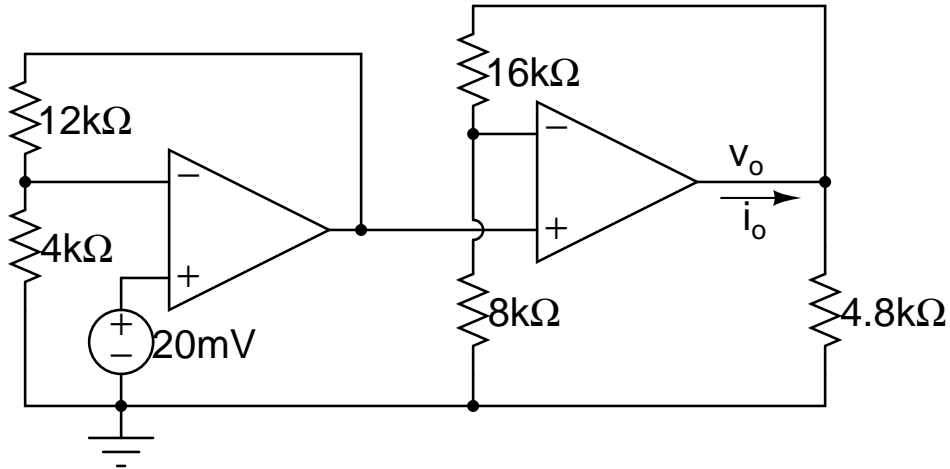
The last problem is for the Graduate level students only. Undergraduates that solve this problem may substitute it for another problem. The points earned will be scaled to the total of the problem that was replaced. If that problem is solved by an undergraduate and sufficient points are earned, I will choose the problem to be replaced such as to optimize the total points.

**Problem 1 (6 pts):**

Find the Thevenin equivalent circuit for the circuit shown below. If you connect a load resistor  $R_L$  between the terminals  $a$  and  $b$ : What value of  $R_L$  will allow for the maximum power transfer to the load?



(continuation of problem 1)

**Problem 2 (6 pts):**Calculate  $v_o$  and  $i_o$  in the circuit below.

(continuation of problem 2)

**Problem 3 (6 pts):**

Write the Karnaugh map and analyze it to find an efficient(!) implementation for the following truth table:

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

(continuation of problem 3)

**Problem 4 (4 pts):**

Design a circuit that clamps the negative peaks of an ac signal to +3.6 V. Allow for 0.6 V forward voltage drop across your diode.

(continuation of problem 4)

**Problem 5 (6 pts):**

Use only the straight-line asymptotes to sketch the Bode Plot (both, amplitude and phase!) for the transfer function:

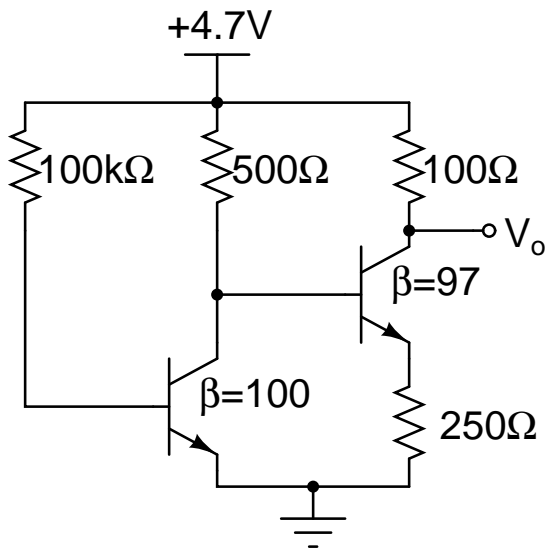
$$H(j\omega) = \left(\frac{1}{1+j\omega}\right)\left(\frac{j\omega}{10+j\omega}\right)$$

What type of filter is this?

(continuation of problem 5)

**Problem 6 (6 pts):**

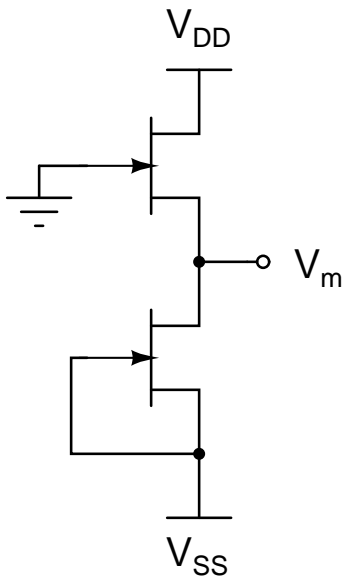
In the following setup you will find that both transistors are biased in the active region. Verify that and determine the output voltage  $V_o$ .



(continuation of problem 6)

**Problem 7 ONLY 6610 students !!! (6 pts):**

In the following circuit both JFETs have  $I_{DSS} = 4\text{mA}$  and  $V_P = -2\text{V}$ . The supply voltages are  $V_{DD} = -V_{SS} = +10\text{V}$ . Show that both JFETs are in the active region and determine  $V_m$ .



(continuation of problem 7)