

# Analog Electronics, Short written exam 1 (2)

Mid Sweden University, Sundsvall 071008, 8-10

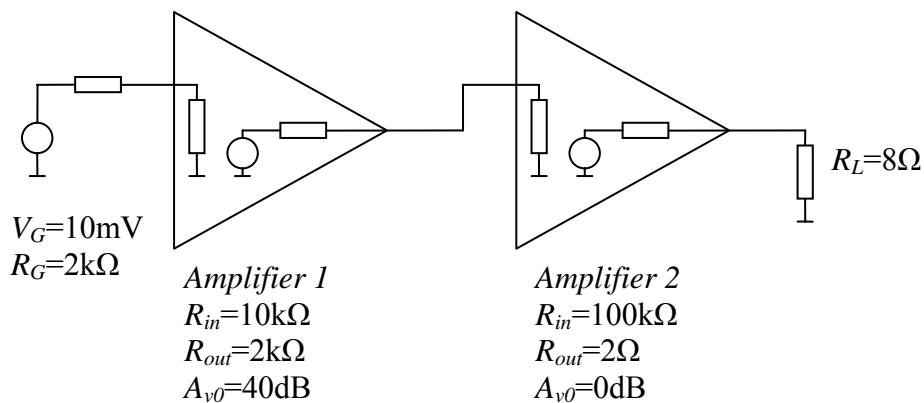
Allowed accessories: Calculator, Any "pure" book of formulas – No textbook with solution allowed.

Preliminary grading

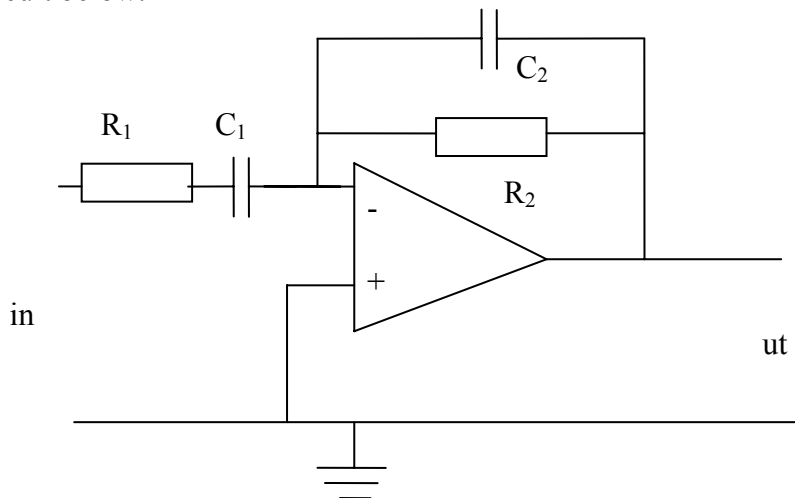
Unsatisfactory:	<7
Satisfactory:	7-8
Good:	9-11
Very Good:	12-14

The solution should be clearly written and easy to follow. All assumptions should be written down. Bode diagrams should be carefully drawn asymptotically with a size of at least 5x10cm on squared paper.

1. Calculate the output signal voltage for the cascaded amplifiers below. (3p)



2. Derive an expression for the transfer function  $H(f)$  in Bodes normal form for the circuit below. (3p)



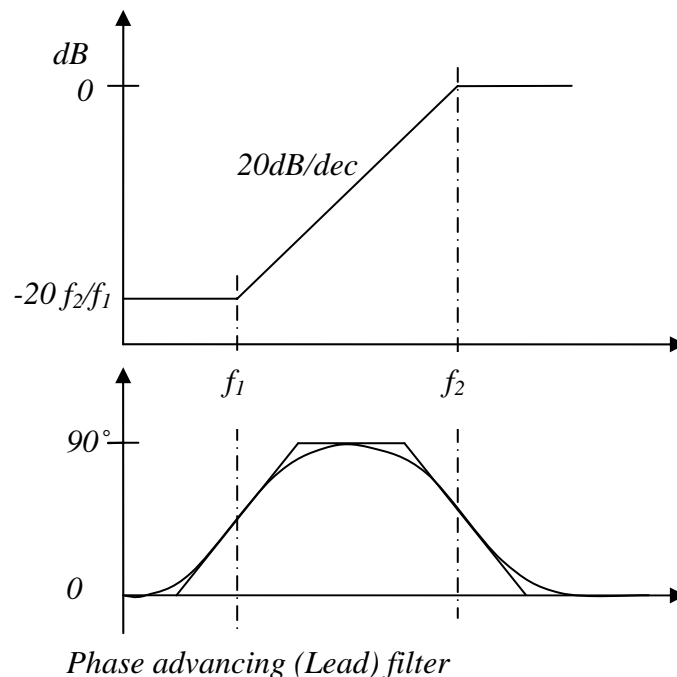
3. Draw a Bode diagram for the circuit in exercise 2 with both amplitude and phase of  $H(f)$  when  $R_1=1\text{k}\Omega$ ,  $C_1=15,9\mu\text{F}$ ,  $R_2=100\text{k}\Omega$ ,  $C_2=159\text{pF}$ . **If you did not solve exercise 2 you can draw the Bode diagram for the following transfer function instead.**

$$H(f) = 10 \frac{\left(1 + j \frac{f}{100\text{Hz}}\right) \left(1 + j \frac{f}{10\text{kHz}}\right)}{j \frac{f}{100} \left(1 + j \frac{f}{10\text{kHz}}\right) \left(1 + j \frac{f}{100\text{kHz}}\right)} \quad (3\text{p})$$

4. An uncompensated Operational amplifier have the following open loop gain

$$A_{ol}(f) = \frac{1000000}{\left(1 + j \frac{f}{10\text{kHz}}\right) \left(1 + j \frac{f}{1\text{MHz}}\right) \left(1 + j \frac{f}{10\text{MHz}}\right)}$$

- Draw a **detailed** Bode diagram with both amplitude and phase. (1p)
- Determine for what amplification closed loop gain the amplifier is stable with a phase margin more than  $45^\circ$  (1p)
- Design the breakpoint for a phase advancing filter that can be used to stabilize the amplifier for unit gain and draw the Bode diagram for both the filter  $H_{lead}$  and  $A_{ol}H_{lead}$ . (2p)
- The stabilized amplifier is used for 20 dB gain. Draw the amplitude for closed loop gain  $A_{cl}$  in the same diagram as above. What is the BW? (1p)



Good Luck  
/Kent