

EE 230

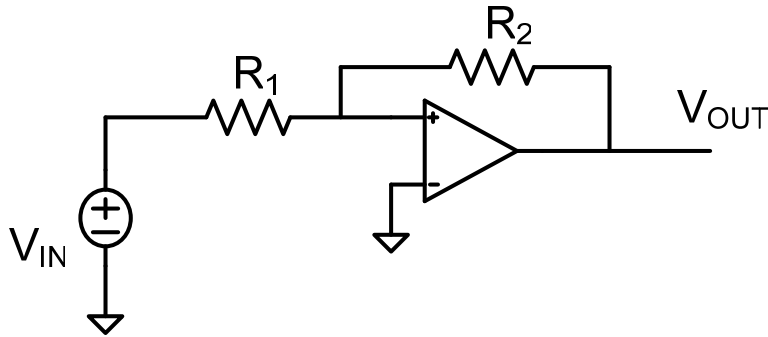
Homework 8

Spring 2010

(Note: Since there is an Exam on Friday March 12, this assignment will not be collected but solutions will be posted)

Problem 1 The circuit shown is a comparator with hysteresis. In this circuit, assume  $R_2=10\text{K}$  and  $R_1=100\Omega$

- Determine the width of the hysteresis region
- Plot the transfer characteristics. Assume the Op Amp is biased with  $\pm 15\text{V}$  power supplies



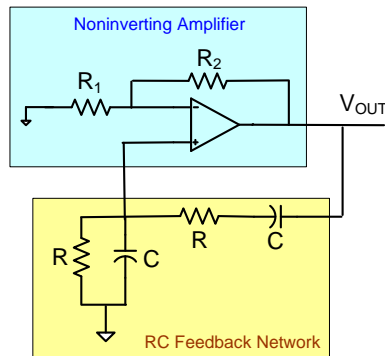
Problem 2

Design a comparator that has an output of  $10\text{V}$  ( $\pm 250\text{mV}$ ) if  $V_{\text{IN}} < 1\text{V}$  and  $0\text{V}$  if  $V_{\text{IN}} > 0\text{V}$ . The region between  $0\text{V}$  and  $1\text{V}$  is a hysteresis region, Assume you have available an operational amplifier biased with  $+15\text{V}$  and  $-15\text{V}$  supplies and that  $V_{\text{SATH}}=15\text{V}$  and  $V_{\text{SATL}}=-15\text{V}$ . You can use any number of resistors of any value.

Problem 3

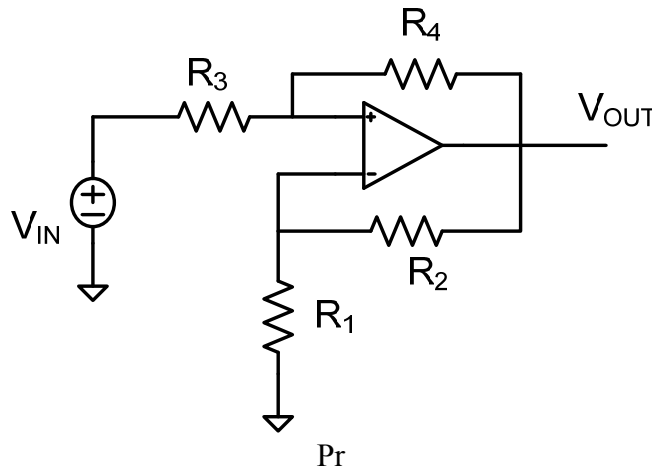
Design a comparator with a hysteresis window for  $-0.5\text{V} < V_{\text{IN}} < 0.5\text{V}$  and that has a high output for  $V_{\text{IN}} > .5\text{V}$  and that is low for  $V_{\text{IN}} < -.5\text{V}$ .

Problem 4 Assume the op amp is ideal and  $R_2/R_1=2$ . Determine the characteristic equation and the poles of the following circuit if  $R=1K$  and  $C=100nF$ .

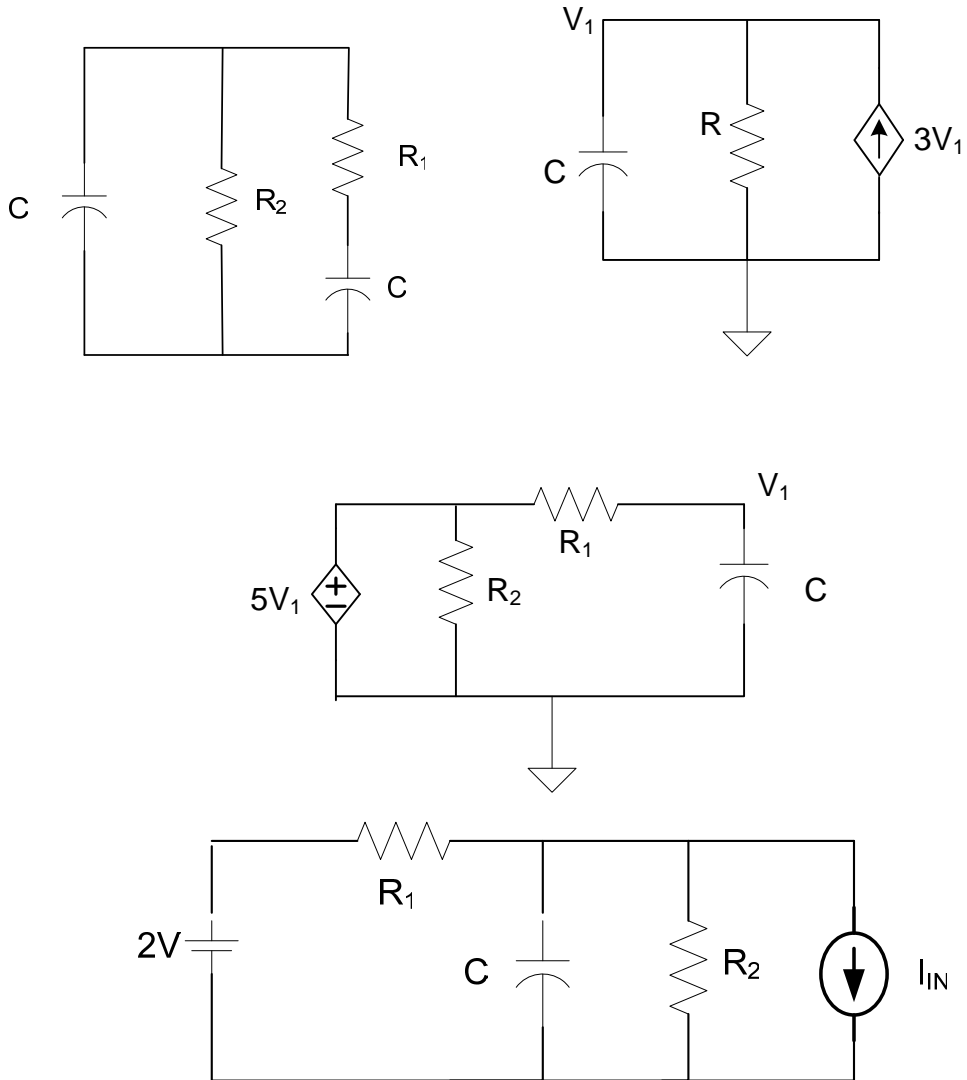


Problem 5 Assume the op amp is ideal except for a frequency dependent gain can be modeled as  $A(s)=GB/s$ . Assume it is biased with  $\pm 15V$  power supplies and that  $R_2=10K$ ,  $R_1=2K$  and  $R_3=1K$ .

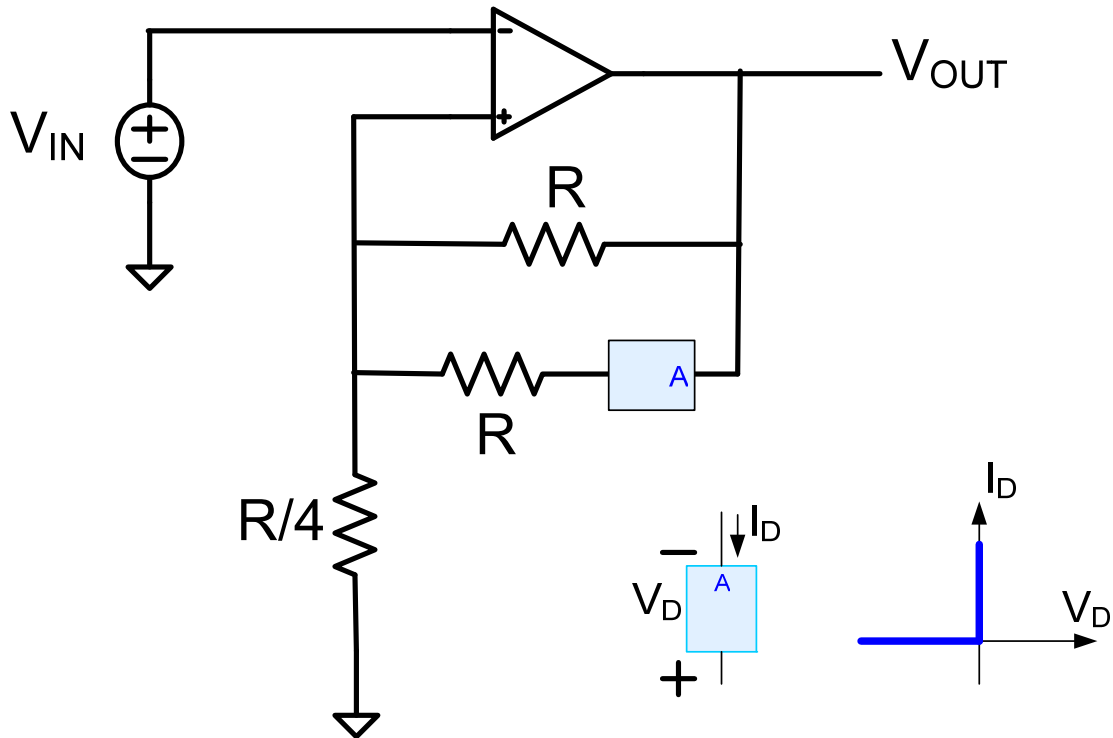
- Obtain an expression for the poles and zeros of this amplifier as a function of  $R_4$
- What is the minimum value of  $R_4$  that will result in stability of this amplifier
- Obtain an expression for and plot the transfer characteristics if  $R_4=0.5R_{4min}$  where  $R_{4min}$  is the minimum value of  $R_4$  for stability.



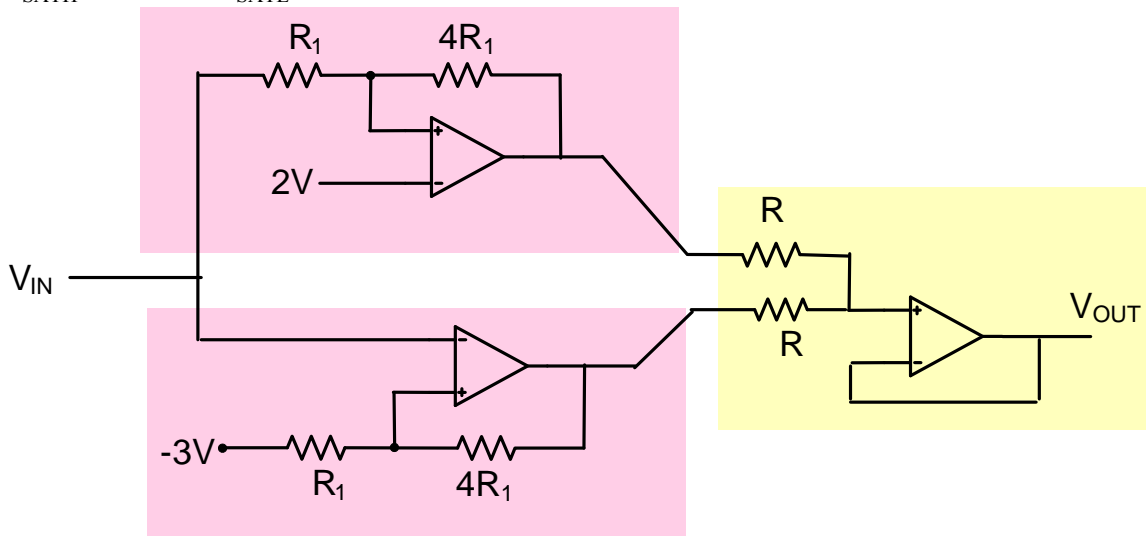
Problem 6 Determine the poles of the following networks without applying excitations. Which are stable?



Problem 7 Assume the nonlinear device has the transfer characteristics shown in the figure.. Obtain the transfer characteristics of the following circuit.



Problem 8 Plot the transfer characteristics for the following circuit. Assume  $V_{SATL}=12V$  and  $V_{SATL}=-12V$ .



Problem 9. Assume the op amp in the following circuit is ideal and that  $V_{SATH}=12V$  and  $V_{SATL}=-12V$ . Design the circuit so that the frequency of oscillation is 2KHz and the p-p value of  $V_{OUT1}=8V$ .

