FALL 2013 **Name _____**
ECEN 457 (ESS)

EXAM #1

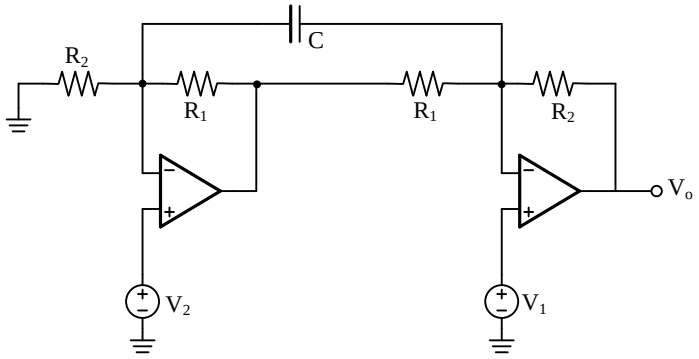
This is a closed book and notes exam. This exam is worth 15% of your total grade.

Prob.	Maximum	Yours
1	3	
2	4	
3	4	
4	4	
Extra Credit	1	
Total	16	

Prob. 1. (Macromodeling). Propose a macromodel of the transfer function H(s) using only SPICE primitives (i.e, passive components and dependent and independent sources)

$$H(s) = K \frac{(1 + s/\omega_z)}{(1 + s/\omega_{p1})(1 + s/\omega_{p2})(1 + s/\omega_{p3})}$$

Prob. 2. (Instrumentation). Obtain the closed form of the transfer function $H(s)=\frac{V_o(s)}{V_{in}(s)}$ of the following circuit. Where $V_{in}(s)=V_1-V_2$.

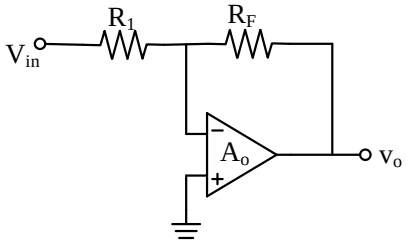


Prob. 3. (Feedback AMP)

a) Obtain the transfer frunction $H = V_o/V_{in}$ assuming a finite open loop op amp gain A_o.

b) The ideal voltage $-R_F/R_1$ is not obtained due to the finite A_o. For $R_F/R_1=9$, determine the value of A_o for a ± 1% voltage gain deviation (ε).

c) Determine the normalized sensitivity expression for $S^H_{A_o}$



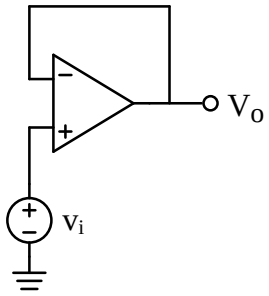
Prob. 4. (Input Offset Voltage)

Assume an op amp with an open loop gain $A_{min} = 10^4\,V/V$,
$V_{oso(max)} = 2mV$, and a $CMRR_{db(min)} = PSRR_{db(min)} = 74dB$ is connected as a voltage follower configuration. $\left(TC(V_{os})_{ovg} = 3\mu V/^oC\right)$, $Supply = \pm 15V$, $T = 35^oC$

i) Estimate the worst case departure of v_o from the ideal when $v_i = 0V$

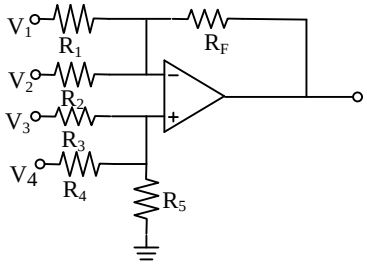
ii) Repeat with $v_i = 10V$

iii) Repeat the problem if the supply voltages are decreased from ± 15V to ± 12V



EXTRA CREDIT (No partial credit)

Describe the conditions of resistors (conductances) that allow the output V_o to be written as



$$V_o = -\frac{R_F}{R_1}V_1 - \frac{R_F}{R_2}V_2 + \frac{R_F}{R_3}V_3 + \frac{R_F}{R_4}V_4$$