FALL 2013 **Name ____________________________**

ECEN 457 (ESS)

FINAL EXAM

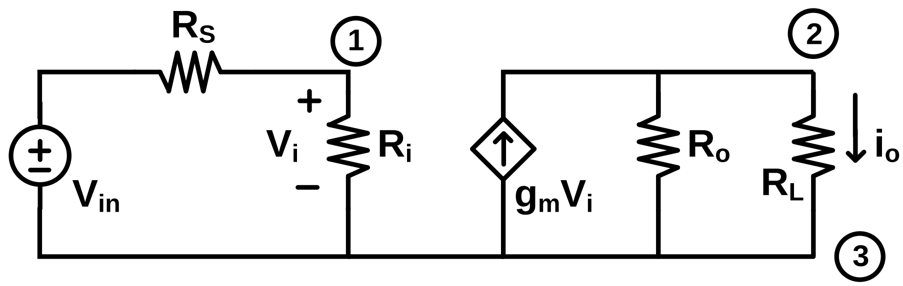
Problem	Maximum	Yours
1	4	
2	4	
3	4	
4	4	
5	4	
Extra Credit*	1	
Total	21	

***Provide the list of five fundamental concepts learned in the course**

Problem 1.

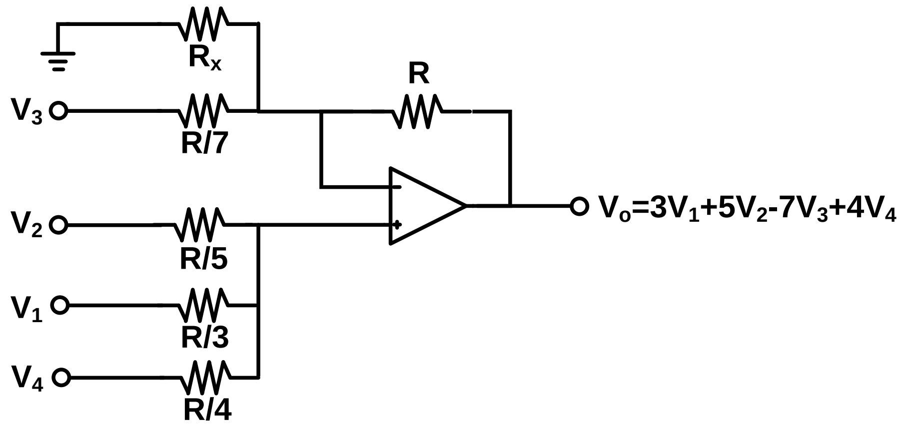
a.) **Write the nodal equations in matrix form (YV=I) of the circuit shown below.**

b.) **Obtain** $G_M = \frac{i_o}{V_i}$ **when** $V_3=0$



Problem 2.

If the output voltage V_o must be equal to $3V_1+5V_2-7V_3+4V_4$



Determine the value of R_X to satisfy the expression of Vo.

Problem 3.

Design a low frequency non-inverting amplifier with an ideal voltage gain K. Assume the open loop gain of the Op Amp is A_o which yields a closed loop transfer function H(s).

$$H(s) = \frac{V_o(s)}{V_{in}(s)} = K(1 - \varepsilon_m)$$

Determine the expression of ε_m by approximating in H(s) by

$$\frac{K}{1+x} \cong K(1-x) \quad \text{when } x \ll 1$$

Also determine the minimum value (expression) of A_o that meets a given error deviation ε_m.

ε_m	
Min Ao	

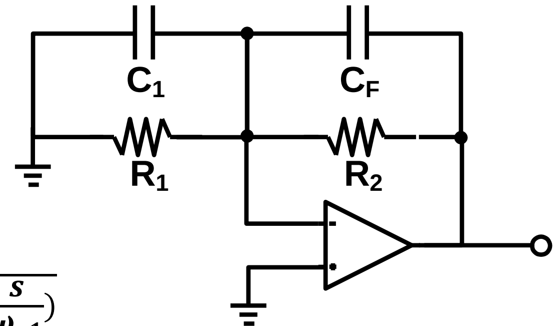
Problem 4.

Propose a macromodel with passive elements and dependent sources that represent

$$\boldsymbol{H(s) = K \cdot \frac{1 - \frac{s}{\omega_z}}{(1 + \frac{s}{\omega_{p1}})(1 + \frac{s}{\omega_{p2}})}}$$

Problem 5. Plot the open-loop gain A(s) and $\left|\frac{1}{\beta}\right|$.

Determine $\frac{1}{\beta}$, ROC, and ϕ_m for the 4 cases.



Here,

$$\frac{1}{\beta} = k\frac{1+\frac{s}{\omega_z}}{1+\frac{s}{\omega_p}}, A(s) = \frac{A_o}{(1+\frac{s}{\omega_{p1}})(1+\frac{s}{\omega_{p1}})(1+\frac{s}{\omega_{p1}})}$$

$\omega_{p1} = 10rad/s$, $\omega_{p2} = 1krad/s$, **and** $\omega_{p3} = 100krad/s$

$A_o = 10^4$, $R_1 = 100k\Omega$, **and** $R_2 = 300k\Omega$

CASE	$\frac{1}{\beta}$	ROC	ϕ_m
a) C_1=0, C_F=0			
b) C_1=0, C_F=10nF			
c) C_1=10nF, C_F=0			
d) C_1=10nF, C_F=10nF			

Extra Credit

List the five most fundamental concepts you learned in this course.

1.

2.

3.

4.

5.