FINAL EXAMINATION

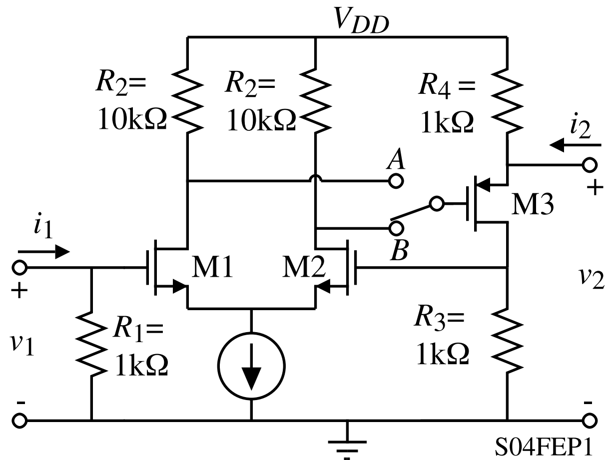
NAME_____________________________P.O. Box No.__________SCORE______/100

Problem	⓵	⓶	3	4	5	6	7	Sum
Points								

INSTRUCTIONS: This exam is closed book with two sheets of notes permitted. The exam consists of 7, 20-point problems of which you are to work only 5 for a total of 100 points. Problems 1 and 2 must be worked and you may choose any three of the last five problems for a total of five problems. Please circle the number in the table above of the five problems you wish graded. If you do not indicate the problems to be graded, then problems 1 through 5 will be graded regardless of whether they are worked or not. Be sure to turn in only the 5 problems you wish graded in proper numerical order. Please show your work leading to your answers so that maximum partial credit may be given where appropriate.

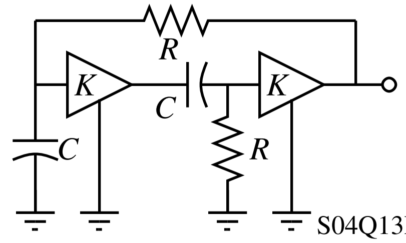
Problem 1 - (20 points - This problem must be attempted)

The simplified schematic of a feedback amplifier is shown. Assume that all transistors are matched and g_m = 1mA/V and $r_{ds} = \infty$. (a.) Where should the switch be connected for negative feedback? (b.) Use the method of feedback analysis to find v_2/v_1, $R_{in} = v_1/i_1$, and $R_{out} = v_2/i_2$.



Problem 2 - (20 points - This problem must be attempted)

This problem deals with finding the open-loop gain and it application. The following questions are independent of each other.



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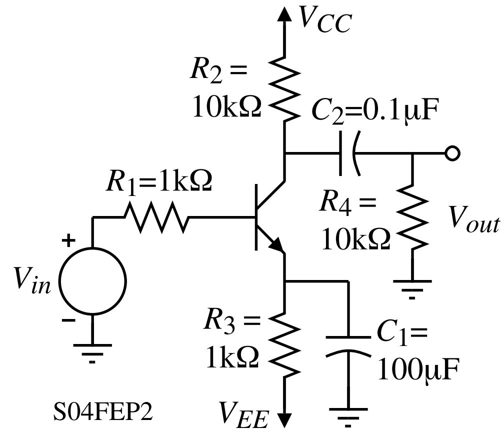
(a.) Find the loop gain of the feedback circuit shown, $T(s)$, if the amplifier is an ideal voltage amplifier with a gain of K.

(b.) If $T(s) = \frac{sKRC}{s^2R^2C^2 + 2RCs + 1}$, find f_{osc} and the value of K necessary for oscillation.

(c.) If $T(s)$ has the following properties: $T(0) = 10$ and two poles at s = -100, what is the phase margin of this feedback circuit?

Problem 3 - (20 points - This problem is optional)

A BJT amplifier is shown. Assume that the BJT has the small signal parameters of $\beta_F = 100$, $r_\pi = 1k\Omega$, and $V_A = \infty$.



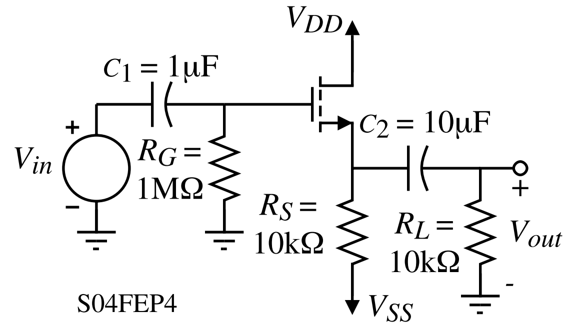
a.) Find the midband voltage gain of this amplifier, V_{out}/V_{in}.

b.) Find the value of the lower -3dB frequency, f_L, in Hz, using any method that is appropriate.

Problem 4 – (20 points - This problem is optional)

a.) If the g_m of the MOSFET is 0.1mA/V, find the midband gain and the location of all zeros and poles of the circuit shown.

b.) If the amplifier above has two zeros at the origin and a pole at –1 rads/sec and –4 rads/sec., what is the lower –3dB frequency in Hz?



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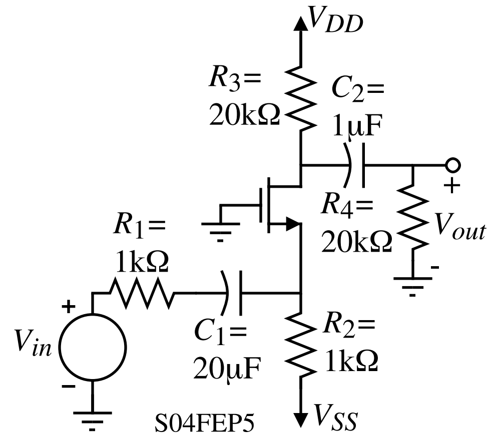
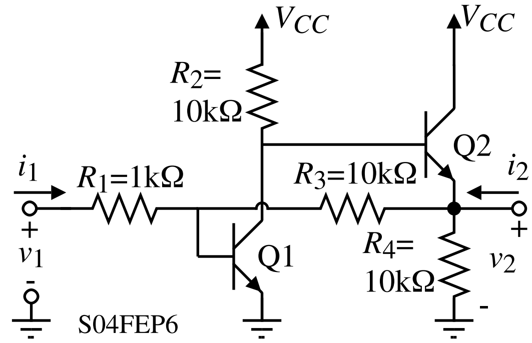
Problem 5 - (20 points - This problem is optional)

The FET in the amplifier shown has g_m = 1mA/V, $r_d = \infty$, C_{gd} = 0.5pF, and C_{gs} = 10pF. (a.) Find the midband gain, V_{out}/V_{in}. (b.) Find the upper -3dB frequency, f_H, in Hz. (Note: You cannot use the Miller's theorem on this problem because there is no bridging capacitor.)



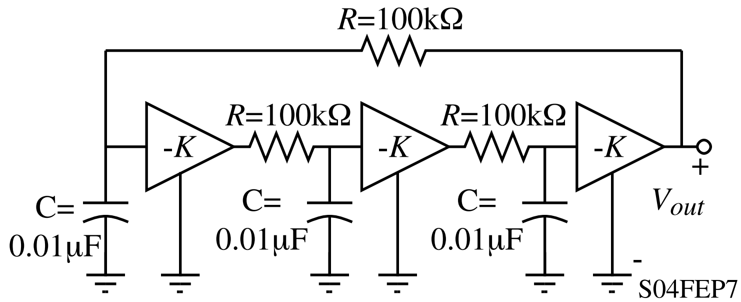
Problem 6 - (20 points - This problem is optional).

A feedback amplifier is shown. Use the methods of feedback analysis to find the numerical values of v_2/v_1, v_1/i_1, and v_2/i_2. Assume that all transistors are matched and that V_t= 25mV, β (of the BJT) = 100, $I_{C1} = I_{C2}$ = 100µA, and $r_o = \infty$.



Problem 7 – (20 points, this problem is optional)

An *RC* oscillator is shown. Express the frequency of oscillation of this circuit in terms of the components and evaluate. What is the value of the voltage amplifier gain, *K*, necessary for oscillation? In words, how is the amplitude of oscillation determined?



Extra Sheet