FINAL EXAMINATION

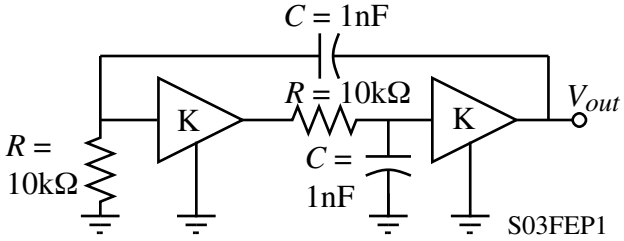
NAME_____P.O. Box No._____SCORE_____/100

Problem	①	②	3	4	5	6	7	8	Sum
Points									

INSTRUCTIONS: This exam is closed book with two sheets of notes permitted. The exam consists of 8, 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 six 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.

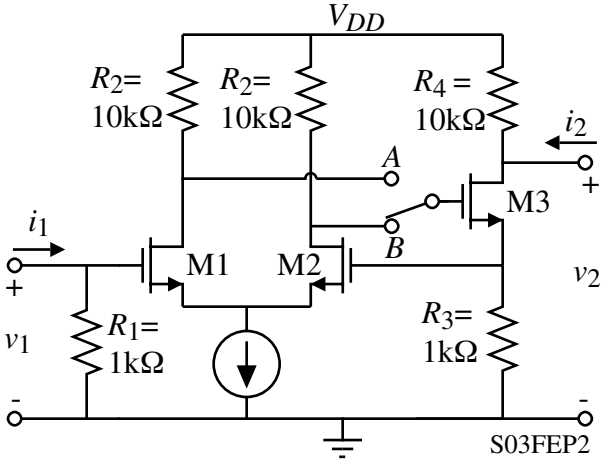
Problem 1 - (20 points - This problem must be attempted)

The circuit shown is a *RC* oscillator. Find the frequency of oscillation in Hertz and the voltage gain, *K*, of the voltage amplifiers necessary for oscillation. The voltage amplifiers have infinite input resistance and zero output resistance.



Problem 2 – (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 $R_{out} = v_2/i_2$.

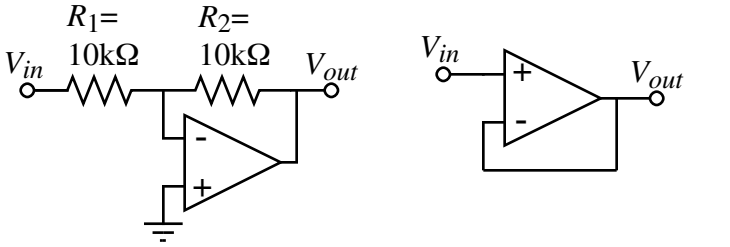


Problem 3 - (20 points - This problem is optional)

An inverting and noninverting unity gain voltage amplifier are shown using op amps. If the differential voltage gain of each op amp is given as

$$A_{vd}(s) = \frac{10^4}{\frac{s}{100} + 1}$$

find the closed loop –3dB bandwidth, ω_{-3dB} for each of the two op amp configurations. Assume the op amps have infinite differential input resistance and zero output resistance.



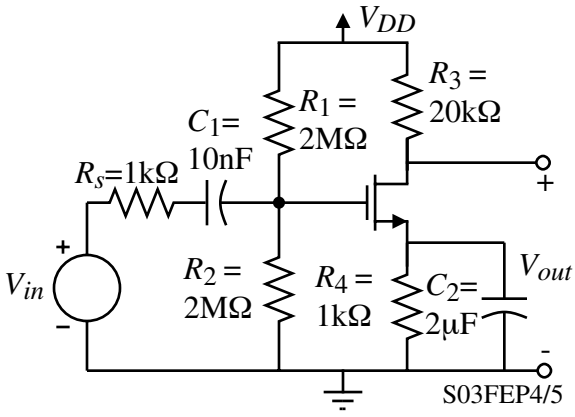
Inverting Unity Gain Noninverting Unity Gain

S03FEP3

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

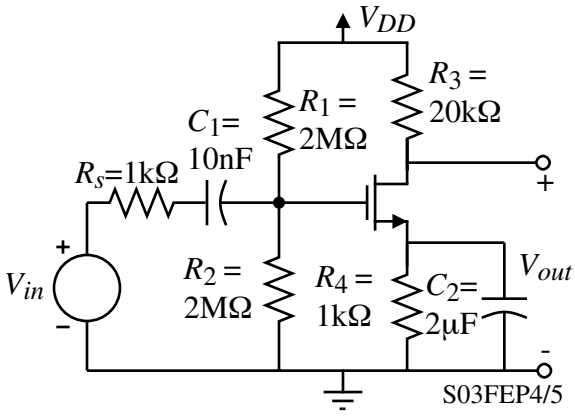
1.) If g_m = 1mA/V, what is the midband voltage gain of the amplifier shown? Assume $r_d = \infty$.

2.) Find all poles and zeros of this amplifier in radians/sec.



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.

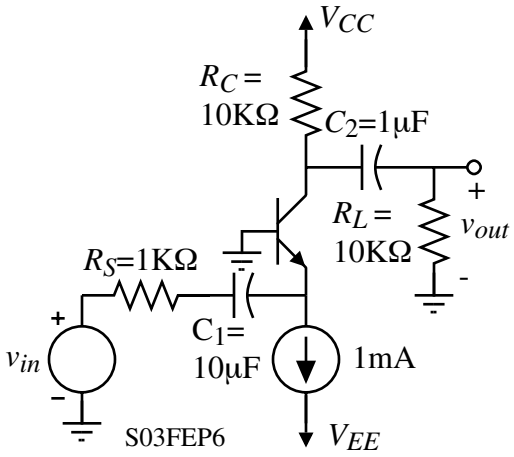


Problem 6 - (20 points - This problem is optional).

A BJT amplifier is shown. Assume that the BJT has the small signal parameters of $\beta_F = 100$, $V_t = 25\text{mV}$, 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.

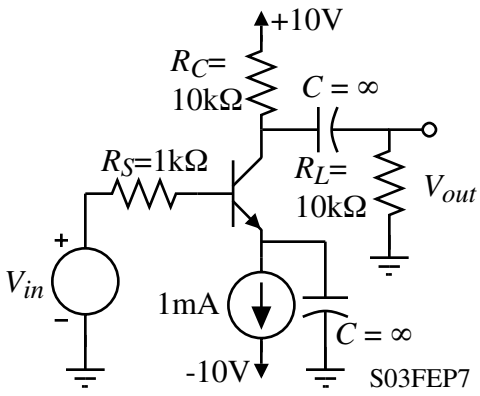


Problem 7 – (20 points, this problem is optional)

A common-emitter BJT amplifier is shown. Assume that the BJT has a $\beta = h_{fe} = 100$, $C_\mu = 2\text{pF}$, $V_t = 25\text{mV}$, $f_T = 500\text{MHz}$, $r_b = 0\Omega$, and $r_o = \infty$.

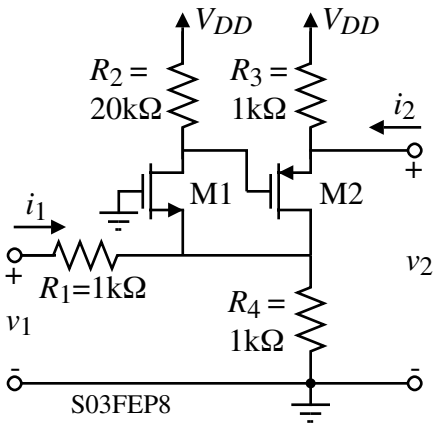
a.) Find the numerical values of r_π, g_m, and C_π.

b.) If $r_\pi = 1\text{k}\Omega$, $g_m = 0.01\text{A/V}$ and $C_\pi = 10\text{pF}$ for the above amplifier, find the value of the upper -3dB frequency, f_H, in Hz.



Problem 8 – (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 g_m= 1mS, and $r_{ds} = \infty$.



Extra Sheet