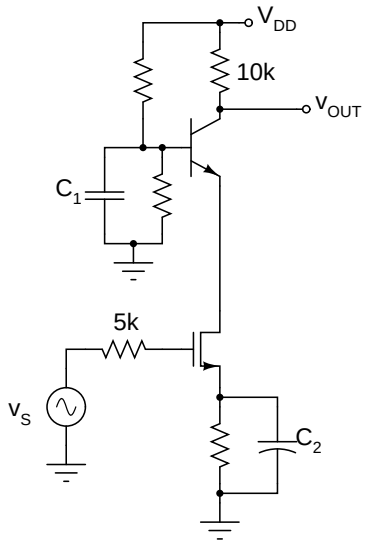
NAME: STUDENT NO.:

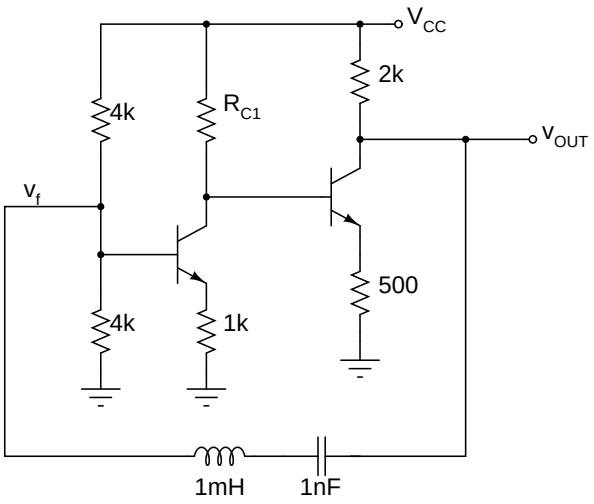
University of Puerto Rico
Electrical and Computer Engineering Department
INEL 4202 - Electronics II - Summer 2001 - Final Exam - Prof. M. Toledo
THERE ARE FOUR PROBLEMS - 25 points each

1. Find the approximate high-frequency 3dB point for the cascode circuit shown below. Consider that C_1 and C_2 are ac shorts. The transistor parameters are $g_m = 10mS$ and $C_{gs} = C_{gd} = 1pF$ for Q_1, and $r_\pi = 1k\Omega$, $g_m = 100mS$, $C_\pi = 10pF$ and $C_\mu = 1pF$ for Q_2.

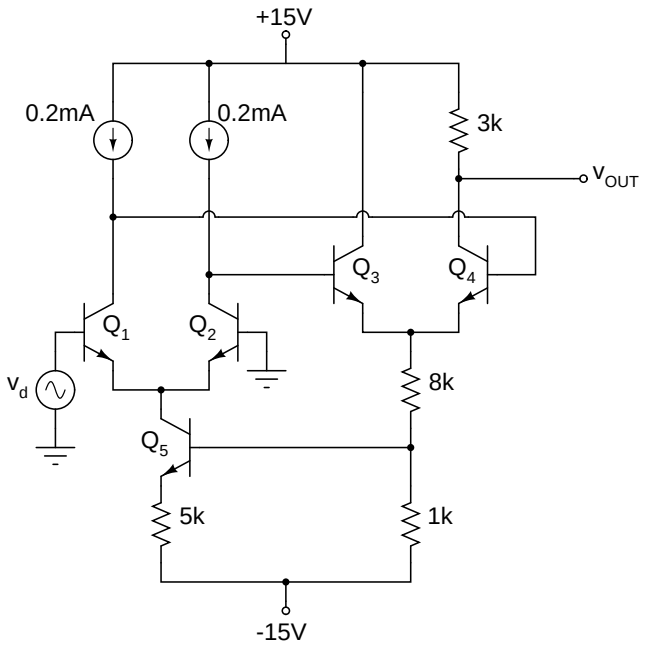


2. The amplifier described in problem 1 is modified by connecting a $100k\Omega$ feedback resistor from the collector of Q_2 to the gate of Q_1. Determine the resulting feedback amplifier's voltage gain and output resistance applying feedback analysis techniques.

3. Determine the frequency of oscillation and the value of R_{C1} for which the circuit shown below just oscillates. You may assume that $r_\pi = 1k\Omega$ and the $h_{fe} = 100$.



4. Find the dc values of v_{OUT}, and all transistor collector-emitter voltages and collector currents for the following circuit.



	Voltage Series	Current Series	Current Shunt	Voltage Shunt
Feedback signal	voltage	voltage	current	current
Sampled signal	voltage	current	current	voltage
Signal source	voltage	voltage	current	current
model	h	z	g	y
β	$\frac{v_1}{v_2}\mid_{i_1=0}$	$\frac{v_1}{i_2}\mid_{i_1=0}$	$\frac{i_1}{i_2}\mid_{v_1=0}$	$\frac{i_1}{v_2}\mid_{v_1=0}$
A_f	$\frac{A_V}{1+\beta A_V}$	$\frac{G_M}{1+\beta G_M}$	$\frac{A_I}{1+\beta A_I}$	$\frac{R_M}{1+\beta R_M}$
R_{if}	$R_i(1+\beta A_V)$	$R_i(1+\beta G_M)$	$\frac{R_i}{1+\beta A_I}$	$\frac{R_i}{1+\beta R_M}$
R_{of}	$\frac{R_o}{1+\beta A_V}$	$R_o(1+\beta G_M)$	$R_o(1+\beta A_I)$	$\frac{R_o}{1+\beta R_M}$

Table 1: Feedback amplifier formulae.

model	h	z	g	y
input source	Thevenin	Thevenin	Norton	Norton
output source	Norton	Thevenin	Thevenin	Norton
11	$\frac{v_1}{i_1}\mid_{v_2=0}$	$\frac{v_1}{i_1}\mid_{i_2=0}$	$\frac{i_1}{v_1}\mid_{i_2=0}$	$\frac{i_1}{v_1}\mid_{v_2=0}$
12	$\frac{v_1}{v_2}\mid_{i_1=0}$	$\frac{v_1}{i_2}\mid_{i_1=0}$	$\frac{i_1}{i_2}\mid_{v_1=0}$	$\frac{i_1}{v_2}\mid_{v_1=0}$
21	$\frac{i_2}{i_1}\mid_{v_2=0}$	$\frac{v_2}{i_1}\mid_{i_2=0}$	$\frac{v_2}{v_1}\mid_{i_2=0}$	$\frac{i_2}{v_1}\mid_{v_2=0}$
22	$\frac{i_2}{v_2}\mid_{i_1=0}$	$\frac{v_2}{i_2}\mid_{i_1=0}$	$\frac{v_2}{i_2}\mid_{v_1=0}$	$\frac{i_2}{v_2}\mid_{v_1=0}$

Table 2: Two-port network formulae.