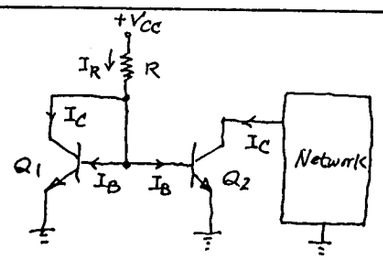
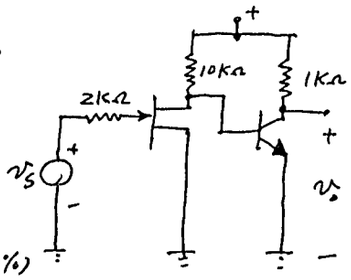
1.



(20%)

For the current mirror shown, the transistors Q_1 & Q_2 are identical. (a) Determine I_C in terms of circuit parameters (b) Evaluate I_C for V_{CC} = 10 V, R = 10 KΩ and $\beta_F = 100$. (c) Repeat (b) for $\beta_F = 200$. (4) Explain why this circuit is called "current mirror". (5) Explain why I_C is a constant current.

2.



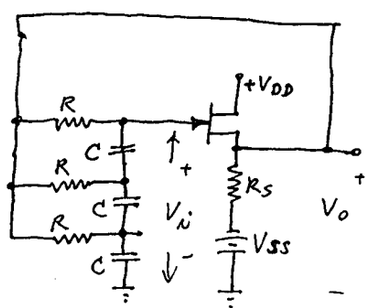
(20%)

The JFET in the circuit shown has g_m = 2 mU, r_d = 30 KΩ, C_{gs} = 10 pF, C_{gd} = 5 pF and C_{ds} = 5 pF. The BJT parameters are: r_π = 2.5 KΩ, β_0 = 125, C_π = 100 pF, and C_μ = 1.5 pF.

(a) Determine A_{VO} and the approximate value of f_H.

(b) Estimate the frequency of the nearest nondominant pole.

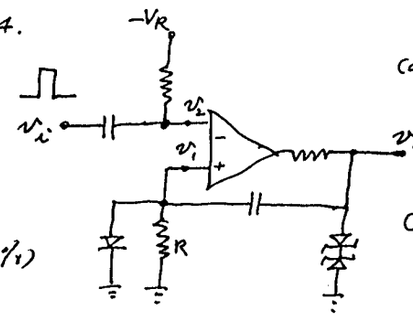
3.



(20%)

For the circuit shown, find (a) The frequency of oscillation (b) the minimum gain of the source follower require for oscillations.

4.



(20%)

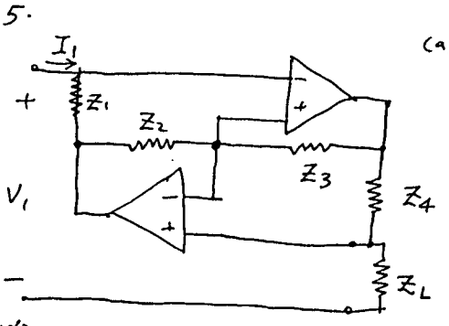
(a) For the circuit shown, find v_2, v_o and v_1 in the quiescent state.

(b) Verify that T is given by $T = RC \ln \frac{V_o}{V_R}$

(c) At t=0, a narrow, positive, triggering pulse v_i whose magnitude exceeds V_R is applied. At $t = 0^+$, find v_o and v_1 (Remember that the voltage across a capacitor cannot change instantaneously) Now plot the waveform v_o and v_1 as a function of time. Demonstrate that the circuit behaves as a monostable multivibrator with a pulse ~~with~~ width T.

(d) Find v_o and v_1 at $t = T^+$ and continue the waveforms until the steady state is reached. What is the recovery-time constant?

5.



(20%)

(a) For the # circuit shown (GIC), show that if the OP. Amps are ideal, then $Y_i = \frac{I_1}{V_1} = \frac{Y_1 Y_3}{Y_2 Y_4} Y_L$

(b) The circuit is often used to simulate an inductance on a chip. Show that if $Y_4 = sC_4$ and all other components are resistive, Y_i is inductive.

(c) Assuming that any resistance can lie between 0.1 and 10 kΩ and $10 \leq C \leq 500$ pF, what is the range of inductance values possible?