

Mid-Term Exam, ECE-137B
March 14, 1996

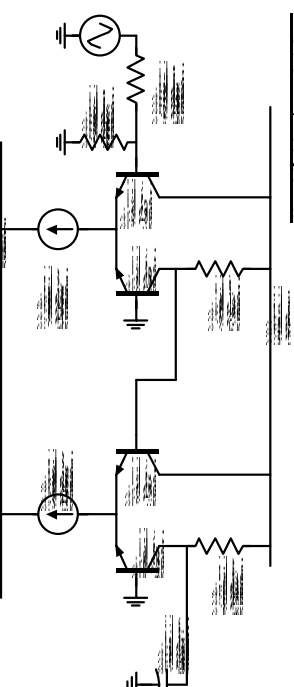
Open-Book Exam
There is 1 problem on this exam (parts a-e), and you have 75 minutes.

Do not turn over the cover page until requested to do so.

Name: _____

Use any and all reasonable approximations. 5% accuracy is fine if the method is correct.

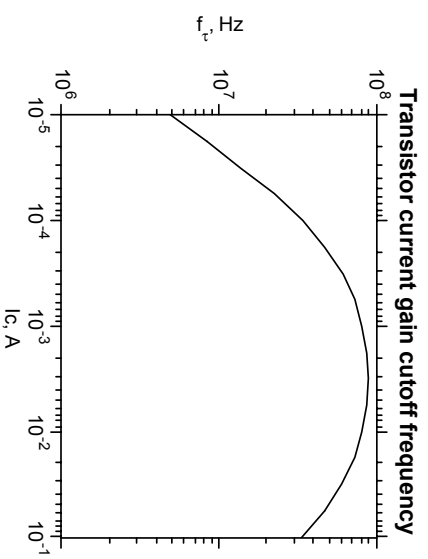
Problem 1, 100 points



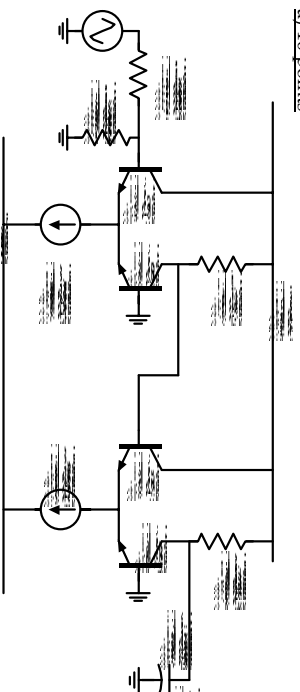
A 2-stage DC-coupled differential amplifier.

Transistor parameters: $C_{cb} = 3 \text{ pF}$, $\beta = 100$, $V_A = \infty$, f_t as shown below.

The load capacitance is 3 pF.



a) 10 points



On the circuit diagram above indicate all bias currents and all bias voltages.

3

b) 20 points

Find the mid-band amplifier parameters below (V_{in} is the voltage at the base of Q1)

$V_{out}/V_{in} =$ _____ $V_{out}/V_{gen} =$ _____

$R_{in} =$ _____, $R_{out} =$ _____

4

c) 10 points

Give the following transistor parameters

C_{r1} = _____

C_{r2} = _____

d) 40 points
High-frequency response. Calculate the gain-frequency characteristics of the amplifier: give an expression for $V_{out}(s)/V_{gen}(s)$.

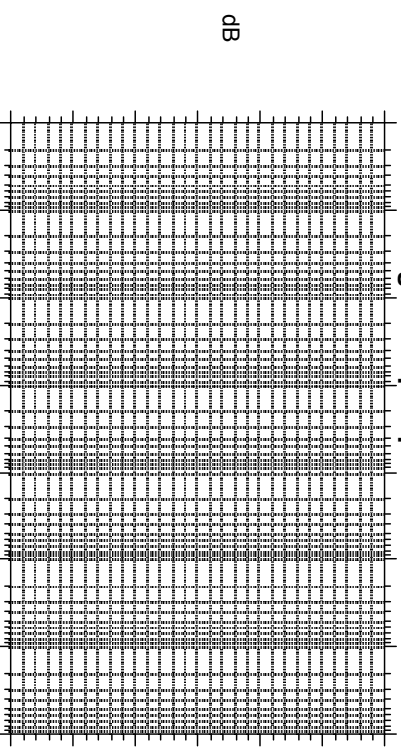
Give all pole frequencies and zero frequencies (in Hz).

Do NOT use the node-by node Miller Approximations.

Hint: This part should take 30 minutes, not two hours, so choose your analytic method sensibly.

e) 20 points

Bode Magnitude plot-please label axes



Draw a Bode Plot (Straight-line asymptotes) of the amplifier transfer function, labelling all pole and zero frequencies