

ECE 137 A Mid-Term Exam

February 15, 2001

Do not open exam until instructed to.

Closed book: Crib sheet and 1 page personal notes permitted

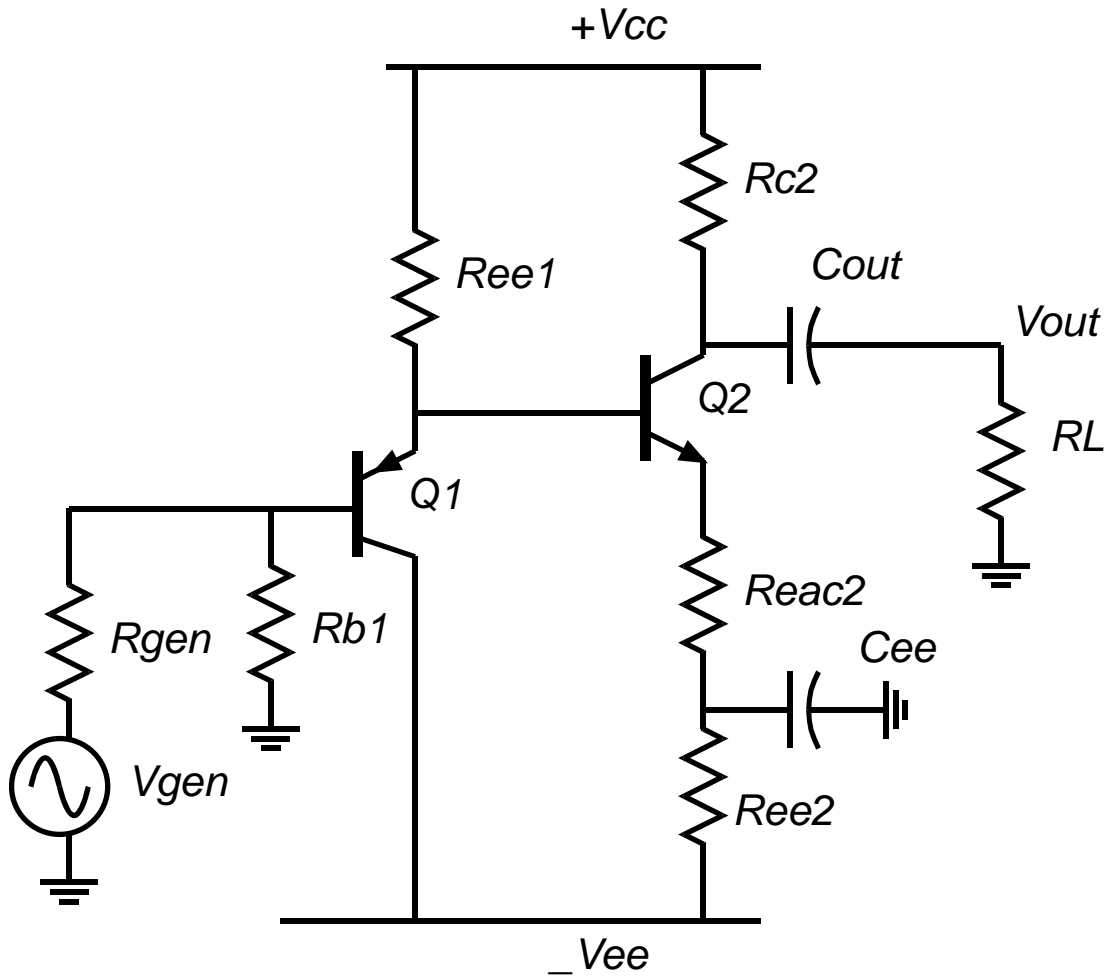
There is one problem on this exam (parts A-F) , and your have 50 minutes.

Use any and all reasonable approximations

Name: _____

Problem 1, 100 points

You will be working on the circuit below:



Q1 and Q2: $\beta=75$, $V_a=200$ Volts.

$R_{b1}= 10 \text{ k}\Omega$.
 $R_{gen}=1 \text{ k}\Omega$
 $V_{cc}= +10 \text{ Volts}$

$R_{ee1}= ???$
 $R_{ee2}= ???$
 $-V_{ee}= -10 \text{ Volts}$

$R_{c2}=??$
 $R_{ac2}=25 \text{ Ohm}$

$R_L=1 \text{ k}\Omega$

C_{out} , and C_{ee} are very big.

Part a, 10 points

DC bias.

Q1 is to be biased with 1 mA emitter current.

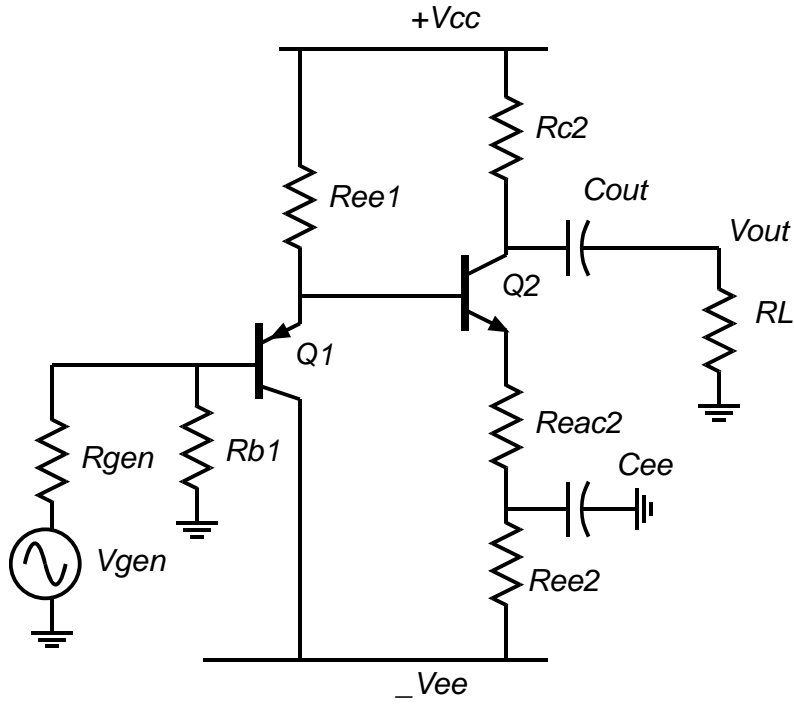
Q2 is to be biased with 5 mA collector current

The collector of Q2 is to be biased at +5 Volts

Find: $R_{e1} =$ _____ $R_{e2} =$ _____ $R_{c2} =$ _____

Part b, 10 points

DC bias



On the circuit diagram above, label the DC voltages at ALL nodes and the DC currents through ALL resistors

Part b, 10 points

Find the small signal parameters of Q1 and Q2. Give the values in the table below:

Transistor	I_e	r_e	r_π	r_o
Q1				
Q2				

Part c, 20 points.

Find the small signal voltage gain (v_{c2}/v_{b2}) of Q2 and Q2's small-signal input resistance.

$v_{c2}/v_{b2} =$ _____

$R_{in,q2} =$ _____

Part d, 20 points

Find the small signal voltage gain (v_{e1}/v_{b1}) of Q1 and the *** amplifier *** input resistance.

$v_{e1}/v_{b1} =$ _____

Rin, amplifier = _____

Part e, 10 points

Find (V_{out}/V_{in}) , (V_{in}/V_{gen}) and (V_{out}/V_{gen})

$$(V_{out}/V_{in}) = \underline{\hspace{10em}}$$

$$(V_{in}/V_{gen}) = \underline{\hspace{10em}}$$

$$(V_{out}/V_{gen}) = \underline{\hspace{10em}}$$

Part f, 20 points

Find the maximum peak-peak output voltage (show all your work, specifically show the limits of the output swing arising from cutoff and saturation of Q1 and Q2)

COMMONSENSE POINT: NOTE THAT THE MAX SWINGS of Q1 must be multiplied by the gain of Q2 in order to find their corresponding limit on output voltage.

Cutoff of Q1; Maximum ΔV_{out} resulting = _____

Saturation of Q1; Maximum ΔV_{out} resulting = _____

Cutoff of Q2; Maximum ΔV_{out} resulting = _____

Saturation of Q2; Maximum ΔV_{out} resulting = _____

Maximum Peak-Peak output = _____

