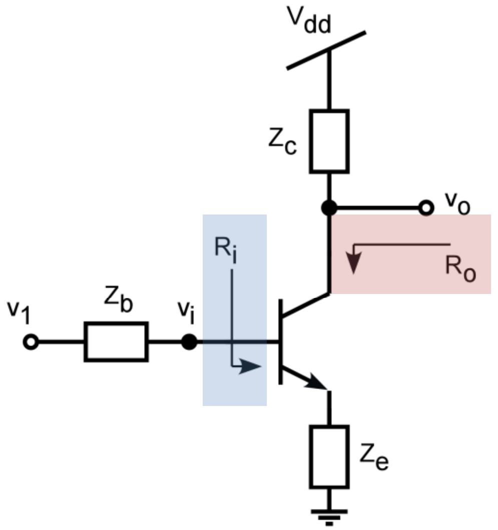
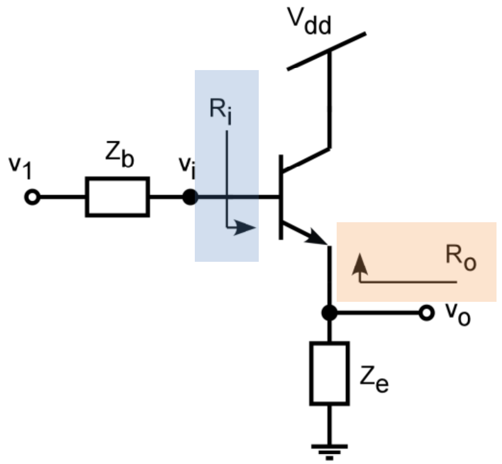
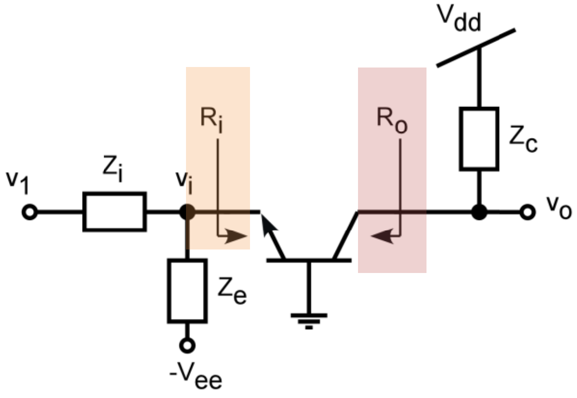
Last Lecture → BJT Single Stage Amps



Common Emitter - CE



Common Collector - CC



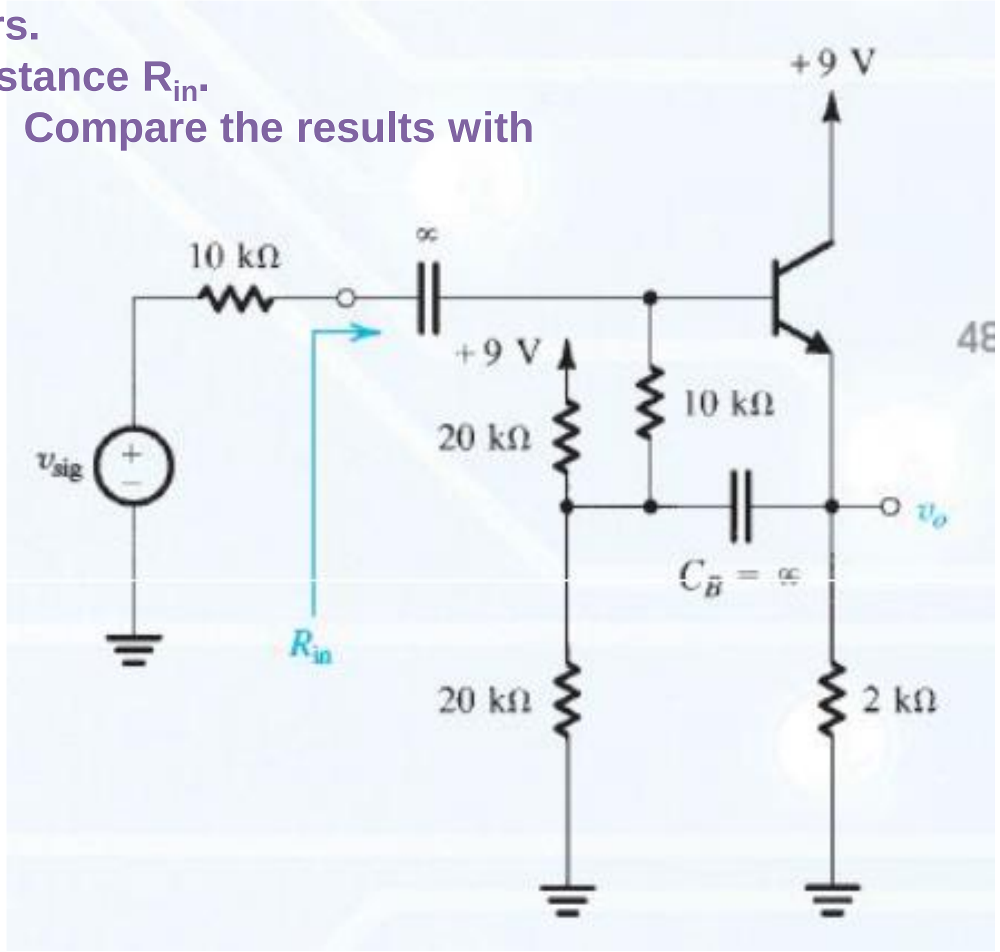
Common Base - CB

Single Transistor Bipolar Amplifier	Common-Emmitter CE	Common-Collector CC	Common-Base CB
Voltage Gain $A_v = \frac{v_o}{v_i}$	$\cong -\frac{g_m}{1+g_m Z_e} \cdot R_o//Z_c$	$\cong +\frac{g_m}{1+g_m Z_e} \cdot Z_e$	$= +g_m \cdot R_o//Z_c$
Input Resistance R_i	$= r_\pi(1+g_m Z_e)$	$= r_\pi\ (1+g_m Z_e)$	$\cong \frac{1}{g_m}$
Output Resistance R_o	$= r_o(1+g_m Z_e)$	$\cong \frac{1}{g_m} + \frac{Z_b}{\beta_o+1}$	$= r_o[1+g_m(Z_i//Z_e)]$

Problem 6.154

For the given circuit, assume β=100 and V_{BE}=0.7V.

a) **Find the dc emitter currents and the small signal parameters.**
b) **Determine the overall voltage gain v_o/v_{sig} and the input resistance R_{in}.**
c) **Repeat b) for the case when capacitor C_B is open-circuited. Compare the results with those obtained in b).**



Problem 6.147

***6.147** The amplifier of Fig. P6.147 consists of two identical common-emitter amplifiers connected in cascade. Observe that the input resistance of the second stage, R_{in2}, constitutes the load resistance of the first stage.

(a) For $V_{CC} = 9$ V, $R_1 = 100$ kΩ, $R_2 = 47$ kΩ, $R_E = 3.9$ kΩ, $R_C = 6.8$ kΩ, and $\beta = 100$, determine the dc collector current and dc collector voltage of each transistor.

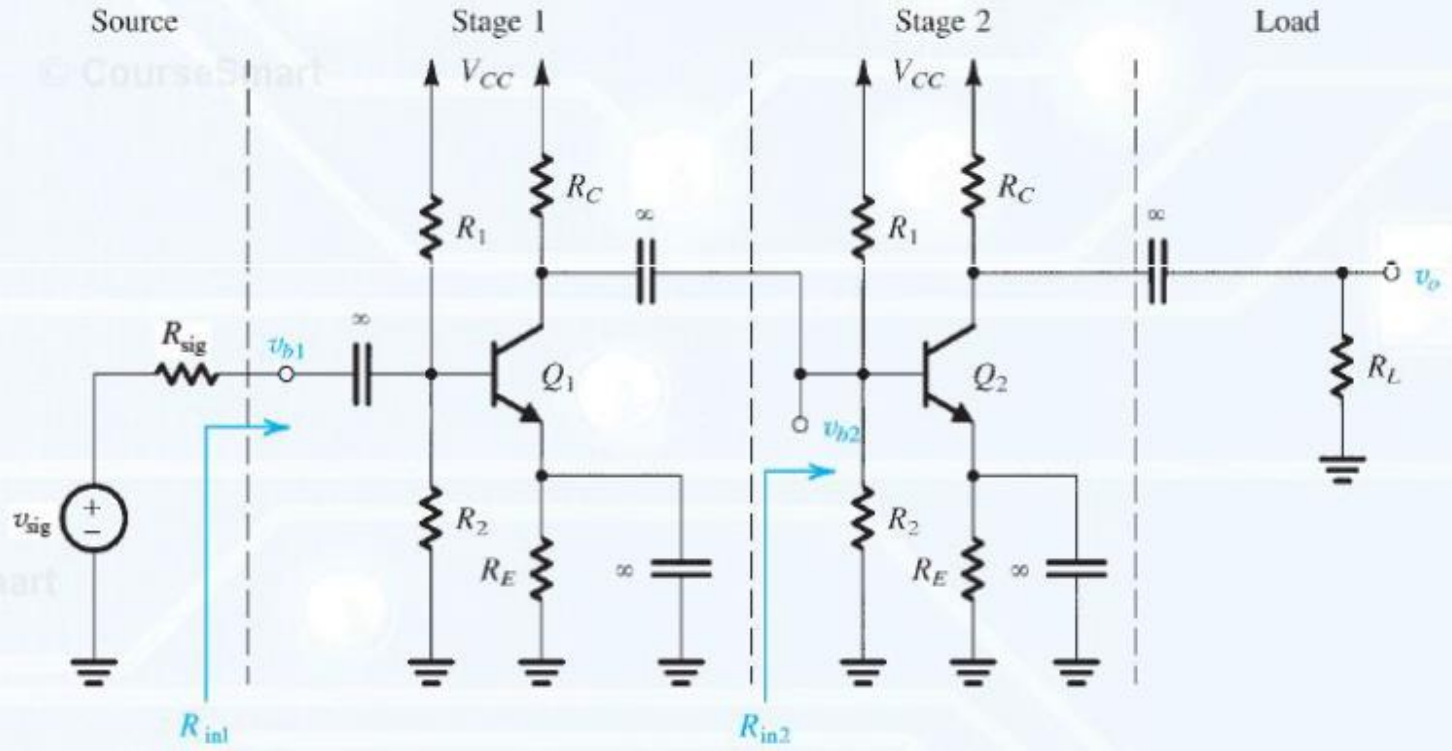
(b) Draw the small-signal equivalent circuit of the entire amplifier and give the values of all its components.

(c) Find R_{in1} and v_{b1}/v_{sig} for $R_{sig} = 5$ kΩ

(d) Find R_{in2} and v_{b2}/v_{b1}.

(e) For $R_L = 2$ kΩ, find v_o/v_{b2}.

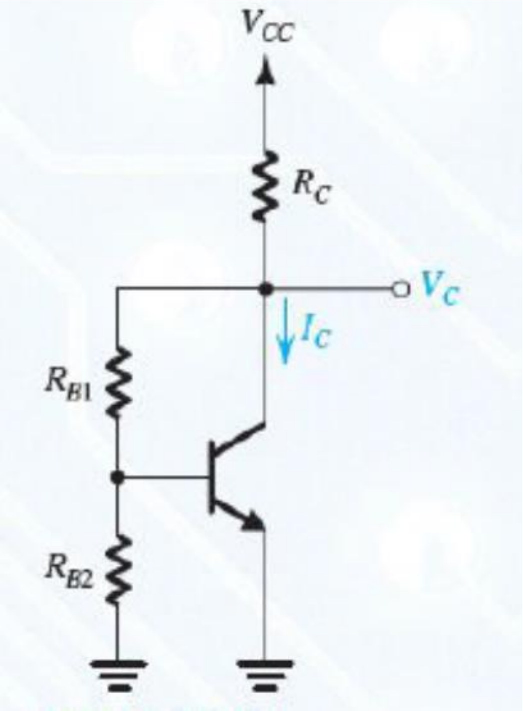
(f) Find the overall voltage gain v_o/v_{sig}.



Problem 6.136

For the given circuit, using a 3-V power supply,

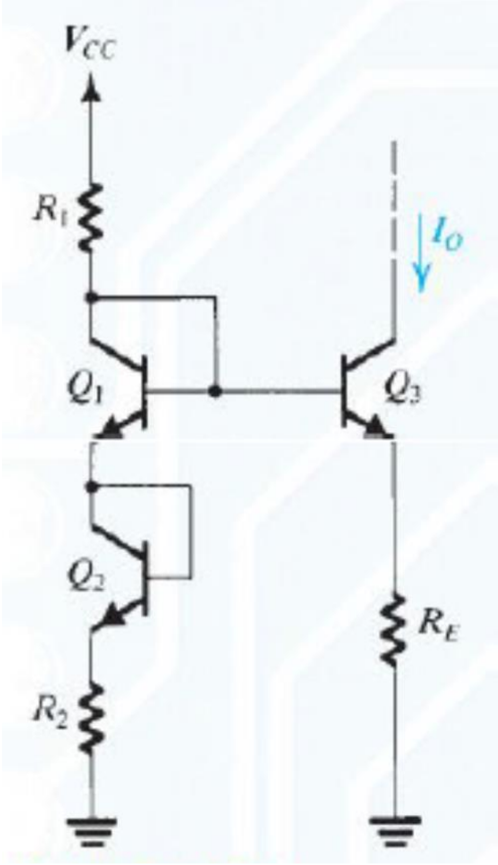
a) and assuming $R_{b2}=\infty$, design R_c and R_{b1} to provide I_c=3mA and $V_c=V_{cc}/2$ for β=90.
b) Find V_c and I_c for $\beta=\infty$.
c) Re design R_{c}, R_{b1} and R_{b2} for β=90 and using a current through R_{b2} equal to the base current.
d) Find V_c and I_c for $\beta=\infty$.



Problem 6.140

For the given circuit, assuming all transistors to be identical with β infinite,

a) **derive an expression for the output current I_0, and show that by selecting R_1=R_2 and keeping the current in each junction the same, the current I_0 will be $I_0=V_{CC}/(2R_E)$**
b) **What must be the relationship of R_E to R_1 and R_2 be?**
c) **For V_{cc}=10V and V_{BE}=0.7V, design the circuit to obtain an output current of 0.5mA.**
d) **What is the lowest voltage that can be applied to the collector of Q_3?**



Problem 6.68

Assuming β=infinite, design the given circuit so that the bias currents in Q_1, Q_2, and Q_3 are 1mA, 1mA, and 2mA, respectively, and V_3=0, V_5=-2V, and V_7=1V.