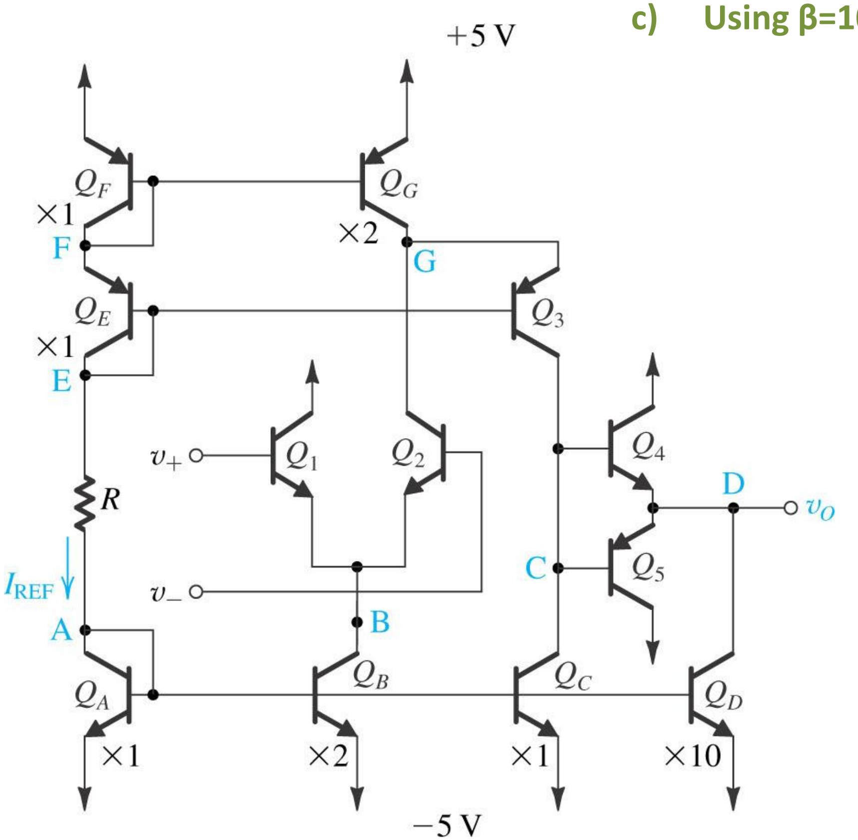
Problem – D8.120

For the circuit below assume all transistors have $|V_{BE}|$=0.7V, V_A=200V, and β=100.

a) **Perform a bias calculation assuming $|V_{BE}|$ = 0.7V, $V_A = \infty$, $\beta = \infty$, $v_+ = v_- = 0$ and v_o is stabilized by feedback to about 0V. Find R so that the reference current I_{ref} is 100μA. What are the voltages at all the labeled nodes?**

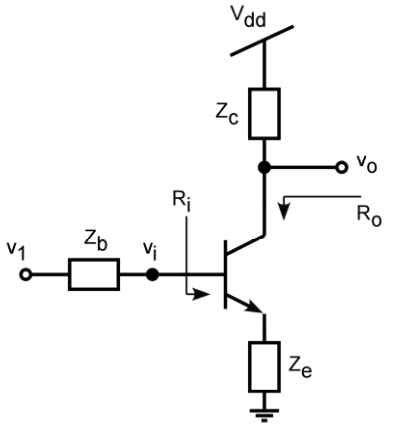
b) **Provide the bias current in all transistors together with g_m and r_o.**

c) **Using β=100, find the voltage gain v_o/v_{id}**

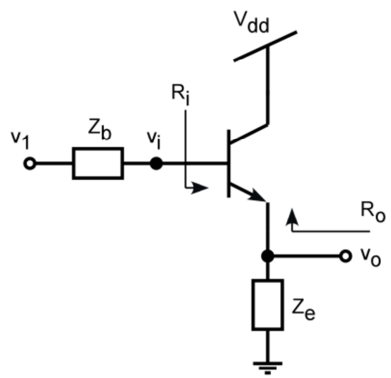


Small-Signal Gain

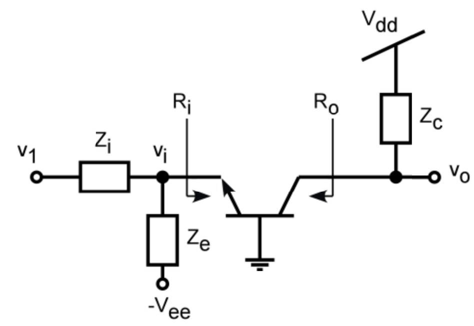
Bipolar



Common Emitter - CE



Common Collector - CC

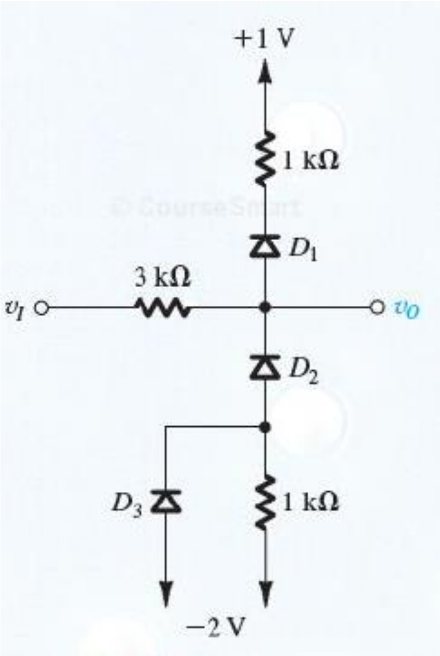


Common Base - CB

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	$= r_o(1+g_m Z_e)$	$\cong \frac{1}{g_m} + \frac{Z_b}{\beta_o + 1}$	$= r_o[1+g_m(Z_i//Z_e)]$

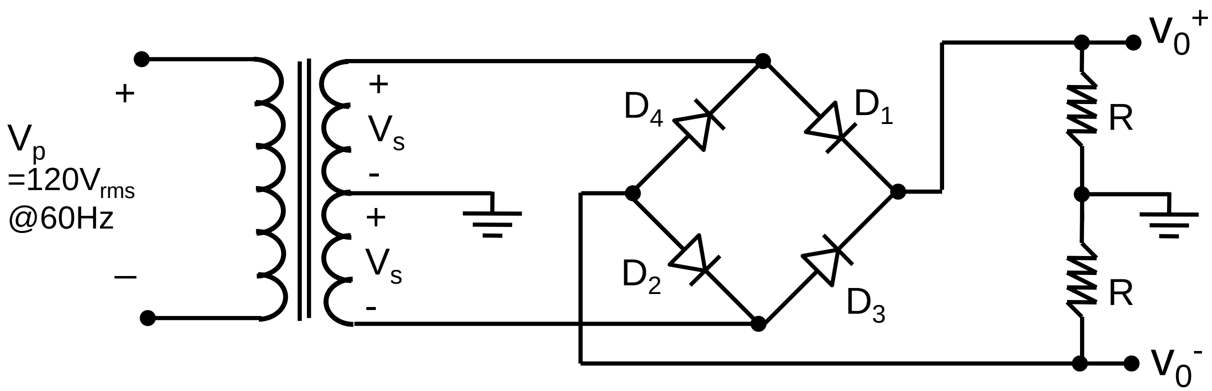
Problem – 4.93

Sketch and label the voltage transfer characteristic v_0 versus v_i of the circuit provided below over a $\pm$10-V range of input signals. Assume a constant voltage drop of 0.7V for all diodes. What are the slopes of the characteristic at the extreme $\pm$10-V levels?



Problem – D4.82

Consider the circuit below with two equal filter capacitors placed across the load resistors R. Assume that the diodes available exhibit a 0.7-V drop when conducting. Design the circuit to provide ±15V dc output voltages with a peak-to-peak ripple no greater than 1V. Each supply should be capable of providing 200mA dc current to its load resistor R. Completely specify the capacitors, diodes and the transformer.



Capacitor: ______________ mF ____________ volts

Diodes- DC current rating: ___________ A Breakdown voltage: _______________ Volts

I surge: ______________ A Peak current: _________________ A

Transformer- Prim/sec: ________ /________

Rectifiers

- **Half-Wave Sine (T=0→π)**

$$\overline{V_0} = 2\frac{V_{peak}}{\pi}$$

- **Half-Wave (filtered)**

$$V_r = \frac{V_S}{fCR} \approx \frac{I_L}{fC}$$

$$\Delta\theta \approx \sqrt{2V_r/V_S}$$

$$i_{Davg} = I_L\left(1 + \pi\sqrt{2V_S/V_r}\right)$$

$$i_{Dmax} = I_L\left(1 + 2\pi\sqrt{2V_S/V_r}\right)$$

- **Full-Wave (filtered)**

$$V_r = \frac{V_S}{2fCR} \approx \frac{I_L}{2fC}$$

$$\Delta\theta \approx \sqrt{2V_r/V_S}$$

$$i_{Davg} = I_L\left(1 + \pi\sqrt{V_S/2V_r}\right)$$

$$i_{Dmax} = I_L\left(1 + 2\pi\sqrt{V_S/2V_r}\right)$$