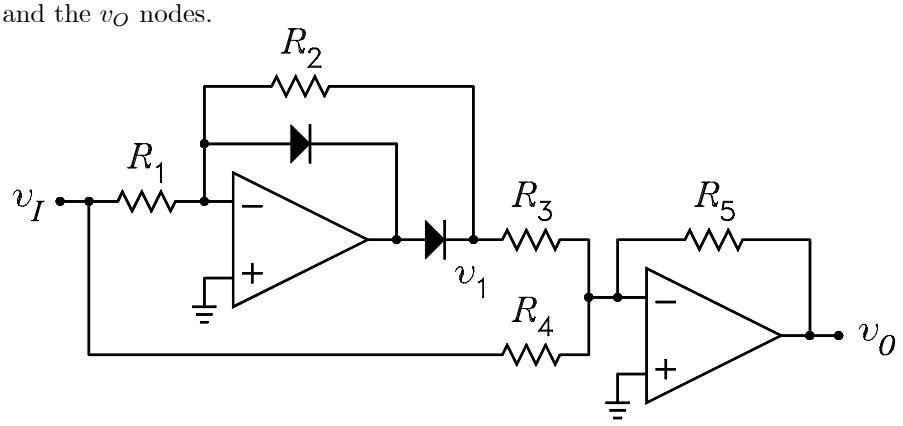
ECE 3050 Analog Electronics Quiz 14

April 22, 2009

Professor Leach Name_____

Instructions. Print your name in the space above. **Honor Code:** *I have neither given nor received help on this quiz.* Initials _____

1 of 2. The figure shows a precision rectifier circuit. The input signal is a sine wave. For $R_1 = 10\,\text{k}\Omega$, $R_2 = 10\,\text{k}\Omega$, $R_3 = 5\,\text{k}\Omega$, $R_4 = 10\,\text{k}\Omega$, and $R_5 = 20\,\text{k}\Omega$, sketch the time domain waveforms for the v_1 and the v_O nodes.

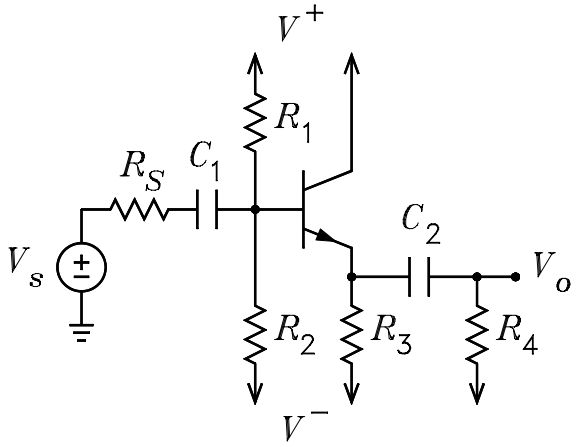


The output signal is a negative going full wave rectified sine wave with a peak voltage of $2v_I$.

2 of 2. $R_S = 1\,\text{k}\Omega$, $R_1 = R_2 = 30\,\text{k}\Omega$, $R_3 = 3\,\text{k}\Omega$, and $R_4 = 1\,\text{k}\Omega$, $C_1 = 1\,\mu\text{F}$, and $C_2 = 50\,\mu\text{F}$. The impedances seen looking into the base and into the emitter are

$$z_{ib} = 10^4 \frac{1 + s/100}{1 + s/10} \qquad z_{ie} = 500 \frac{1 + s/20}{1 + s/2}$$

(a) For the lower cutoff frequency, solve for the worse case pole frequency for C_1.
(b) For the lower cutoff frequency, solve for the worse case pole frequency for C_2.
(c) Which pole dominates in calculating the lower cutoff frequency f_L?



$R_S := 1000$ $R_1 := 30000$ $R_2 := 30000$ $R_3 := 3000$ $R_4 := 1000$

$r_{ib} := 1000$ $r_{ie} := 50$ worst case values which are the high frequency limits

$C_1 := 1 \cdot 10^{-6}$ $C_2 := 50 \cdot 10^{-6}$

$\tau_1 := \left(R_S + R_{p3}\left(R_1, R_2, r_{ib}\right)\right) \cdot C_1$ $\frac{1}{2 \cdot \pi \cdot \tau_1} = 82.144$ this frequency dominates because it is the highest

$\tau_2 := \left(R_{p2}\left(r_{ie}, R_3\right) + R_4\right) \cdot C_2$ $\frac{1}{2 \cdot \pi \cdot \tau_2} = 3.034$