Microelectronics Circuit Analysis and Design Homework(15th)

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15.15 Consider the bandpass filter in Figure P15.15.(a) Show that the voltage transfer function is

$$A_v(s) = \frac{v_O}{v_I} = \frac{-1/R_4}{(1/R_1) + sC + 1/(sCR_2R_3)}$$

(b) For $C = 0.1\ \mu$ F, $R_1 = 85$ kΩ, $R_2 = R_3 = 300\Omega$, $R_4 = 3$ kΩ, and $R_5 = 30$ kΩ, determine: (i) $|A_v(\max)|$;(ii) the frequency f_o at which $|A_v(\max)|$ occurs; and (iii) the two 3 dB frequencies.

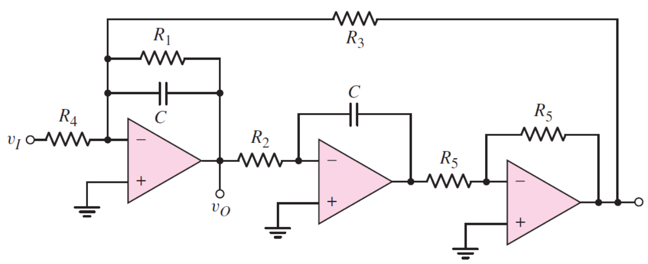

Figure 1: Problem 15.15

15.17 For each of the circuits in Figures P15.17, derive the expressions for the voltage transfer function $T(s) = V_o(s)/V_i(s)$ and the cutoff frequency $f_{3\text{dB}}$.

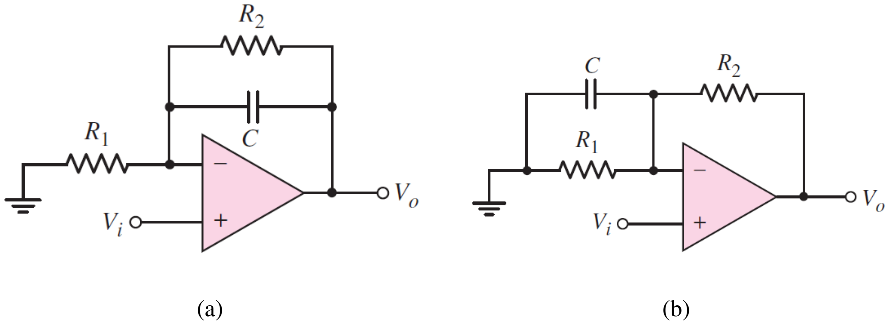

Figure 2: Problem 15.17

15.46 Consider the Schmitt trigger in Figure P15.46. Assume the saturated output voltages are $\pm V_P$. (a) Derive the expression for the crossover voltages V_{TH} and V_{TL}. (b) Let $R_A = 10$ kΩ, $R_B = 20$ kΩ, $R_1 = 5$ kΩ, $R_2 = 20$ kΩ, $V_P = 10$ V, and $V_{\text{REF}} = 2$ V. (a) Find V_{TH} and V_{TL}.(b) Sketch the voltage transfer characteristics.

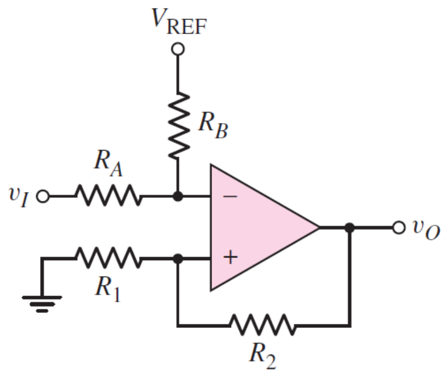

Figure 3: Problem 15.46

15.47 The saturated output voltages are $\pm V_P$ for the Schmitt trigger in Figure P15.47. (a) Derive the expressions for the crossover voltages V_{TH} and V_{TL} (b) If $V_P = 12$V, V REF$= -10$V, and $R_3 = 10$kΩ, find R_1 and R_2 such that the switching point is $V_S = -5$ V and the hysteresis width is O.2 V. (c) Sketch the voltage transfer characteristics.

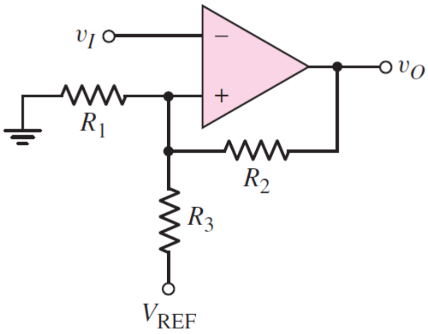

Figure 4: Problem 15.47

15.48 (a) Plot the voltage transfer characteristics of the comparator circuit in Figure P15.48 assuming the open-loop gain is infinite. Let the reverse Zener voltage be $V_Z = 5.6$ V and the forward diode voltage be $V_\gamma = 0.6$ V. (b) Repeat part (a) for an open-loop gain of $10^3.(c)$ Repeat part (a) for 2.5 V applied to the inverting terminal l of the comparator.

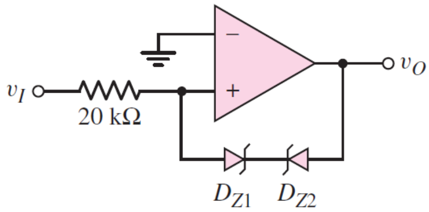

Figure 5: Problem 15.48