QUIZ #2 REVIEW

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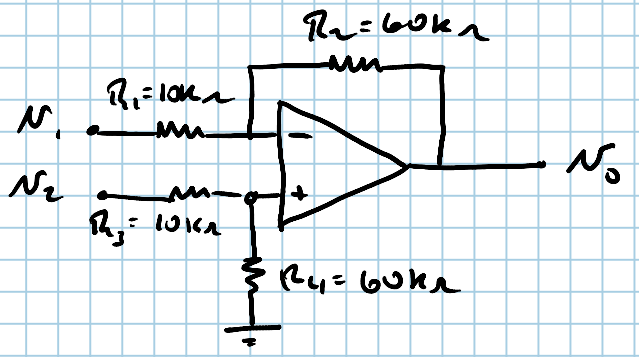
5:00 PM



FIND AN EXPRESSION FOR V_o IN TERMS OF $V_1 + V_2$

SUPERPOSITION:

$$\left.\begin{aligned} V_{o1} &= -6V_1 \\ V_{o2} &= 6V_2 \end{aligned}\right\} \quad V_o = V_{o1} + V_{o2} = 6(V_2 - V_1)$$

IF $\frac{R_4}{R_3} = \frac{R_2}{R_1} \Rightarrow \quad V_o = \frac{R_2}{R_1}(V_2 - V_1)$

IF $\frac{R_4}{R_3} \neq \frac{R_2}{R_1} \Rightarrow$

$$V_o = \left(\frac{1 + \frac{R_2}{R_1}}{1 + \frac{R_3}{R_4}}\right) V_2 - \frac{R_2}{R_1} V_1$$

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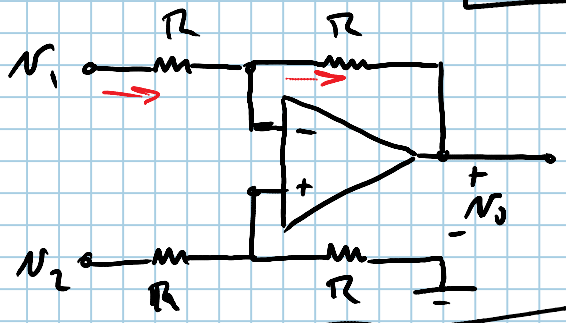
2.62

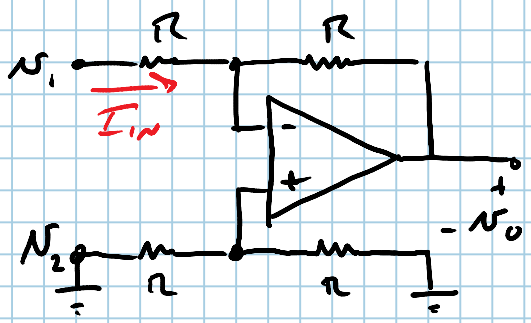


$$V^+ = \left(\frac{R}{R+R}\right)V_2 = \tfrac{1}{2}V_2 = V^-$$

$$\frac{V_1 - V^-}{R} = \frac{V^- - V_0}{R} \Rightarrow V_1 - \tfrac{1}{2}V_2 = \tfrac{1}{2}V_2 - V_0$$

$$\therefore \boxed{V_0 = V_2 - V_1}$$

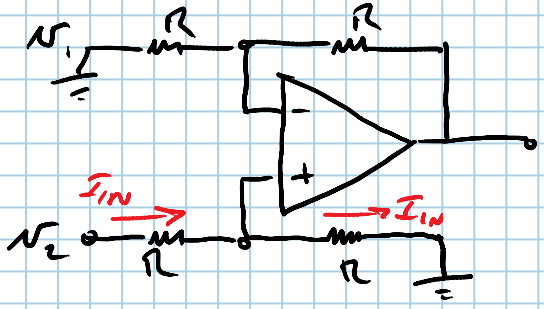
FWD R_{IN} SEEN BY V_1 ALONE



$$R_{IN} = \frac{V_1 - \cancel{V^-}^{\,0}}{I_{IN}} \qquad (V^+ = V^- = 0V)$$

$$R_{IN} = \frac{V_1}{I_{IN}} = \boxed{R}$$

FWD R_{IN} SEEN BY V_2 ALONE



$$R_{IN} = \frac{V_2}{I_{IN}} = 2R$$

$$I_{IN} = \frac{V_2}{2R} \Rightarrow R_{IN} = 2R$$

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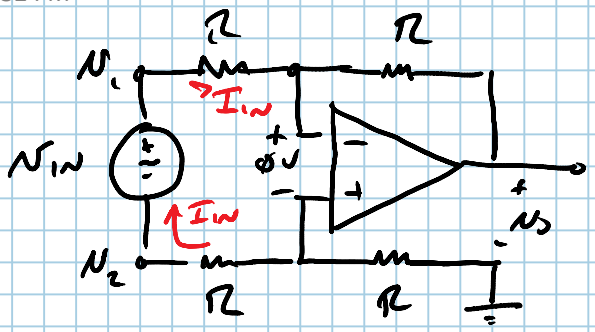
FWD R_{IN} DUE TO A SOURCE CONNECTED BETWEEN INPUT TERMINALS

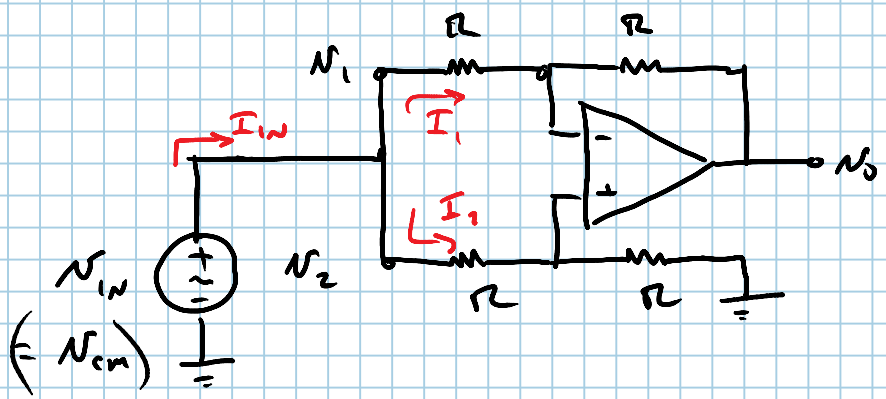


KVL: $I_{IN}R + 0 + I_{IN}R = N_{IN}$

$2RI_{IN} = N_{IN}$

$$R_{IN} = \frac{N_{IN}}{I_{IN}} = 2R$$

FWD N_3 DUE TO A COMMON-MODE VOLTAGE



$$V^+ = \left(\frac{R}{R+R}\right) N_{IN} = \frac{1}{2} N_{IN} \quad (= V^-)$$

$I_{IN} = I_1 + I_2$

$$I_1 = \frac{N_{IN} - (V^-)}{R} = \frac{N_{IN} - \frac{1}{2}N_{IN}}{R}$$

$$I_1 = \frac{N_{IN}}{2R}$$

$$I_2 = \frac{N_{IN}}{2R}$$

$$I_{IN} = I_1 + I_2 = \frac{N_{IN}}{2R} + \frac{N_{IN}}{2R} = \frac{N_{IN}}{R} = I_{IN}$$

$$R_{IN} = \frac{N_{IN}}{I_{IN}} = \boxed{R}$$

2.63

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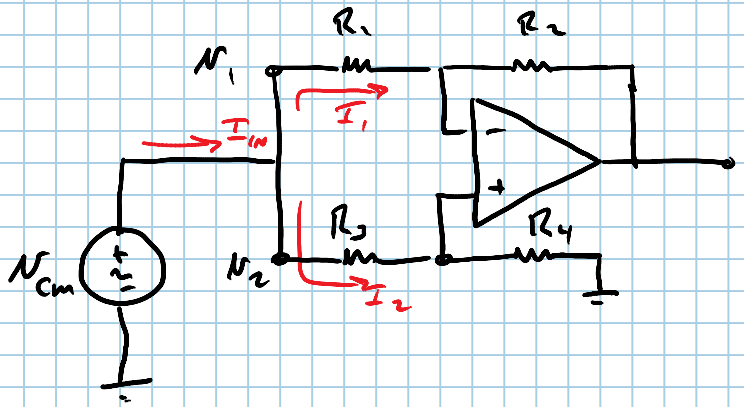

IF $\frac{R_2}{R_1} = \frac{R_4}{R_3}$, SHOW THAT

$$R_{IN_{cm}} = (R_3+R_4) \,//\, (R_1+R_2)$$

$$V^+ = \left(\frac{R_4}{R_3+R_4}\right) N_{cm} = V^-$$

$$I_1 = \frac{N_{cm}-V^-}{R_1} = \frac{N_{cm} - \left(\frac{R_4}{R_3+R_4}\right) N_{cm}}{R_1} = \frac{N_{cm}}{R_1}\left[1 - \left(\frac{R_4}{R_3+R_4}\right)\right]$$

$$\vdots$$

$$= \frac{N_{cm}}{R_1}\left(\frac{R_3}{R_3+R_4}\right)$$

$$I_2 = \frac{N_{cm}}{R_3+R_4}$$

$$I_{IN} = I_1 + I_2$$

$$R_{IN} = \frac{N_{cm}}{I_{IN}}$$

$$\frac{I}{IN} = \frac{N_{cm}}{R_1}\,\frac{R_3}{R_3+R_4} + \frac{N_{cm}}{R_3+R_4}$$

$$I_{IN} = N_{cm}\left(\frac{R_3}{R_1}+1\right)\left(\frac{1}{R_3+R_4}\right)$$

$$\frac{I_{IN}}{N_{cm}} = \left(\frac{R_3}{R_1}+1\right)\left(\frac{1}{R_3+R_4}\right) = \frac{1}{R_{IN}}$$

$$\left(\frac{R_2}{R_1} = \frac{R_4}{R_3}\right) \quad ?$$

FULL-WAVE RECTIFIER

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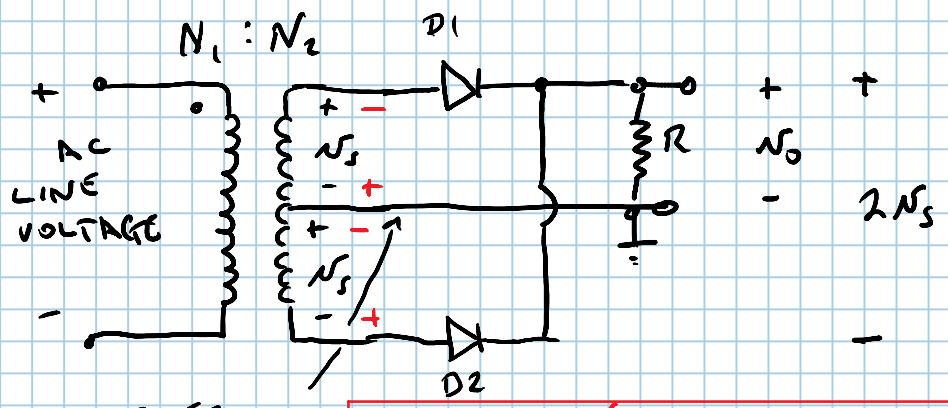
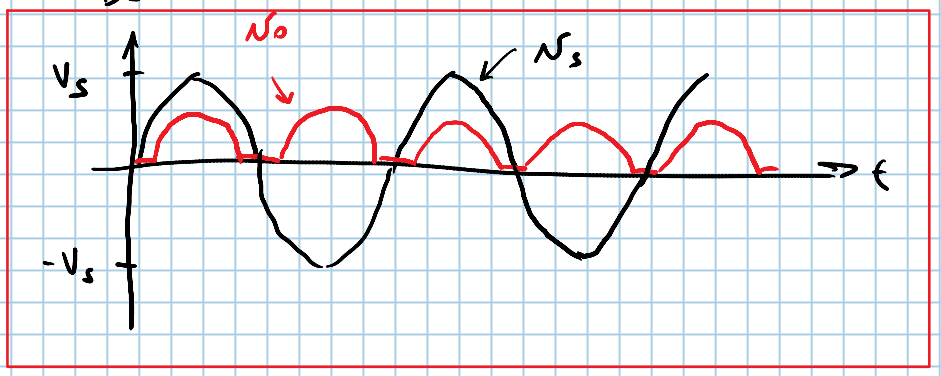
1ST CASE: 2 DIODES, ONE CENTER-TAPPED TRANSFORMER





DURING THE POS. HALF-CYCLE: BOTH SECONDARIES ARE POSITIVE, D1 IS FWD-BIASED, D2 IS REV. BIASED (CUT-OFF). CURRENT FLOWS THROUGH RL & BACK THROUGH CENTER TAP.

DURING THE NEG. HALF-CYCLE: BOTH SECONDARIES ARE NEGATIVE, D1 IS REV-BIASED, D2 IS FWD. BIASED. CURRENT FLOWS THROUGH RL & BACK THROUGH CENTER TAP.

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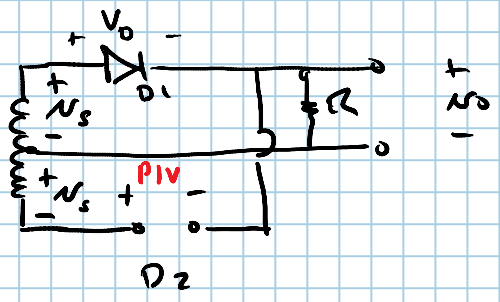
PIV

FIND THE PEAK-INVERSE VOLTAGE / THE DIODES ARE REQUIRED TO WITHSTAND

POS. HALF-CYCLE, BOTH N_s VOLTAGES >0, D_1 IS FWD-BIASED
D_2 IS REV BIASED



KVL: $N_s + N_s + PIV - V_D = 0$

$PIV = V_D - 2N_s$

$(V_D \approx 0.7\,V)$

HW #3 4.2
4.3
4.9
4.57
4.60