

Homework 7 - ECE 351

Due: May 5th

20pts

The stray capacitance between conductors 1 and 2 in the Fig. below is 50 pF. Each conductor has a capacitance to ground of 150 pF. Conductor 1 has a 10V ac signal at a frequency of 100 KHz on it. What is the noise voltage picked up by conductor 2 if it is terminated with: a) R_T is open b) $R_T = 1K\Omega$ and c) $R_T = 50\Omega$.

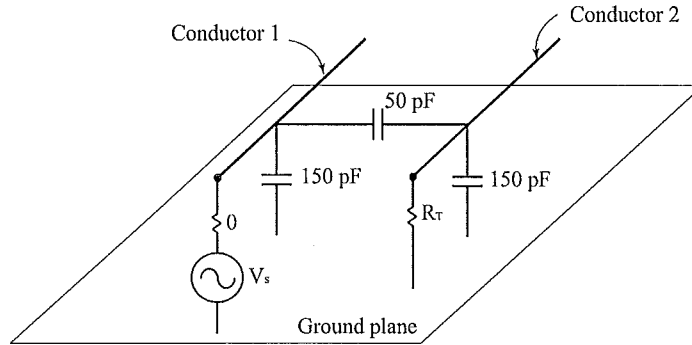
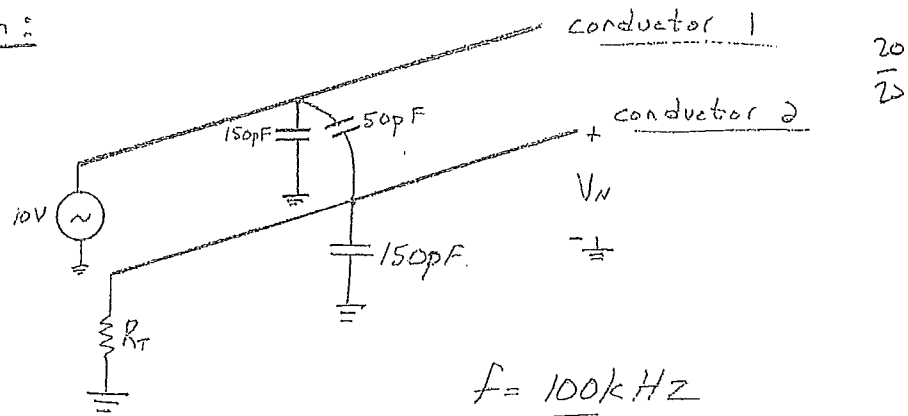


Figure 1. Coupled lines for problem 1.

Graded



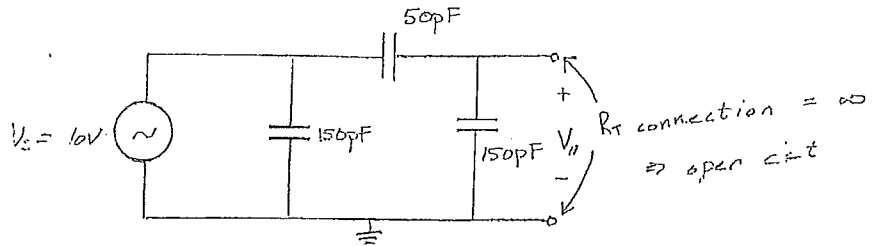
Known:



Find: V_N for

a) $R_T = \infty$

eq. ckt:



$$V_N = \left[\frac{\frac{1}{5 \cdot 150pF}}{\frac{1}{5 \cdot 150pF} + \frac{1}{5 \cdot 50pF}} \right] \cdot V_s \quad \left| \begin{array}{l} s = j\omega \end{array} \right.$$

$$\Rightarrow V_N = \left[\frac{\frac{1}{150pF \cdot s}}{\frac{50pF + 150pF}{5 \cdot 150pF \cdot 50pF}} \right] \cdot V_s = \left[\frac{50pF}{200pF} \right] V_s$$

$$\Rightarrow V_N = \frac{1}{4} V_s = \frac{5}{2} V = \underline{2.5 V} \quad /$$



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b) $R_T = 1k\Omega$ assume $\omega \ll \frac{1}{R_T(C_{gr} + C_r)}$

$$V_N \approx j\omega C_{gr} V_{in} R_T = j \cdot 2\pi f \cdot 50pF \cdot 10 \cdot 1k\Omega$$

$$\Rightarrow V_N = 314.15 \angle 90 \text{ mV} \quad \checkmark$$

c) $R_T = 50\Omega$ assume $\omega \ll \frac{1}{R_T(C_{gr} + C_r)}$

$$\Rightarrow V_N \approx j \cdot 2 \cdot \pi \cdot 100kHz \cdot 50pF \cdot 10 \cdot 50$$

$$\Rightarrow V_N = 15.7 \angle 90 \text{ mV} \quad \checkmark$$

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