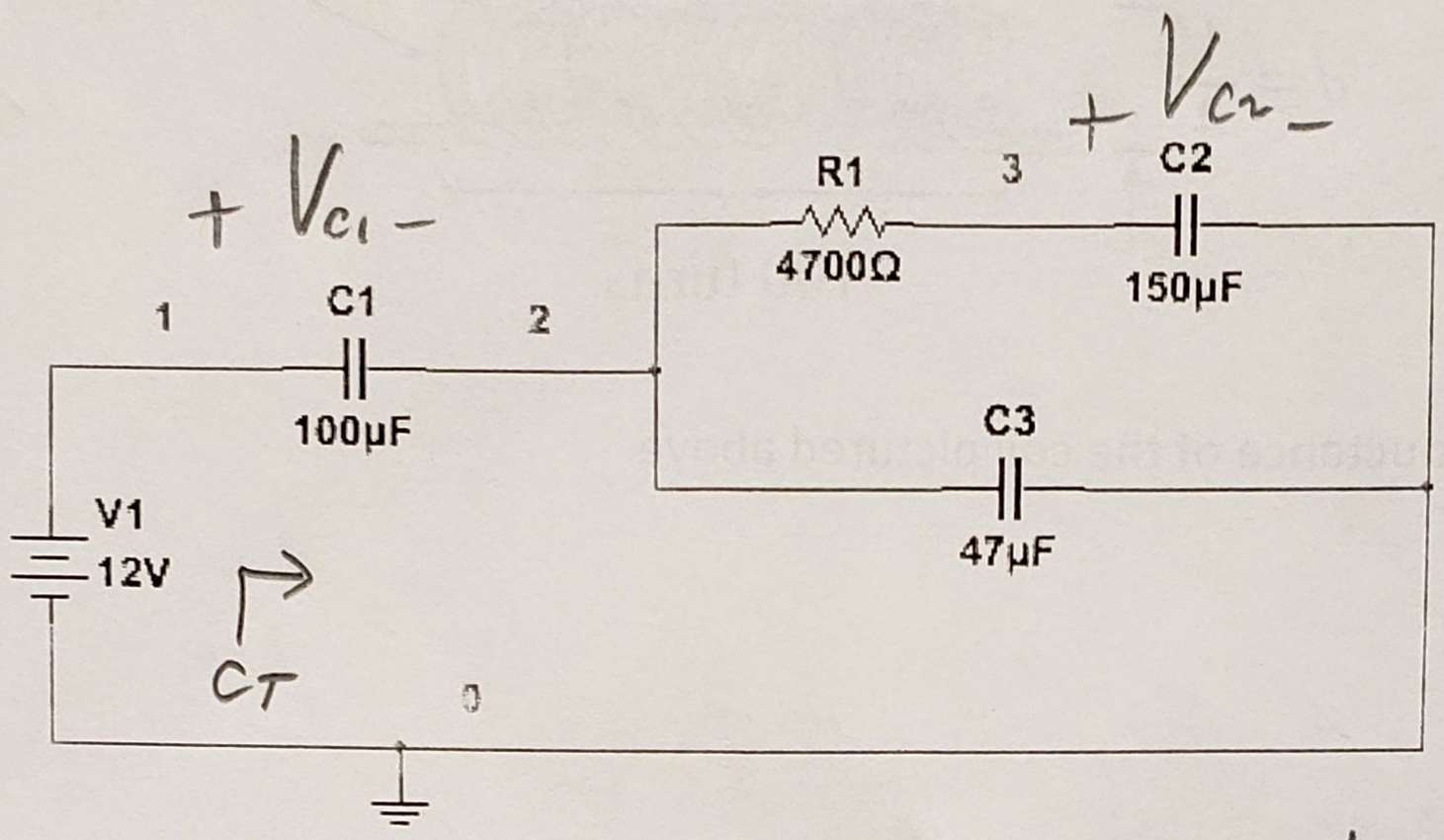
DC Circuits (EEET-111)

Quiz #10 SS Capacitors and Inductor Intro — Fall 2018 (2181)

NAME (first and last): * SOLUTIONS * **Section:** _____

All 5 questions are equally weighted, circle or box-in your final answers. No partial credit will be awarded, choose carefully and check your work:

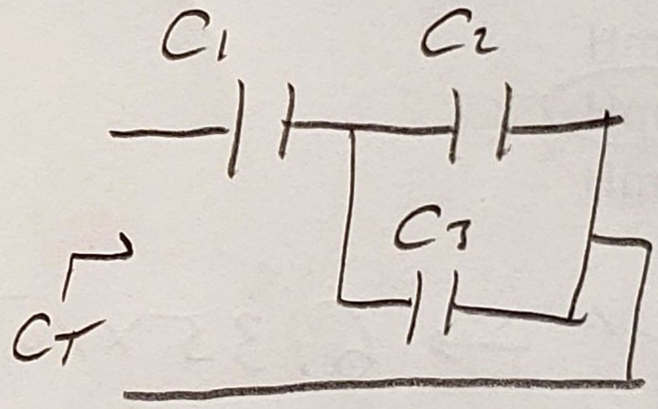


REPLACE R1 W/ S.C. (NO CURRENT FLOW)

For the circuit shown above **under steady-state conditions**:

1. Find the total capacitance seen by source V1 (C_T)

a. 33.6 uF
b. 66.3 uF
c. 147 uF
d. 297 uF



C_1 SERIES WITH $C_2 // C_3$

100µF SERIES 197µF

$$C_T = \frac{1}{\frac{1}{100\mu F} + \frac{1}{197\mu F}}$$

$C_T = 66.3\,\mu F$

2. Find the total charge on C_T

a. 40.4 uC
b. 190 uC
c. 606 uC
d. 796 uC

$Q = CV$
$= (66.3\mu F)(12V)$
$= \boxed{796\mu C}$

3. Find the voltage across C_2

a. 4.0 V
b. 6.1 V
c. 8.0 V
d. 12 V

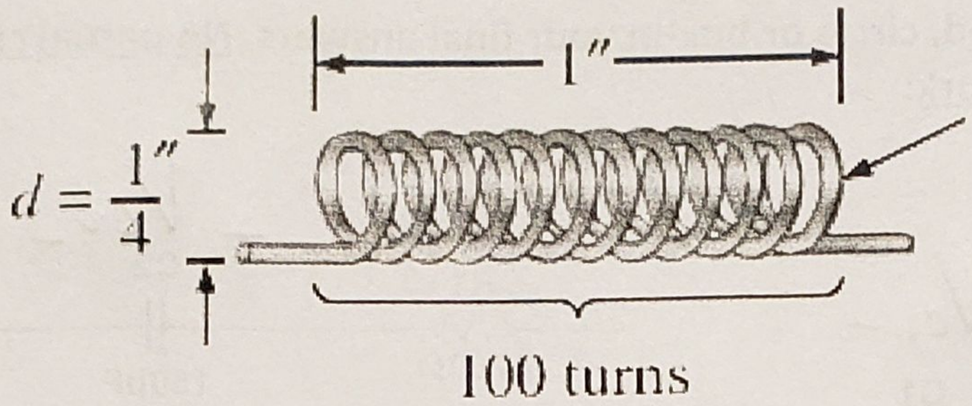
$Q_{C1} = Q_T$ (IN SERIES)
$Q_{C1} = (V_{C1})(C_1)$
OR $V_{C1} = \frac{Q_{C1}}{C_1} = \frac{796\mu C}{100\mu F} = \underline{7.96V}$

Questions 4 & 5 on the back →

HENCE
$V_{C2} = V_{C3} = V_1 - V_{C1}$
$= \boxed{4.04V}$

$$L = \frac{N^2 \mu_o \mu_r A}{\ell}$$

$$A = \frac{\pi d^2}{4}$$



$$\mu_o = 4\pi \times 10^{-7} \frac{Wb}{A \cdot m}$$

4. Find the inductance of the coil pictured above

a. 6.35 uH
b. 15.7 uH
c. 31.4 uH
d. 80.0 uH

5. If the air core is replaced by an iron alloy (with $u_r = 300$), what would the inductance change to?

a. 953 uH
b. 2.35 mH
c. 4.70 mH
d. 31.4 mH

$0.25'' \rightarrow 6.35 \times 10^{-3} m$

$1'' = 25.4 mm \times 10^{-3} m$

$$A = \frac{\pi d^2}{4} = \frac{\pi (6.35 \times 10^{-3} m)^2}{4}$$

$$= 31.67 \times 10^{-6} m^2$$

$$\therefore L_o = \frac{(100)^2 \left(4\pi \times 10^{-7} \frac{Wb}{A \cdot m}\right)(31.67 \times 10^{-6} m^2)}{25.4 \times 10^{-3} m}$$ AIR CORE

$$\boxed{L_o = 15.67 \mu H}$$

$$L = \mu_r L_o = (15.67 \mu H)(300) = \boxed{4.70 mH}$$

μ_r: 300 (IRON ALLOY)