Problem Set 4

Due Date: Sat Oct 17 2015
by 9 PM

Name:_____

Lab Section & TF:_____

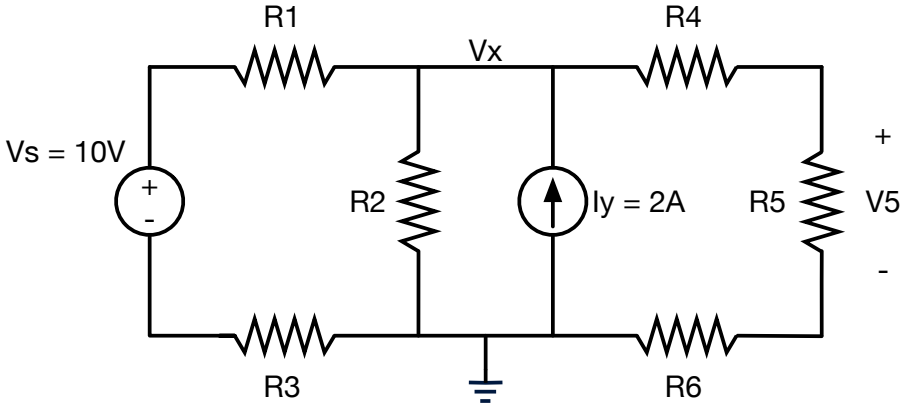
Collaborators:_____

For Grading Purposes Only:

Q1: _____ / 10
Q2: _____ / 10
Q3: _____ / 15
Q4: _____ / 10
Q5: _____ / 5

Total:_____ / 50

Problem 1: Circuit Analysis (10 points)

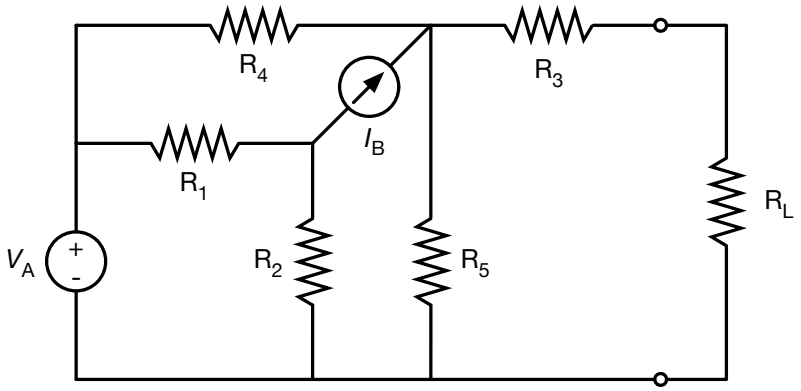


Assume the following resistances: R1=R3=1Ω, R2=2Ω, R4=R6=2Ω, and R5=1Ω.

a. (5 points) For the circuit above, solve for Vx and V5 using the **node voltage method**.

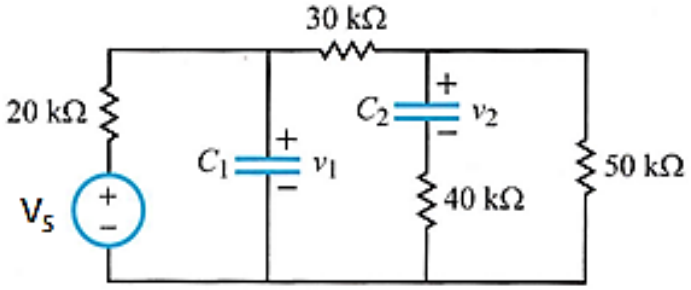
b. (5 points) Now, solve for Vx and V5 using **superposition**.

Problem 2: Thevenin Equivalent Circuit (10 points)



(10 points) For the circuit shown above, find the Thevenin equivalent circuit from the perspective of R_L. Please find V_{THEV} and R_{THEV} in terms of V_A, I_B, and $R_{1\text{-}5}$.

Problem 3: RC Circuit (15 points)



For the circuit shown above, find v_1, v_2, and the *current* through the voltage source for two conditions below.

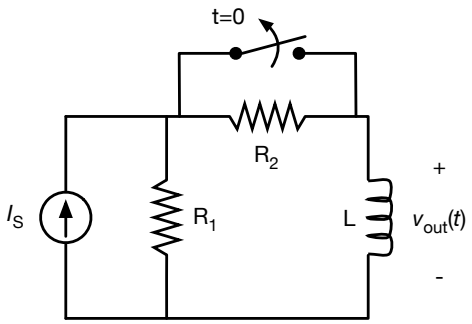
a. (5 points) The voltage source is a DC source (e.g., battery) with $V_s = 20V$.

b. (5 points) The voltage source, V_s, is an AC source $V_s = 20\sin(2\pi ft)$, where f is very high frequency relative to the RC time constants of this circuit.

c. (5 points) Calculate the average power delivered by the source for both (a) and (b) above.

Problem 4: Step Response of RL Circuit (10 points)

Please refer to the circuit shown (to the right) and answer the questions the below. The switch has been closed for a long time and opens at t = 0 and remains open. Please provide your answers in terms of I_S, R_1, R_2 and L.



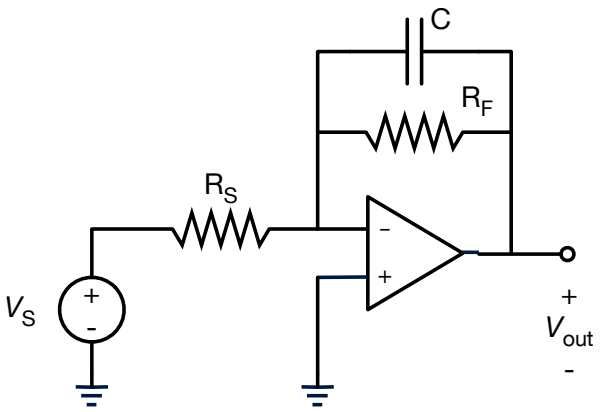
a. (2 points) What is the current flowing through the inductor, L, at $t=0^-$ and $t=\infty$?

b. (3 points) What is the current flowing through R1 and R2 at $t=0^-$ and $t=\infty$?

c. (5 points) Please *sketch* the voltage, $v_{out}(t)$, across the inductor vs. time.

Problem 5: Op-amp Circuit with C (5 points)

For this problem, assume V_s provides a unit voltage step, u(t), 0V for t<0 and transitions to 1V at t=0 and stays at 1V for t>0.



a. (5 points) For the op-amp circuit, sketch the resulting waveform for V_{out} versus time.