

Homework 1 Terminal Relations

HW01:

John is an electrical engineering student and Jasmine is a chemistry student. John doesn't think anything important happens the first day of classes, so he skips his Electric Circuits class to go visit Jasmine. She says that a 40 W light bulb in her house is burned out and asks John if he has a spare. He says that he only has a 40 W bulb for a light in his car, but that he is certain it will work in her apartment since it has the same power rating. She says that she doesn't think that sounds right, and so they make a bet. The loser has to clean the other person's apartment. Who wins the bet and why?

HW02:

A current measured through a $2\mu\text{F}$ capacitor is: $i(t) = [\cos(2t) - 1]$ (mA). Assuming the capacitor voltage is zero for $t < 0$,

(A) Find the voltage across the capacitor for $t > 0$.

(B) What is the energy stored in the capacitor for $t > 0$?

HW03:

Swati has a voltage supply that has the following start-up characteristic when it is turned on:

$$v(t) \text{ (V)} = \begin{cases} 500t & \text{for } 0 < t < 10 \text{ ms} \\ 5 & \text{for } t > 10 \text{ ms} \end{cases}$$

a. What is the current through a 1 mH inductor that is connected to the supply for $t > 0$?

b. What is the current through a 1 μF capacitor that is connected to the supply for $t > 0$?

Assume any initial conditions are zero.

HW04:

Gladys wants to connect a 1 mH inductor to her computer clock (square wave) that has an off voltage of zero and an on voltage of 2.7 V. The clock runs at 1 GHz and has a 50% duty cycle (half on, half off).

(a) Plot the current through the inductor for 10 ns.

(b) If the inductor can handle a maximum current of 100 mA, how long until the maximum current is exceeded?

HW05:

John wants to connect a 20 μF capacitor to a current source given by $i(t) = 200\cos(200t)$ mA. Amparo says he should buy a capacitor rated for 75V or more, but he buys one rated for 25V because it costs less. Will the capacitor work fine or will its maximum voltage be exceeded when it is connected to the current source? Explain your answer.