Department of Electronics and Communication Engineering, IIT Roorkee
ECC – 205: Network Theory – Tutorial 1

Question – 1:

a) Determine the value of current and voltage (i_1, v_1, etc.) in the circuit of Fig. 1.
b) What are the different dependent sources in the circuit.
c) Also calculate the power generated/dissipated by each element and verify that they sum to zero.

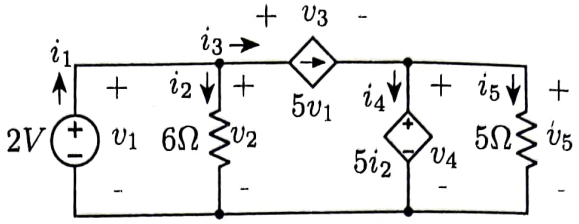

Fig. 1: A circuit with dependent sources

Question – 2:

The current delivered by a current source is increased linearly from zero to 10A in 1ms (milli-seconds) time and then is decreased linearly back to zero in 2ms. The source feeds a 3kΩ resistor in series with a 2 H inductor.

a) Find the energy dissipated in the resistor during the rise time (W_1) and the fall time (W_2).
b) Find the energy delivered to the inductor during the above two intervals.
c) Find the energy delivered by the current source to the series R-L combination during the preceding two intervals.

Question – 3:

Consider the circuits in Fig. 2(a) and Fig. 2(b). Both these circuits have two independent sources *v(t)* and *i(t)*. Can you solve both these circuits using superposition. Note that the output of the circuit of Fig. 2(a) is $v_L(t)$ and that of Fig. 2(b) is $v_C(t)$. If they obey superposition, can we say that the inductor and capacitor are linear elements?

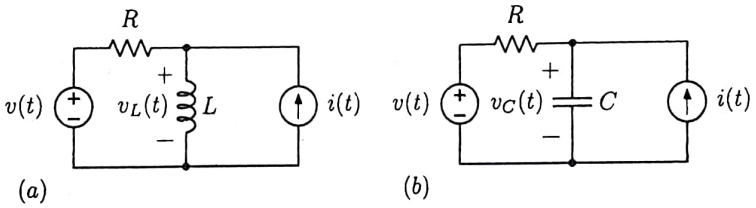

Fig. 2: Circuit for question – 3.

Question – 4:

In class, we discussed that a circuit simulator solves a circuit by reducing it into matrix form $GV = I$, where G is conductance matrix, V is the voltage array, and I is the independent current source array. This matrix form can be generalized (to include dependent sources and independent voltages) as $AX = B$, where A is a matrix which depends on component values (and has dimensions of Ω^{-1}), X is the array of unknowns, while B is the independent sources array. Write the A, X and B matrices for the circuit below.

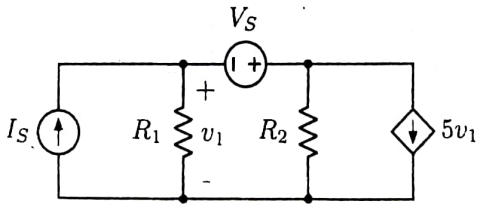

Fig. 3: Circuit for question – 4