ECE 2202 – CIRCUIT ANALYSIS II

HOMEWORK #3

1) An inductor with an inductance of 6.8[H] is connected in parallel with an ideal voltage source. At *t* = 0, the voltage source has a voltage of zero, and the energy stored in the inductor is zero. The voltage stays zero for 50[s], and then the voltage of the voltage source increases instantaneously to 5[V]. Then, 10[s] after that, the voltage source decreases instantaneously to a value of -2[V]. Finally, 20[s] later the voltage source instantaneously returns to zero, and stays at that value. In summary, the voltage makes three step jumps in value, at 50[s], at 60[s], and at 80[s] after *t* = 0.

a) Find expressions for the energy stored in the inductor, as a function of time, for the time period 0 < *t* < 100[s].

b) Plot the energy stored in the inductor, as a function of time, for the time period
0 < *t* < 100[s].

2) A capacitor with a capacitance of 4.7[mF] is connected in series with an ideal current source. At *t* = 0, the current source has a current of zero, and the energy stored in the capacitor is zero. The current source has a current given by



a) Find an expression for the energy stored in the capacitor, as a function of time, for two periods of the sinusoid after *t* = 0.

b) Plot the energy stored in the capacitor, as a function of time, for two periods of the sinusoid after *t* = 0.

3) In the circuit shown below, the switches SWA and SWB were closed for a long time before
*t* = 0, allowing all voltages and currents to stop changing. Then, at *t* = 0, switch SWA opened. After that, 50[ms] later, switch SWB opened.

a) Find *iQ*(0-).

b) Find *iX*(0-).

c) Find *iQ*(0+).

d) Find *iX*(0+).

e) Find the energy stored in the capacitor just before *t* = 0.

f) Find the energy stored in the capacitor just after *t* = 0.



4) In the circuit shown below, switch SWA was closed and switch SWB was open for a long time before *t* = 0, long enough so that all voltages and currents had stopped changing. Then at
*t* = 0, switch SWA opened. Ten milliseconds later, switch SWB closed.

a) Find *iX*(10[ms]-).

b) Find *iX*(10[ms]+).

c) Find the energy stored in the capacitor just before *t* = 10[ms].

d) Find the energy stored in the capacitor just after *t* = 10[ms].



5) Use the circuit given below to solve.

a) Find the energy stored in inductor *LA* at *t* = 0.

b) Find the expression for *iA(t)*, as a function of time, *t*, for *t* ≥ 0.

c) Find the value for *iB(t)*, at *t* = 5[s].



Numerical Solutions:

1. a) *wSTO.BY.L* = 0; for 0  t  50[s],

 *wSTO.BY.L* = 1.838x106[J/s2]t2 – 183.8[J/s]t + 4.595x10-3[J]; for 50[s]  t  60[s],

 *wSTO.BY.L* = 0.294x106[J/s2]t2 – 49.98[J/s]t + 2.125x10-3[J]; for 60[s]  t  80[s],

 *wSTO.BY.L* = 7.353x10-6[J]; for 80[s]  t  100[s].

 b) Omitted

2. Omitted

3. a) 0, b) 2.358[mA], c) 10.35[mA], d) 4.054[mA], e) 712.9[J], f) 712.9[J]

4. a) 0, b) -10.29[mA], c) 2.094[mJ], d) 2.094[mJ]

5. a) 7.28[J], b)  c) 7.98[A]