Week 6, HW Integrals Applied Handout: (5per day from handout)

1) The current in a circuit was $i = 4t^3$ amps. How many coulombs were transmitted in 3 seconds?

$$q = 81\ coulombs$$

2) An 80μf capacitor is charged to 100 volts. We then apply a current $i_c = 0.04t^3$ amps in the same polarity as the initial charge. After how many seconds will the capacitor voltage reach 225 volts?

$$t = 1\ sec$$

3) The voltage applied to a circuit was $v = 2t + 1$ volts. If the current followed the equation $i = 0.03t$ amperes, find the energy w delivered from $t = 0$ to $t = 50$ seconds.

$$w = 2.5375\ Kwatts$$

4) A 110 turn winding carries a flux of 0.8 weber. If we now want to vary the flux so that a voltage $v_{ind} = -5t^2$ volts appears in the winding, what equation must the flux through the winding follow?

$$\Phi = \frac{t^3}{66} + 0.8\ webers$$

5) A DC current of 0.3 ampere flows in a 15 henry inductor. Superimposed on this DC is a varying current such that the voltage $v_{ind} = 120t^{½}$ volts appears in the inductor. Find the instantaneous total current when $t = 1$ second (Assume that the DC and AC currents have the same polarity when $t = 1$ second).

$$i = 6.3\ amps$$

6) An inductance of 8 henrys is connected in series with a 12Ω resistor. Apply to this circuit a voltage $v = 20t^2$ volts. If $i = 0$ when $t = 0$, find an equation for i.

$$ig = \frac{5t^2}{3} - \frac{5t^3}{6}$$

7) If we apply a voltage $v = 90t^{1/2}$ to a circuit consisting of a 30 henry inductance shunted by a 50 ohm resistance, what current flows when $t = 4$ seconds? (Let $i = 0$ when $t = 0$).

$$ig = -12.4\ amps$$

8) If we apply a voltage $v = 20t^4$ volts across a parallel RL combination, where $R = 500\Omega$ and $L = 40$ henrys, find the total current when $t = 0.2$ seconds. Let $i = 4\mu A$ when $t = 0$.

$$ig = 36uA$$

9) In a parallel RL circuit, $R = 5\Omega$ and $L = 0.2$ henrys. If a voltage $v = t^{3/2} + 2$ volts were applied, what would the current i be when $t = 4$ seconds? Assume $i = 0.4$ amps when $t = 0$.

$$ig = 101.6\ amps$$

10) A current $i = 0.005t^{1/2}$ amps flows in a parallel RC circuit where $R = 8.8 \times 10^4\ \Omega$ and $C = 1\mu f$. Find a formula for the voltage across the circuit as a function of time t. Assume the capacitor to be initially discharged.

$$vg = 440t^{\frac{1}{2}} + 3.333 \times 10^3 t^{\frac{3}{2}}\ volts$$

11) The current function $i = 1 \times 10^{-3}\ t^{1/2}$ amperes is applied to a series RC circuit where $R = 8.8 \times 10^4\ \Omega$ and $C = 1\ \mu f$. Find a formula for the impressed voltage as a function of time t. (Assume the initial capacitor charge to be 100 v.)

$$vg = 88t^{\frac{1}{2}} + 666.667t^{\frac{3}{2}} + 100$$

12) A series LC circuit where $L = 0.1$ henry and $C = 100$ μf has applied to it a current $i = 0.1$A from $t = 0$ onward. Find (a) the formula for the voltage across the circuit, and (b) the rate of change of the voltage at $t = 2$ sec. (Assume $V_c = 0$ when $t = 0$).

$$a)\ vg = 1000t$$

$$b)\ \frac{dv}{dt} = 1000v$$

13) A series circuit has these constants: $R = 5$kΩ, $L = 200$ henrys, and $C = 20$ μf. If we supply to the circuit a current $i = 0.02t^2$ amperes, at what rate does the voltage across the circuit change when $t = 0.2$ seconds?

$$\frac{dv}{dt} = 72v/s$$

14) In a series RCL circuit, let $R = 10\Omega$, $C = 10{,}000$μf, and $L = 10$ henrys. Through this circuit we pass a current $i = 1 - t^{1/2}$ amps. Find the total voltage v across this circuit when $t = 4$ seconds. Assume $v = 0.25$ volts when $t = 1$ second.

$$vg = -178.9v$$