Week 6 Questions and Answer Key

- Day 1, Presidents Day
- Day 2, Integrals Test
- Day 3, questions 1-4
- Day 4, questions 5-9
- Day 5, questions 10-14

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

   $q = 81$ coulombs

2. A $80\mu f$ 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?

   $t = 1$ second

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.

   $w = 2.5375$K watts

4. A 110 turn winding caries a flux of 0.8 webers. 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 $v_{ind} = 120t^{\frac{1}{3}}$ 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).

   $i = 6.3$ or -6.3 amps

6. An inductance of 8 henrys is connected in parallel 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.

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

7. If we apply a voltage $v = 90t^{\frac{1}{2}}$ to a circuit consisting of a 30 henry inductance shunted by a 50Ω 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 $t = 0$.

   $ig = 36\mu$A

9. In a parallel RL circuit, $R = 5\Omega$ and $L = 0.2$ henrys. If a voltage $v = t^{\frac{3}{2}} + 2$ 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 $i = 0.005t^{\frac{1}{2}}$ 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 $i = 1 \times 10^{-3}t^{\frac{1}{2}}$ 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 100v.)

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

12. A series LC circuit where $L = 0.1$ henry and $C = 100\mu f$ 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 at $t = 2$ sec. (assume $v_c = 0$ when $t = 0$)

    a. $vg = 1000t$

    b. $\frac{dv}{dt} = 1000v/s$

13. A series circuit has these constants: $R = 5K\Omega$, $L = 200$ henrys, and $C = 20\mu f$. 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 $R = 10\Omega$, $C = 10,000\mu f$, and $L = 10$ henrys. Through this circuit we pass a current $i = 1 - t^2$ amps. Find the total voltage v across this circuit when $t = 4$ seconds. Assume $v = 0.25$ volts when $t = 1$ second.

    a. $vg = -178v$