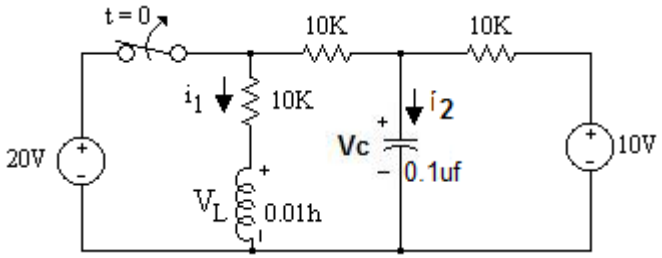
EE 210 **Name_____**
Hour Exam 3 **November 24, 2015**

1. A series RLC circuit is critically damped. However, the resistor in the circuit is sensitive to temperature and as the temperature rises the resistance gets larger. Does the circuit become overdamped or underdamped? Explain.

2. For the circuit at right, find the following:
$i_1(0^-)$ = _____
$i_1(0^+)$ = _____
$i_1(\infty)$ = _____

$v_C(0^-)$ = _____
$v_C(0^+)$ = _____
$v_C(\infty)$ = _____



3. A certain RLC circuit has a characteristic equation given by: $s^2 + 8s + 15 = 0$ and a steady state solution of V_{ss} = 12 volts. Write the complete solution for the system in terms of constants determined by initial conditions. You need not solve for the constants.

4. A 1 Ω resistor is connected in parallel with a 2 H inductor which is connected in parallel with a 3 F capacitor. What is the characteristic equation?

5. A characteristic equation for a second order series RLC circuit is given by:
$S^2 + 7S + 16 = 0$
Answer the following questions:

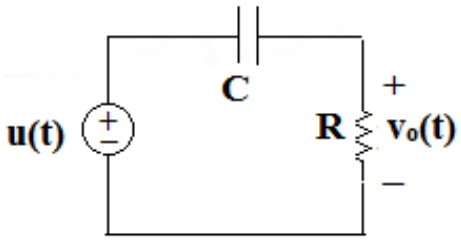
A) Is the system under-damped, critically damped, or over-damped?

B) Write the homogeneous differential equation describing the system if this equation is in terms of voltage.

C) Write the *form* of the solution to this equation. You need not solve for constants.

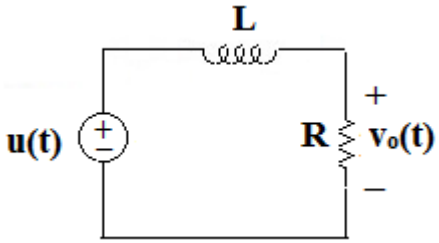
6. 1. For the four problems below R = 1Ω, L = 2 H, and C = 3 F. Find the equation for $v_o(t)$ for t > 0.

A)



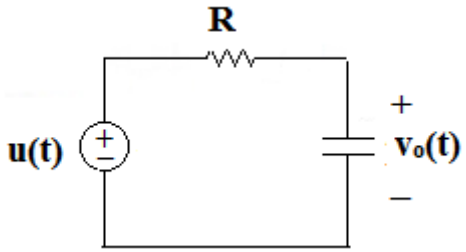
$v_o(t)$ = _____

B)



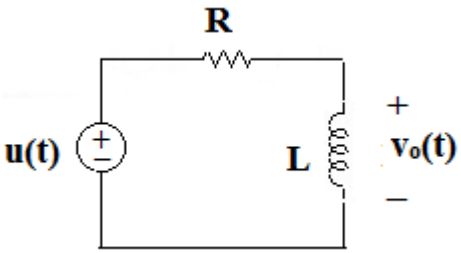
$v_o(t)$ = _____

C)



$v_o(t)$ = _____

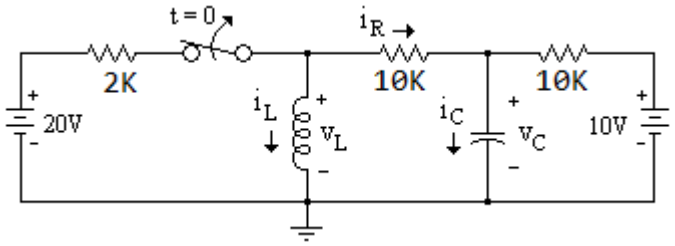
D)



$v_o(t)$ = _____

7. For the circuit below find the value of each of the parameters shown. Let C = 10μf and L = 1.0H. Show all work.

$I_L(0^+)$ = _____
$V_L(0^+)$ = _____
$I_C(0^+)$ = _____
$V_C(0^+)$ = _____
$I_R(0^+)$ = _____



8. Given the following differential equation: $\frac{d^2i}{di^2} + \frac{R}{L}\frac{di}{dt} + \frac{i}{LC} = \frac{10}{LC}$. If C = 1μf and L = 0.1H find the range of values of R necessary for critical damping.

9. Consider a series RLC circuit where R = 1Ω, C = 1 F, and L = 1 H. If the current is 1 amp at 0^- and the capacitor voltage is 1 volt at 0^- find the following:

$\left.\frac{di}{dt}\right|_{t=0^+}$ = _____ and $\left.\frac{dv}{dt}\right|_{t=0^+}$ = _____