Desk Copy

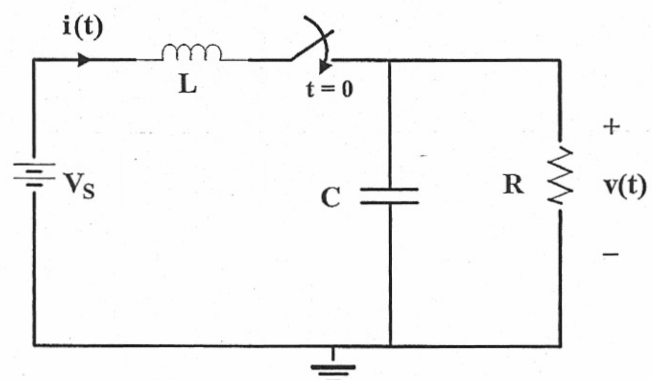
**ECE 301**
**Fall Semester, 2006**
**Take Home Problem**
**Test #2**

wlg: Due: October 26 Name W. Green
Last, first

This problem can add up to 6 points to your score on Test #2. You are to receive no help from another person with this work. You are allowed to use any text and any other form of literature. **By submitting the work you are stating that you have not received help from another person.**

Do your work on engineering paper. Use only one side of the paper. Do neat work.

You are given the following circuit. The circuit is initially at rest, that is, $i(0^-) = v(0^-) = 0$.




(a) Develop the differential equation that can be solved directly to find v(t). Leave your equation in general form (use parameters R, L, C, $V_S$).

(b) Assume the general form for the characteristic equation of

$$s^2 + 2\xi w_n s + w_n^2 = 0$$

You are to design the circuit for $V_s$, R, L, and C so that

- after the switch is closed, the final value of v(t) = 10 volts
- $\xi$ is selected as 0.4
- the response is to be in the band of $10(1 \pm 0.01)$ by $t = 0.1$ seconds but cannot reach this band prior to 0.09 seconds and must remain in this band after $t = 0.1$ seconds.

Constraints: C must be selected from $1\,\mu F,\ 10\,\mu F,\ 100\,\mu F$
L must be in the range $0.3H \le L \le 4H$

The deliverables of this problem are (submit with your work)

- show your development of the differential equation
- show how you determined $\omega_n$
- show how you determined $V_S$, R, L, and C
- explicitly give your differential equations with numerical values
- give your hand determined solution for v(t)
- verify your solution for v(t) using the MATLAB Symbolic Tool kit, ie dsolve( ……..
- Use MATLAB to plot v(t)
- Use MATLAB to give your numerical values of t vs v(t) ( a statement of [t;v]' will do this include evidence that you met the design requirement on reaching steady state