University ☺f P☺rtland
Sch☺☺l ☺f Engineering

EE 261-Electrical Circuits-3 cr. hrs.
Spring 2006

Midterm Exam # 3

(Friday, April 21, 2006)
(Closed Book Exam, Three Formula Sheets Allowed)
(Total Time: 55 minutes)

Name:_____☺

Signature:_____☺

"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.–65A.D.)

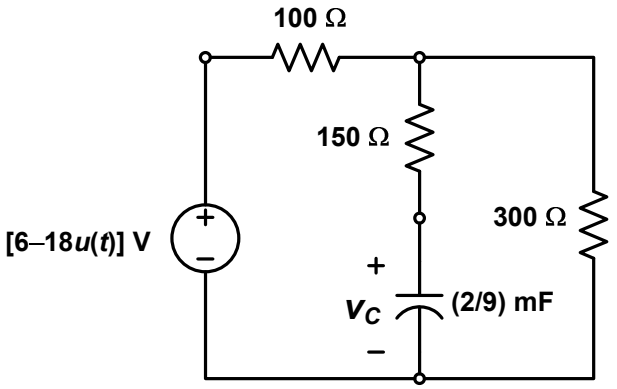
"Honest people are the true winners of the universe."
Anonymous

"Honesty is not for sale."
A. Inan

This box will be used by Inan for grading →	**Problem # 1** **Problem # 2** **Problem # 3** **Total Score:**

NOTE: On all the problems, please show your work clearly, and provide the appropriate units for your answers. Also mark on the schematic to show any current or voltage that you define in your solution.

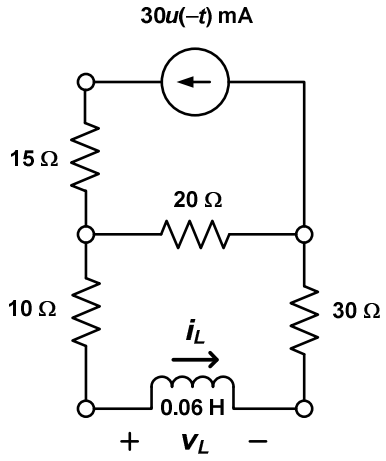
1. (15 mins., Total: 30 points) **Step excitation of a first-order *RC* circuit.** Consider the first-order *RC* circuit shown.



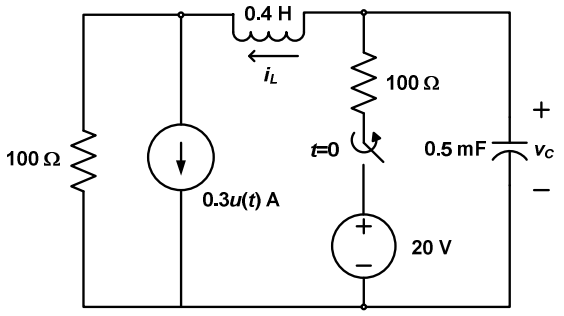
(a) (20 points) Find the complete mathematical expression for the capacitor voltage $v_C(t)$ for $t \geq 0$.

(b) (10 points) Sketch the waveform $v_C(t)$ found in part (a) roughly with respect to time between $t = 0$ and $t = \infty$ and provide all the appropriate values including their units on the sketch.

(2) (15 mins., 30 points) **A first-order *RL* circuit.** In the first-order *RL* circuit shown, find the complete mathematical expressions for the inductor current $i_L(t)$ and the inductor voltage $v_L(t)$ for $t \geq 0^-$. Please put each expression in a rectangular box.



(3) (15 mins., Total: 40 Points) **A second-order switching circuit.** In the second-order circuit shown, the switch is opened at $t = 0$, after being closed for a long time.



(a) (15 points) Find the values of $i_L(0^+)$ and $v_C(0^+)$.

(b) (15 points) Find the roots of the characteristic equation of this circuit after $t = 0$ and based on these roots, write the general mathematical form for the capacitor voltage $v_C(t)$ for $t \geq 0$.

(c) (10 points) Find the complete mathematical expression for the capacitor voltage $v_C(t)$ after $t = 0$. (This is the part where you find the coefficients of $v_C(t)$.)