University of Arizona
Department of Electrical & Computer Engineering

ECE 220 Basic Circuits

Examination 4

April 18, 2002

Closed book/notes, calculators allowed.

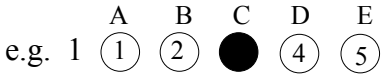
Part I: 6 questions Part II: 6 questions.
Part II is worth twice as much as Part I.

On the SCANTRON write and bubble-in your:

1. **Name** (Last, first)
2. **1-3 digit ID number** which was given to you at the first exam. Write this left-justified under columns A-C under IDENTIFICATION NUMBER.
3. Write the **color of your exam paper** (IVORY or GREEN) on the top left margin of the SCANTRON.

Place your UA picture ID card on the adjacent desk where it can be easily seen.

When the 9:00 bell rings, begin the examination. All work should be done on the examination paper. Allow for reasonable amounts of roundoff error, and **carefully** mark one choice for each problem on the SCANTRON answer sheet.



if the answer for Question 1 is C.

All answer sheets and examinations will be collected at or before 9:55. You will be asked to stop writing and hand in your papers/answer sheets. **Failure to comply promptly may result in disqualification from the exam.**

NAME: _____

SIGNATURE: _____

Write your ECE 220 ID number here and on the SCANTRON:

_____ _____ _____

Neper frequency for RLC ckts

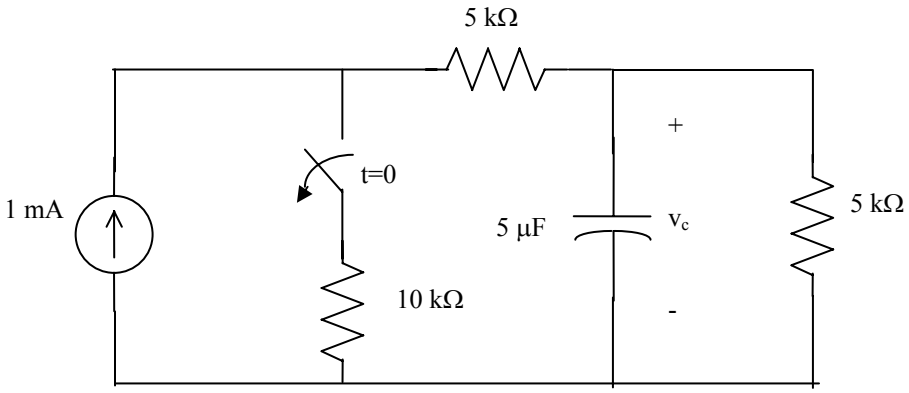
PARALLEL RLC: $\alpha = \frac{1}{2RC}$

SERIES RLC: $\alpha = \frac{R}{2L}$

Part I 10 min

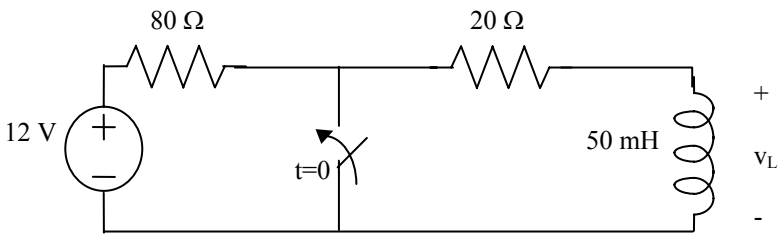
1. The switch has been closed for a long time. It is opened at t = 0. What is the capacitor voltage at $t = 0^+$?

(a) 5 V
(b) 1.25 V
(c) 2.5 V
(d) ∞
(e) None of these.



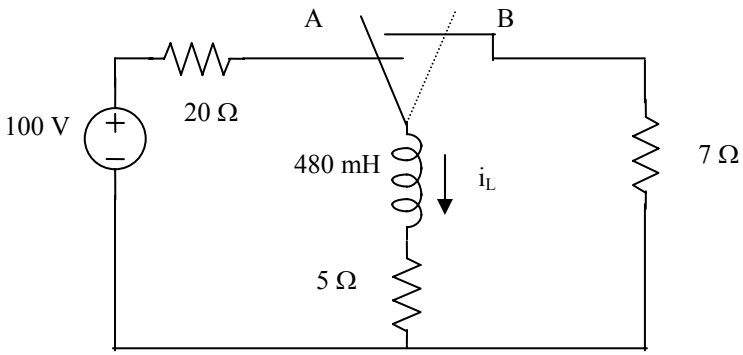
2. The switch has been open for a long time, then it is closed at t = 0. Find $v_L(0^+)$.

(a) -2.4 V
(b) 0 V
(c) 12 V
(d) - 3.6 V
(e) None are true.

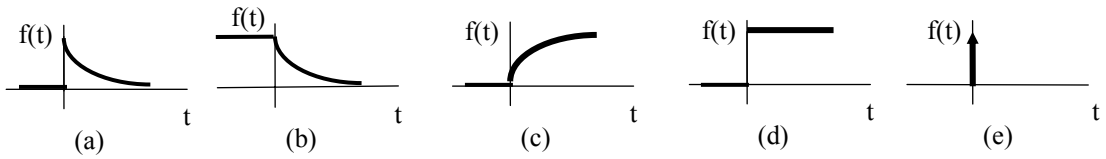


3. The switch has been in position **A** for a long time before being moved to position **B**. For all practical purposes, how long does it take after the switch is moved to **B** before for the coil current becomes negligible?

(a) 40 ms
(b) 200 ms
(c) 1 s
(d) 5 s
(e) > 10 s



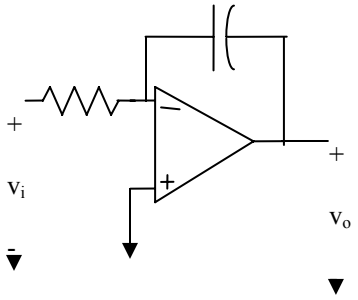
4. In an RL circuit, which of the following waveforms can represent the natural response for the inductor current?



5. The input to this ideal amplifier is of the form $v_i(t) = V_i \sin \omega t$. Assuming saturation does not occur, what is the form of the output voltage $v_0(t)$?

(Assume V_o is a positive quantity.)

(a) $V_o \cos \omega t$
(b) $-V_o \cos \omega t$
(c) $V_o \sin \omega t$
(d) $-V_o \sin \omega t$
(e) None of these



6. A series RLC circuit is critically damped. What is the damping if the resistance is increased?

(a) Overdamped
(b) Critically damped
(c) Underdamped
(d) Undamped
(e) None of these.

PART II

7.

This **AC circuit** is operating in steady state. Find v(t)

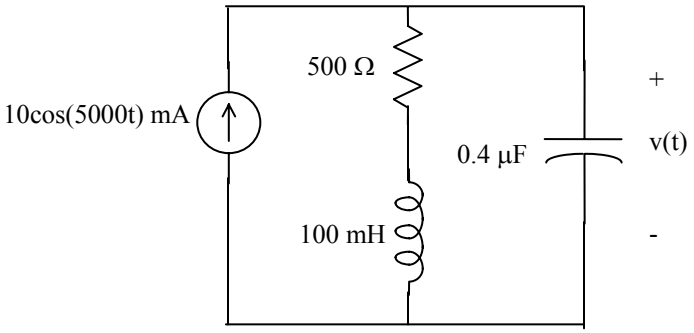
(a) $v(t) = 7.071\cos(5000t - \frac{\pi}{4})$ volts

(b) $v(t) = 1.414\cos(5000t - \frac{\pi}{4})$ volts

(c) $v(t) = 7.071\cos(5000t + \frac{\pi}{4})$ volts

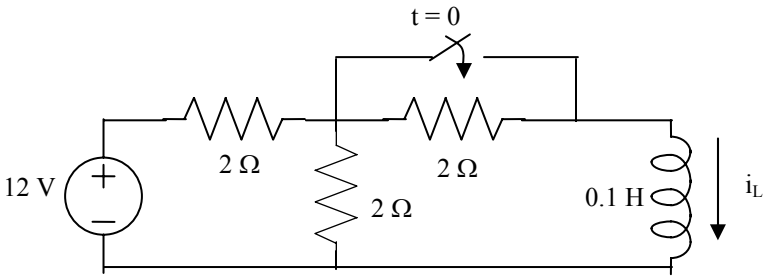
(d) $v(t) = 1.414\cos(5000t)$ volts

(e) None of these



8. The switch has been open for a long time and is closed at t = 0. What is the expression for $i_L(t)$ for t > 0?

(a) $8 - 6e^{-10t}$ A
(b) $6 - 4e^{-10t}$ A
(c) $6 - 2e^{-20t}$ A
(d) $6 - 4e^{-20t}$ A
(e) None of these.



9. The value of the voltage source $v_s(t)$ changes from -9V to 9V at t = 0, as follows:

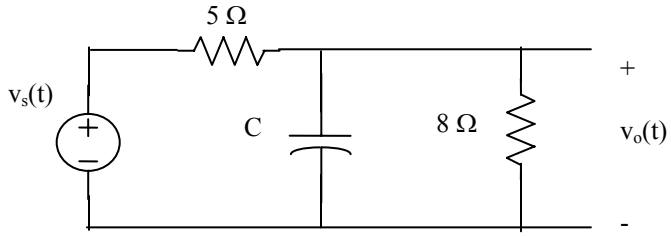
$$v_s(t) = -9\text{V}, \quad t < 0$$
$$v_s(t) = 9\text{V}, \quad t > 0$$

The output voltage $v_o(t)$ is found to be:

$$v_o(t) = 5.53 - 11.07e^{-3.60t} \text{ Volts}$$

What is the value of the capacitor?

(a) 90.3 mF
(b) 72.3 mF
(c) 45.7 mF
(d) 119.4 mF
(e) None of these



10. The switch has been open for a long time before being closed at t = 0. What is the expression for the capacitor voltage for t > 0?

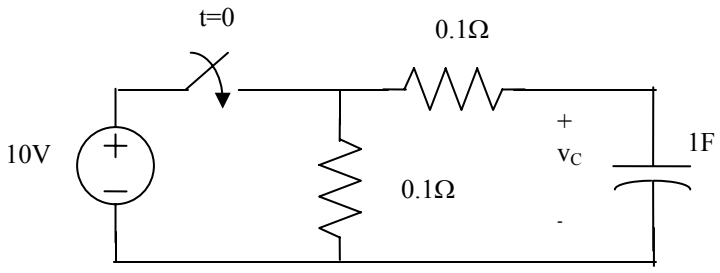
(a) $v_c(t) = 10(1 - e^{-5t})$ V

(b) $v_c(t) = 10(1 - e^{-10t})$ V

(c) $v_c(t) = 5(1 - e^{-5t})$ V

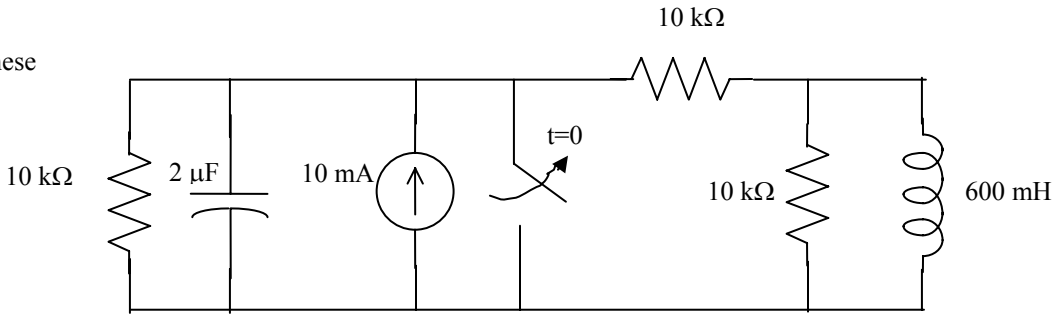
(d) $v_c(t) = 5(1 - e^{-10t})$ V

(e) None of these



11. Find the energy stored in the coil at t = infinity.

(a) 9 μJ
(b) 12.5 μJ
(c) 22 μJ
(d) 7.5 μJ
(e) None of these



12. The switch has been closed for a long time before being opened at t = 0. Find v(t), t > 0.

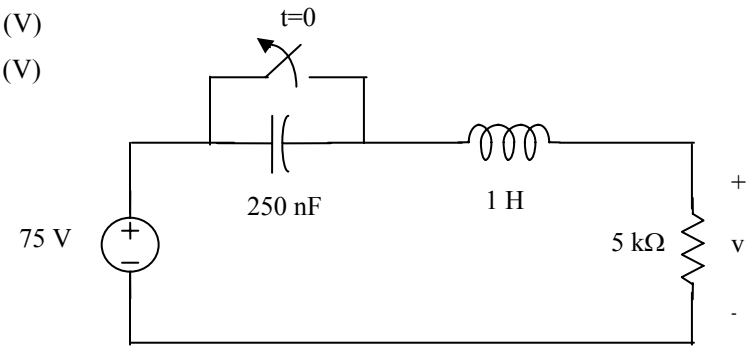
(a) $v(t) = 60e^{-1000t} + 15e^{-4000t}$ (V)

(b) $v(t) = 100e^{-1000t} - 25e^{-2000t}$ (V)

(c) $v(t) = 100e^{-1000t} - 25e^{-4000t}$ (V)

(d) $v(t) = 100e^{-1000t} + 25e^{-2000t}$ (V)

(e) None of these



Answer Key

1c	2a	3b	4b	5a	6a
7a	8b	9a	10b	11d	12c