EELE 250 Midterm Exam 2 NAME: _____.
October 17, 2011 50 Minutes Closed book – one sheet of handwritten notes OK.
6 problems, 5 pages, 80 points

SHOW YOUR WORK: Correct answer with no work shown may not receive credit.
Wrong answer with work shown may receive partial credit.

## 1. (10 points)

A 4400 μF capacitor is initially charged to 6 volts. If the capacitor is discharged through a 1 MΩ resistor, how long will it take for the capacitor voltage to decrease from 6 volts to 1 volt?

□ 2 seconds

□ 61 seconds

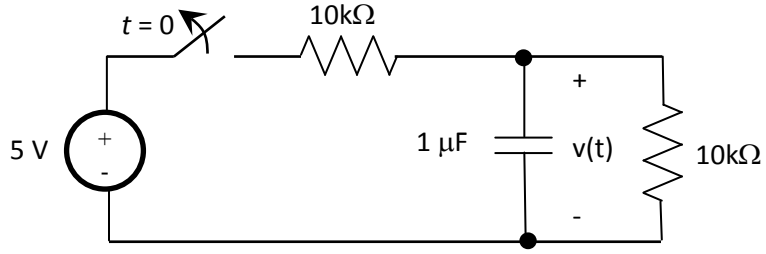
□ 243 seconds

□ 2200 seconds

□ 7884 seconds

## 2. (15 points)

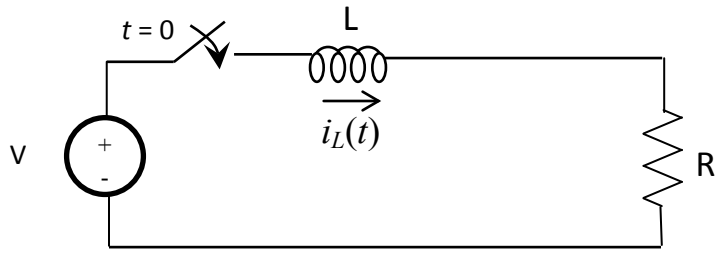
The switch in the circuit shown below has been *closed* for a long time prior to $t = 0$, then the switch opens abruptly at $t = 0$.

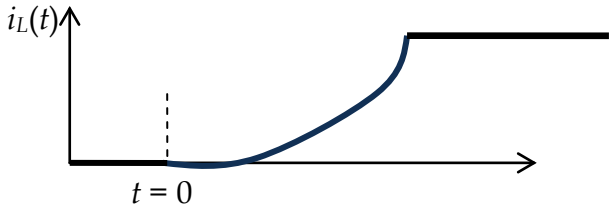



| What is $v(0+)$? **(5 points)** | What is $v(\infty)$? **(5 points)** | What is the *time constant* for $t>0$? **(5 points)** |
|---|---|---|
| □ 0 volts | □ 0 volts | □ 1 millisecond |
| □ 1 volt | □ 1 volt | □ 2 milliseconds |
| □ 2.5 volts | □ 2.5 volts | □ 5 milliseconds |
| □ 4 volts | □ 4 volts | □ 7 milliseconds |
| □ 5 volts | □ 5 volts | □ 10 milliseconds |

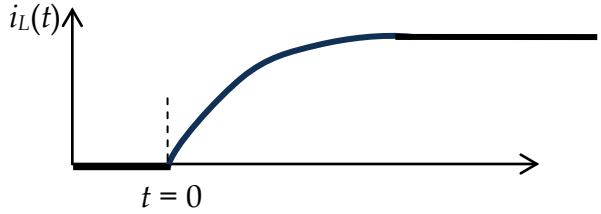
**3. (15 points)**

The switch has been *open* for a long time, then *closes* abruptly at $t = 0$. Which of the following plots represents the *current through the inductor* as a function of time?

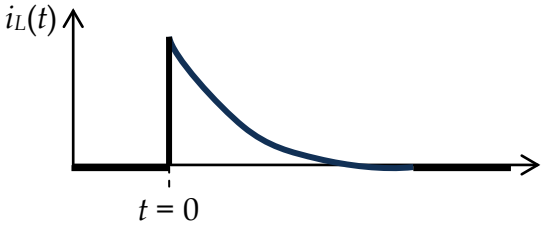


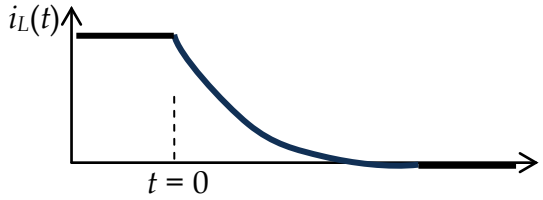

□ Figure (a)




□ Figure (b)



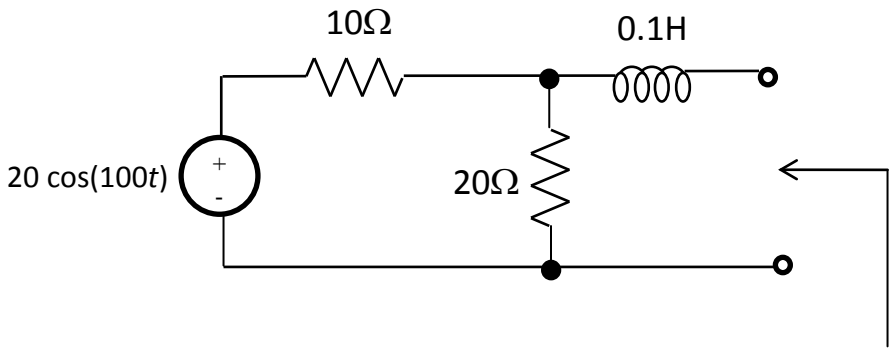

□ Figure (c)




□ Figure (d)

**4. (15 points)**

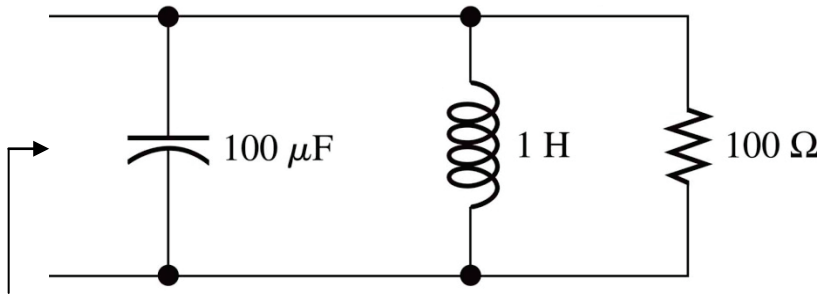
Answer the following questions using AC steady-state principles.




| What is the Thévenin equivalent phasor voltage? **(5 points)** | What is the Thévenin equivalent impedance? **(5 points)** | If the frequency were made much higher, the magnitude of the Thévenin impedance would: **(5 points)** |
|---|---|---|
| □ 20 ∠0° volts | □ 20 + j0.1 ohms | □ decrease |
| □ 20 ∠100° volts | □ 6.67 + j10 ohms | □ increase |
| □ 40 ∠45° volts | □ 20 + j10 ohms | □ stay the same |
| □ 13.33 ∠0° volts | □ 30 + j0.1 ohms | □ no way to determine |
| □ 20 ∠-90° volts | □ 6.67 - j10 ohms | |

**5. (10 points)**

Which is the correct expression for the equivalent impedance of the circuit shown below?




□ $\dfrac{1}{100+j\omega+\dfrac{1}{j\omega 10^{-4}}}\ \Omega$

□ $\dfrac{100}{1+j\left(\dfrac{\omega}{100}-\dfrac{100}{\omega}\right)}\ \Omega$

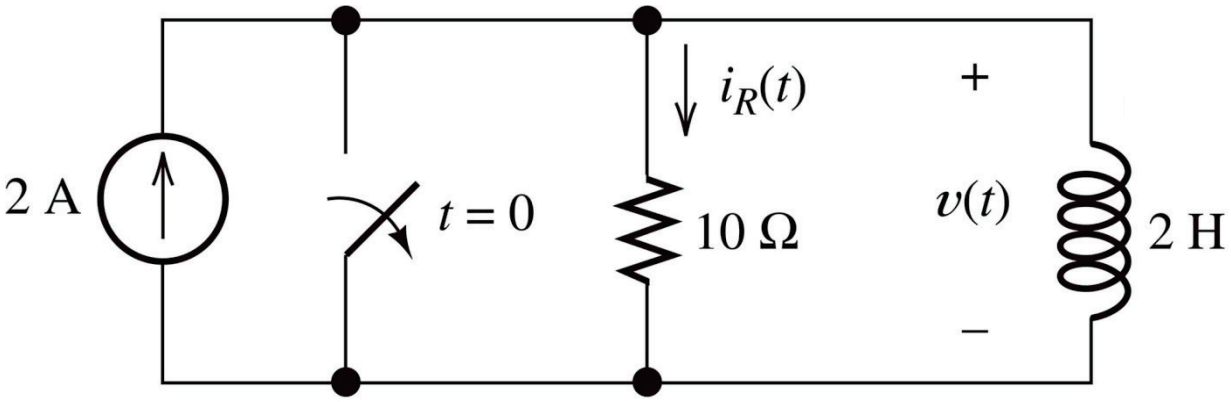
□ $\dfrac{1}{\dfrac{1}{100}+j\dfrac{1}{\omega}+\dfrac{1}{j\omega 10^{-4}}}\ \Omega$

□ $\dfrac{1}{\dfrac{1}{100}+\dfrac{1}{j\omega}-j\omega 10^{-4}}\ \Omega$

□ $200\ \Omega$

**6. (15 points) SHOW YOUR WORK**

The switch in the circuit shown below has been *closed* for a long time prior to $t = 0$, then the switch opens abruptly at $t = 0$.




Determine an expression for the current $i_R(t)$ for $t > 0$ .