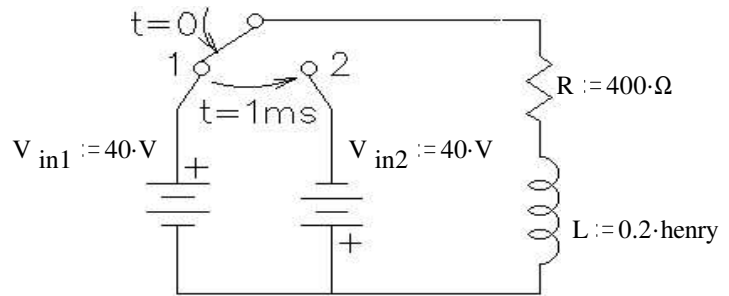
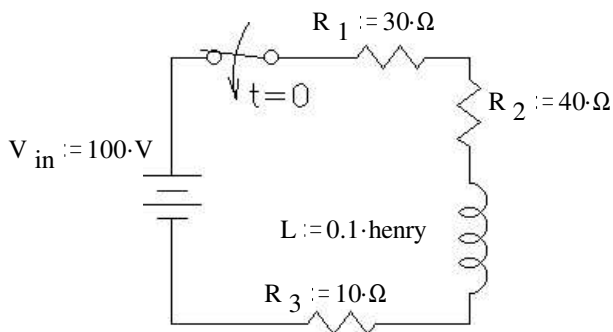


ECE 2210 homework # 11

a

1. A 12 V car ignition coil has an inductance of 10 mH and resistance of 2 Ω (so its equivalent circuit is a 10 mH inductor in series with a 2 Ω resistor). Calculate how long it takes the current to build up to 95% of its maximum value after a 12 V battery is connected to the coil.
2. A constant voltage is applied to a series RL circuit by closing a switch. The voltage across L is 30 volts at $t = 0$ and drops to 6 volts at $t = .0025$ sec. If $L = 0.2$ H, what must be the value of R?
3. In the circuit shown, the switch is closed at $t = 0$. Find the transient current expression.
4. In the circuit shown, the switch is closed on position 1 at $t = 0$, and then instantly moved to position 2 after 1 millisecond. Find the time at which the current is zero and reversing its direction.



note the different battery directions

If you learn to use the complex math feature of your calculator, you may use that to work the following problems. In that case you may report the answers without showing any work.

5. Convert the following complex numbers to polar form ($m\angle\theta$ or $me^{j\theta}$).

- a) $1 + j$ b) $2.6 + 8.7j$ c) $3 + 4j$ d) $3 - 4j$ e) $-3 + 4j$ f) $-3 - 4j$

6. Convert the following complex numbers to rectangular form ($a + bj$).

- a) $10 \cdot e^{j60 \text{ deg}}$ b) $0.4 \cdot e^{j12 \text{ deg}}$ c) $1500 \cdot e^{j\frac{\pi}{2} \text{ rad}}$ d) $10 \cdot e^{-j45 \text{ deg}}$ e) $20 \cdot e^{j120 \text{ deg}}$ f) $30 \cdot e^{j210 \text{ deg}}$

7. Perform the following additions and subtractions of complex numbers.

- a) $(3 + 2j) + (6 + 9j)$ b) $(9 - 10j) - (9 + 10j)$ c) $(-2 - 2j) + (-6 + 9j)$ d) $(3 + 0j) - (0 + 9j)$
 e) $(5 + 6j) + 5 \cdot e^{j53 \text{ deg}}$ f) $(-2 + 3j) - 8 \cdot e^{-j37 \text{ deg}}$

8. Perform the following multiplications of complex numbers.

- a) $(8 + j) \cdot 3$ b) $(3 + 2j) \cdot j$ c) $(20 \cdot e^{j40 \text{ deg}}) \cdot (10 \cdot e^{j60 \text{ deg}})$ d) $(-6 + 9j) \cdot (10 \cdot e^{j60 \text{ deg}})$ e) $(-2 - j) \cdot (-6 - 9j)$

9. Perform the following divisions of complex numbers.

- a) $\frac{20 \cdot e^{j40 \text{ deg}}}{10 \cdot e^{j60 \text{ deg}}}$ b) $\frac{9 - 10j}{3 \cdot e^{-j20 \text{ deg}}}$ c) $\frac{3 + 0j}{0 + 9j}$ d) $\frac{-2 - 2j}{-6 + 9j}$

Answers

1. 15·ms 2. 129·Ω 3. $1.25 \cdot A \cdot \left(1 - e^{-\frac{t}{1.25 \text{ ms}}}\right)$ 4. 1.312·ms

5. a) $1.414 \cdot e^{j45 \text{ deg}}$ b) $9.08 \cdot e^{j73.4 \text{ deg}}$ c) $5 \cdot e^{j53.1 \text{ deg}}$ d) $5 \cdot e^{-j53.1 \text{ deg}}$ e) $5 \cdot e^{j126.9 \text{ deg}}$ f) $5 \cdot e^{-j126.9 \text{ deg}}$

6. a) $5 + 8.66 \cdot j$ b) $0.391 + 0.083 \cdot j$ c) $1500 \cdot j$ d) $7.071 - 7.071 \cdot j$ e) $-10 + 17.321 \cdot j$ f) $-25.981 - 15 \cdot j$

7. a) $9 + 11 \cdot j$ b) $-20 \cdot j$ c) $-8 + 7 \cdot j$ d) $3 - 9 \cdot j$ e) $8.009 + 9.993 \cdot j$ f) $-8.389 + 7.815 \cdot j$

8. a) $24 + 3 \cdot j$ b) $-2 + 3 \cdot j$ c) $200 \cdot e^{j100 \text{ deg}}$ d) $108 \cdot e^{-j176 \text{ deg}}$ e) $24.2 \cdot e^{j82.9 \text{ deg}}$

9. a) $2 \cdot e^{-j20 \text{ deg}}$ b) $4.485 \cdot e^{-j28.01 \text{ deg}}$ c) $0.333 \cdot e^{-j90 \text{ deg}}$ d) $-0.051 + 0.256j$