Academic Dishonesty Statement

I have not given or received help to or from any student during this test. I have not copied from another student, used notes, or used any other form of cheating.

Lab Section Number:________

Printed Name:_____________________________________

Signed Name:_____________________________________

Equations

\[ V = I \cdot R = L \cdot \frac{dI}{dt} \quad (1) \]

\[ I = C \cdot \frac{dV}{dt} \quad (2) \]

\[ V(t) = \frac{1}{C} \int_{t_0}^{t} I \cdot d\tau + V(t_0) = V_1 + (V_0 - V_1) \cdot e^{\left(-\frac{t}{\tau}\right)}, \tau = RC \quad (3) \]

\[ I(t) = \frac{1}{L} \int_{t_0}^{t} V \cdot d\tau + I(t_0) = I_1 + (I_0 - I_1) \cdot e^{\left(-\frac{t}{\tau}\right)}, \tau = \frac{L}{R} \quad (4) \]

\[ P = I \cdot V = I \cdot L \cdot \frac{dI}{dt} = V \cdot C \cdot \frac{dV}{dt} \quad (5) \]

\[ W = \int L \cdot I \cdot dI = \frac{1}{2} \cdot L \cdot I^2 = \int C \cdot V \cdot dV = \frac{1}{2} \cdot C \cdot V^2 \quad (6) \]

\[ \frac{1}{R_{EQ}} = \frac{1}{R_1} + \frac{1}{R_2} \quad (7) \]

\[ R_{EQ} = \frac{R_1 \cdot R_2}{R_1 + R_2} \quad (8) \]
1. Write an equation for the voltage supplied by the voltage source.

2. Write an equation for current leaving the positive terminal of the voltage source.

3. Write an equation for the charge transferred out of the positive terminal of the voltage source. How much charge is transferred over 6 seconds?

4. Write an equation for the power generated by the voltage source.

5. Write an equation for the energy transferred out of the voltage source. How much energy is transferred over 6 seconds?
2 Resistor, Capacitor, and Inductor Combinations - 15 points

1. Find the resistance from A to B. Include the units.

2. Find the capacitance from C to D. Include the units.

3. Find the Inductance from E to F. Include the units.
3 Mesh or Nodal Analysis - 20 points

1. Use mesh analysis to find the three mesh currents or nodal analysis to find the node voltages (A, B, C, D, and E).

2. Use your answer from the prior part to calculate the power dissipated by R3.
4 Thevenin Equivalence - 10 points

1. Find $V_{\text{Thevenin}}$, $R_{\text{Thevenin}}$, and $I_{\text{Norton}}$ from Node A to Node B. Node B is the negative terminal of the Thevenin model and node A is the positive terminal of the model.
5 Op Amp - 20 points

1. Find the Output voltage. Show your work for partial credit.
6 Capacitor & Inductor Transient Response - 20 points

You have the choice of analyzing the right circuit or the appropriate circuit.

1. Circle the rectangle above one of the circuits to indicate which circuit you would like to solve. Choosing (and analyzing) the more challenging circuit will be awarded 5 extra credit points.

2. The capacitor is initially charged to 2 volts at time $t = 0$. The voltage source turns on to 8 volts at $t = 0$. The voltage source changes to 5 volts at $t = 6$.

3. Plot the voltage across the capacitor on the graph.

4. What is the most energy stored in this capacitor?

5. What are the values of time at which the voltage crosses 6 volts? Use the graph for partial credit or an equation for full credit.