Closed book/notes, calculators allowed up to level of TI89, TI Inspire, HP50.

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. Write the color of your exam paper (IVORY or GREEN) on the top left margin of the SCANTRON.

Show your UofA picture ID card when you turn in your exam.

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.

All answer sheets and examinations will be collected at 10:30. 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: ________________________
Formula Sheet for Exam #4 and Final Exam

\[ x(t) = x(\infty) + A_1 e^{s_1(t-t_0)} + A_2 e^{s_2(t-t_0)} \]
\[ x(t_0) = x(\infty) + A_1 + A_2 \]
\[ x'(t_0) = s_1 A_1 + s_2 A_2 \]

\[ x(t) = x(\infty) + (B_1 \cos[\omega_d (t - t_0)] + B_2 \sin[\omega_d (t - t_0)]) e^{-\alpha(t-t_0)} \]
\[ x(t_0) = x(\infty) + B_1 \]
\[ x'(t_0) = -\alpha B_1 + \omega_d B_2 \]

\[ x(t) = x(\infty) + [D_1(t - t_0) + D_2] e^{-\alpha(t-t_0)} \]
\[ x(t_0) = x(\infty) + D_2 \]
\[ x'(t_0) = D_1 - \alpha D_2 \]

\[ s_1, s_2 = -\alpha \pm \sqrt{\alpha^2 - \omega_0^2} \]

Parallel RLC
\[ \alpha = \frac{1}{2RC} \]

Series RLC
\[ \alpha = \frac{R}{2L} \]
**Part I.** Assume all switches have been in their initial positions for a long time.

1. The circuit below is in steady state. Find \( v(t) \).

   \[
   \begin{align*}
   a) & \quad 12 \text{ V} \\
   b) & \quad 9 \text{ V} \\
   c) & \quad 6 \text{ V} \\
   d) & \quad 3 \text{ V} \\
   e) & \quad \text{none of these}
   \end{align*}
   \]

2. The characteristic roots of the following circuit for \( t > 0 \) are:

   \[
   \begin{align*}
   a) & \quad -189, -61 \\
   b) & \quad -125 \pm j64 \\
   c) & \quad 64 \pm j125 \\
   d) & \quad -189, +61 \\
   e) & \quad \text{none of these}
   \end{align*}
   \]

3. The circuit shown is underdamped. Which graph best represents \( v(t), t > 0 \).

   e) none of these
4. Find \( i(\infty) \).

a) 6 mA  
b) \(-4\) mA  
c) 3 mA  
d) \(-2\) mA  
e) none of these

5. Find \( \tau, t > 5\) ms.

a) 6 ms  
b) 8 ms  
c) 10 ms  
d) 12 ms  
e) none of these

6. Find \( i(4^+) \).

a) \(-1.00\) mA  
b) 0.75 mA  
c) \(-0.50\) mA  
d) 0.25 mA  
e) none of these
Part II. Assume all switches have been in their initial positions for a long time.

7. Find $i(t)$ for $t = 6 \mu s$.

a) 6.16 mA
b) 8.16 mA
c) 10.16 mA
d) 12.16 mA
e) none of these
8. Given $v(4^-) = 15 \text{ V}$ and $i(4^-) = 5 \text{ mA}$, find $v'(4^+)$. 

a) $-10 \text{ V/s}$  
b) $8 \text{ V/s}$  
c) $-6 \text{ V/s}$  
d) $4 \text{ V/s}$  
e) none of these
9. Given that $v(0^-) = 5 \text{ V}$ and $i(0^-) = 4 \text{ mA}$, find $v'(0^+)$. 

- a) $10 \text{ kV/s}$
- b) $-5 \text{ kV/s}$
- c) $4 \text{ kV/s}$
- d) $-2 \text{ kV/s}$
- e) none of these
10. Given that \( i(0^-) = 8 \text{ A} \) and \( i'(0^+) = -20 \text{ A/s} \), find the constants (\( A_1 \) & \( A_2 \) or \( B_1 \) & \( B_2 \) or \( D_1 \) & \( D_2 \)) required for the solution of \( i(t) \).

a) \(-1 & 2\)
b) \(2 & 4\)
c) \(-4 & 8\)
d) \(8 & 16\)
e) none of these
11. Find $v(t)$ for $t = 12 \mu s$.

a) 1.35 V  

b) $-2.71 \text{ V}$

c) 5.42 V

d) $-10.84 \text{ V}$

e) none of these
12. Find $v(0.12)$.

a) 3.75 V  
   b) 5.75 V  
   c) 7.75 V  
   d) 9.75 V  
   e) none of these
Extra Credit:

13. What is the ECE220 class favorite color?

a) Yellow
b) Red
c) Blue
d) Green
e) none of these
Answers:
1. d
2. a
3. b
4. d
5. a
6. c
7. c
8. a
9. c
10. c
11. b
12. d