Color: Ivory

University of Arizona
Department of Electrical & Computer Engineering
ECE 220 Basic Circuits

Examination 3
November 8, 2012

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

Part I: 7 questions
Part II: 7 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 UA 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: ______________________
Part I.

1. Find $i$.
   
   a) $2 \text{ mA}$
   b) $1 \text{ mA}$
   c) $0.5 \text{ mA}$
   d) $0.25 \text{ mA}$
   e) none of these

2. If the number of turns in an inductor is reduced by a factor of 2, the inductance $L$ is
   
   a) increased by a factor of 4
   b) increased by a factor of 2
   c) decreased by a factor of 2
   d) decreased by a factor of 4
   e) none of these

3. The dot for the right coil should appear at
   
   a) the top of the coil
   b) the bottom of the coil
   c) both the top and bottom
   d) not enough information given
   e) none of these
4. Assume that a constant current flows through a capacitor starting at time $t = 0$. Which of the following can represent the capacitor voltage?

![Graphs of voltage vs. time for a, b, and c.]

d) all of the above

e) both a) and b)

5. Assume the following circuit is in steady state. How much energy is stored in the inductor?

![Diagram of a circuit with a voltage source, resistor, and inductor.]

a) 2 nJ
b) 4 nJ
c) 2 μJ
d) 4 μJ
e) none of these
6. What is the maximum possible mutual inductance $M$?

a) 12 µH  
b) 30 µH  
c) 75 µH  
d) 900 µH  
e) none of these

7. Find $v_o(t)$ when $t = 7$ sec.

a) 0 V  
b) 2 V  
c) 7 V  
d) 10 V  
e) none of these
Part II.

8. Find $v_o$. Assume no saturation occurs.

a) $-2 \text{ V}$

b) $-4 \text{ V}$

c) $-6 \text{ V}$

d) $-10 \text{ V}$

e) none of these
9. Which of the following is a valid mesh equation. The mutual inductance between the two inductors is \( M = 4 \text{H} \).

\[
\begin{align*}
\text{a)} & \quad 2 \frac{di_1(t)}{dt} + 4 \frac{di_2(t)}{dt} - 4 \frac{dv(t)}{dt} + 10i_1(t) - 4i_2(t) - 6i(t) = v(t) \\
\text{b)} & \quad 2 \frac{di_1(t)}{dt} + 4 \frac{di_2(t)}{dt} + 10i_1(t) - 4i_2(t) - 6i(t) = v(t) \\
\text{c)} & \quad 2 \frac{di_1(t)}{dt} - 4 \frac{di_2(t)}{dt} + 4 \frac{dv(t)}{dt} + 10i_1(t) - 4i_2(t) - 6i(t) = v(t) \\
\text{d)} & \quad 2 \frac{di_1(t)}{dt} - 4 \frac{di_2(t)}{dt} + 10i_1(t) - 4i_2(t) - 6i(t) = v(t) \\
\text{e)} & \quad \text{none of these}
\end{align*}
\]
10. Find $v_o$.

a) 30 V
b) 10 V
c) 0 V
d) $-5$ V
e) none of these
11. Find $v_o$.

a) 0 V  
b) 2 V  
c) 5 V  
d) 7 V  
e) none of these
12. Find $v_0$. Note that $v_0$ is measured across an open circuit.

- a) $20\sin(10t) \text{ V}$
- b) $-20\sin(10t) \text{ V}$
- c) $20\cos(10t) \text{ V}$
- d) $-20\cos(10t) \text{ V}$
- e) none of these
13. Given $v(0) = -2$, find $v(t)$ at $t = 1$ second.

a) 2 V  

b) 4 V  

c) 6 V  

d) 8 V  

e) none of these
14. Find \( v_n \).

a) 0 V  
b) 0.91 V  
c) 2.00 V  
d) 2.73 V  
e) none of these
Answers
1. c
2. d
3. b
4. e
5. a
6. b
7. d
8. b
9. a
10. b
11. c
12. a
13. d
14. b