Your name: _____

EECS 215.
Final Exam
December 19, 2016

This text consists of 6 problems with points as indicated to total 60 points.

Read through the entire exam before beginning.
Show all work (on the pages provided in this booklet) to earn partial credit.

No credit will be given if no work is shown.

Briefly explain major steps, include units, and write your final answers in the areas provided.
Do not unstaple the pages.

Exam policies

- The College of Engineering Honor Code is followed. Please write and sign the honor code pledge ("I have neither given nor received unauthorized aid on this examination, nor have I concealed any violations of the Honor Code.") in the box below.
- No food allowed during exam.
- Three sides of 8.5x11" notes pages are allowed. No books allowed (closed book exam).
- Calculators allowed (But **you may not use the following functions: graphs, integrals, derivatives**).
- No communication of any kind is allowed. No use of cell phones, computers, or any devices besides calculators. Violation of this will be treated as an honor code violation.

In which section are you enrolled? ☐**EECS 215-001 (Finelli)** ☐**EECS 215-002 (Zhang)**

Write and sign the honor pledge:

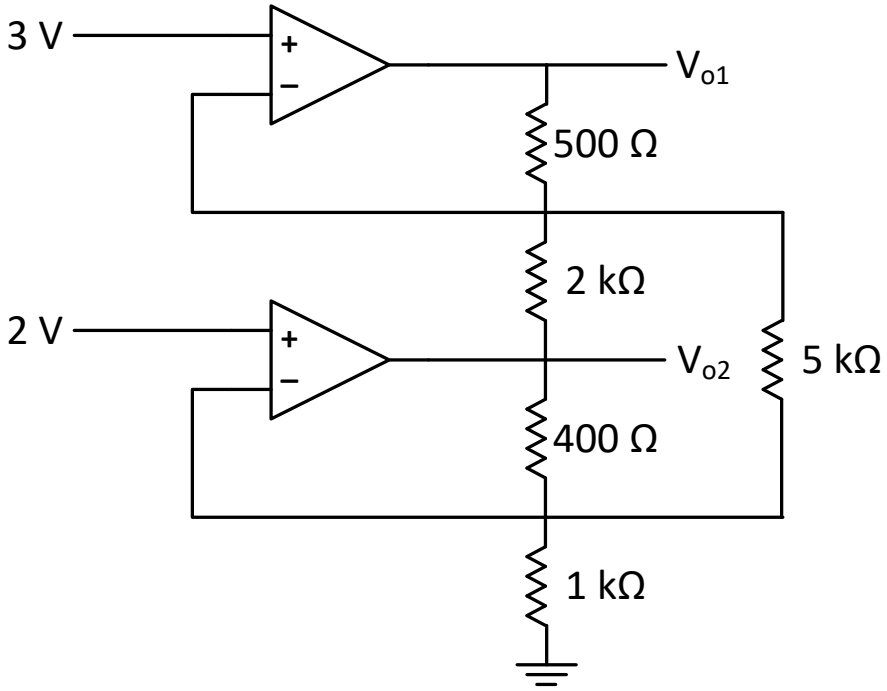
Signed: _____

Do not write in this space

Problem 1: [ ]/10
Problem 2: [ ]/10
Problem 3: [ ]/10
Problem 4: [ ]/10
Problem 5: [ ]/10
Problem 6: [ ]/10

Total score [ ]/10

1. Assume that the two op amps below are ideal.
   a. (5 points) Calculate $v_{o1}(t)$.
   b. (5 points) Calculate $v_{o2}(t)$.



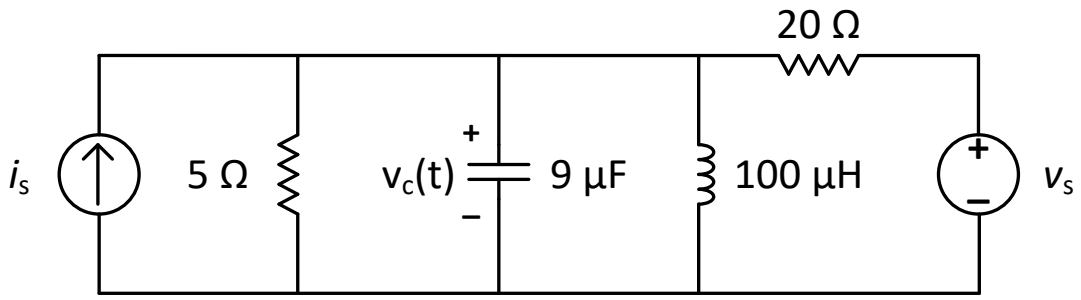
Write your answer here:

a. $v_{o1}(t) =$ _____

b. $v_{o2}(t) =$ _____

Problem 1 score: [ ]/10

2. For the circuit below, $i_s(t) = 10\cos 50{,}000\,t$ A and $v_s(t) = 100\sin 50{,}000\,t$ V.
   a. (2 points) Draw the phasor domain representation of the circuit.
   b. (8 points) Use phasor domain nodal analysis to find the steady-state voltage $v_{C-ss}(t)$.



Write your answer here:

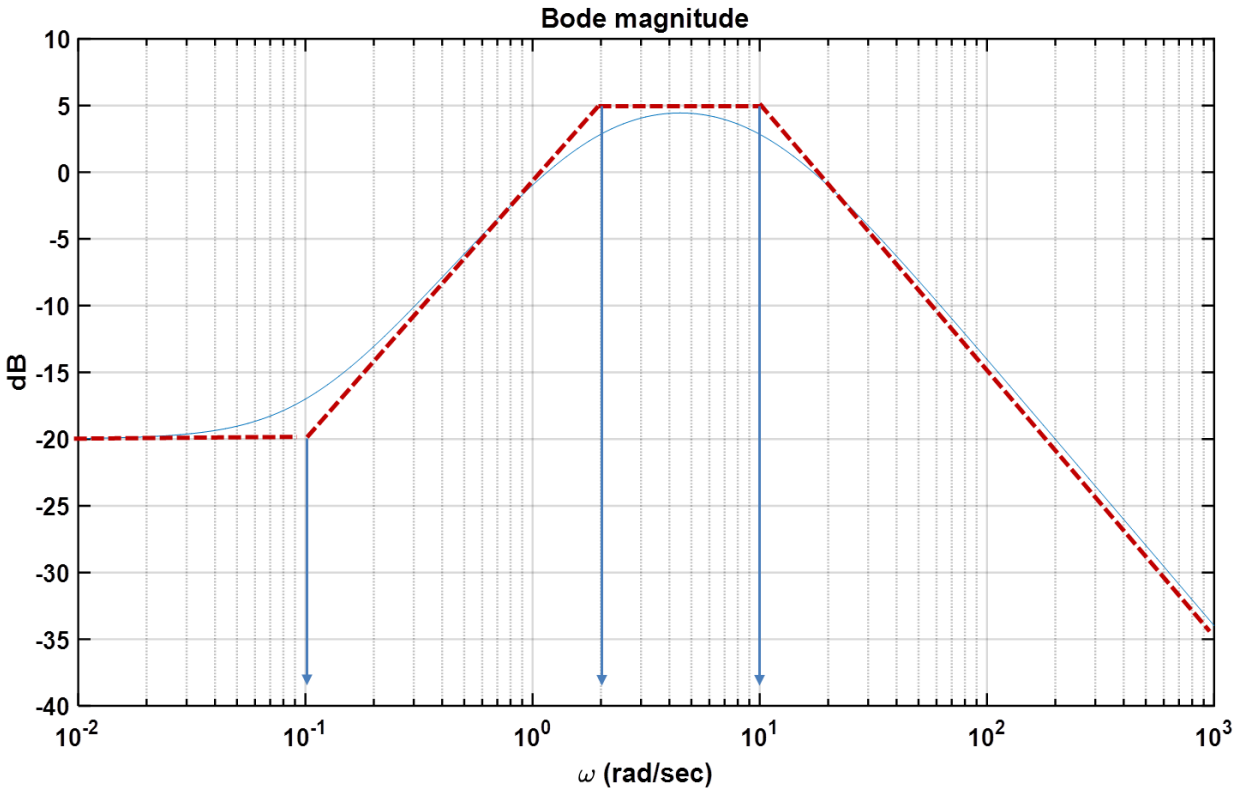
$v_{C-ss}(t) =$ _____

Problem 2 score: [ ]/10

3. A given circuit has a Bode magnitude plot shown below (and the straight line approximation as shown by the dotted line).
   a. (5 points) Find the transfer function $\boldsymbol{H}(\omega)$. Leave each term in **standard Bode form**

   For example: $\boldsymbol{H}(\omega) = K(1 + \frac{j\omega}{\omega_c})(j\omega)^2 \left(1 + \frac{2\zeta\omega}{\omega_k} + \left(\frac{\omega}{\omega_k}\right)^2\right)$

   b. (5 points) At $\omega = 0, \theta(\omega) = 0$. Plot the Bode phase plot on the attached semilog paper.

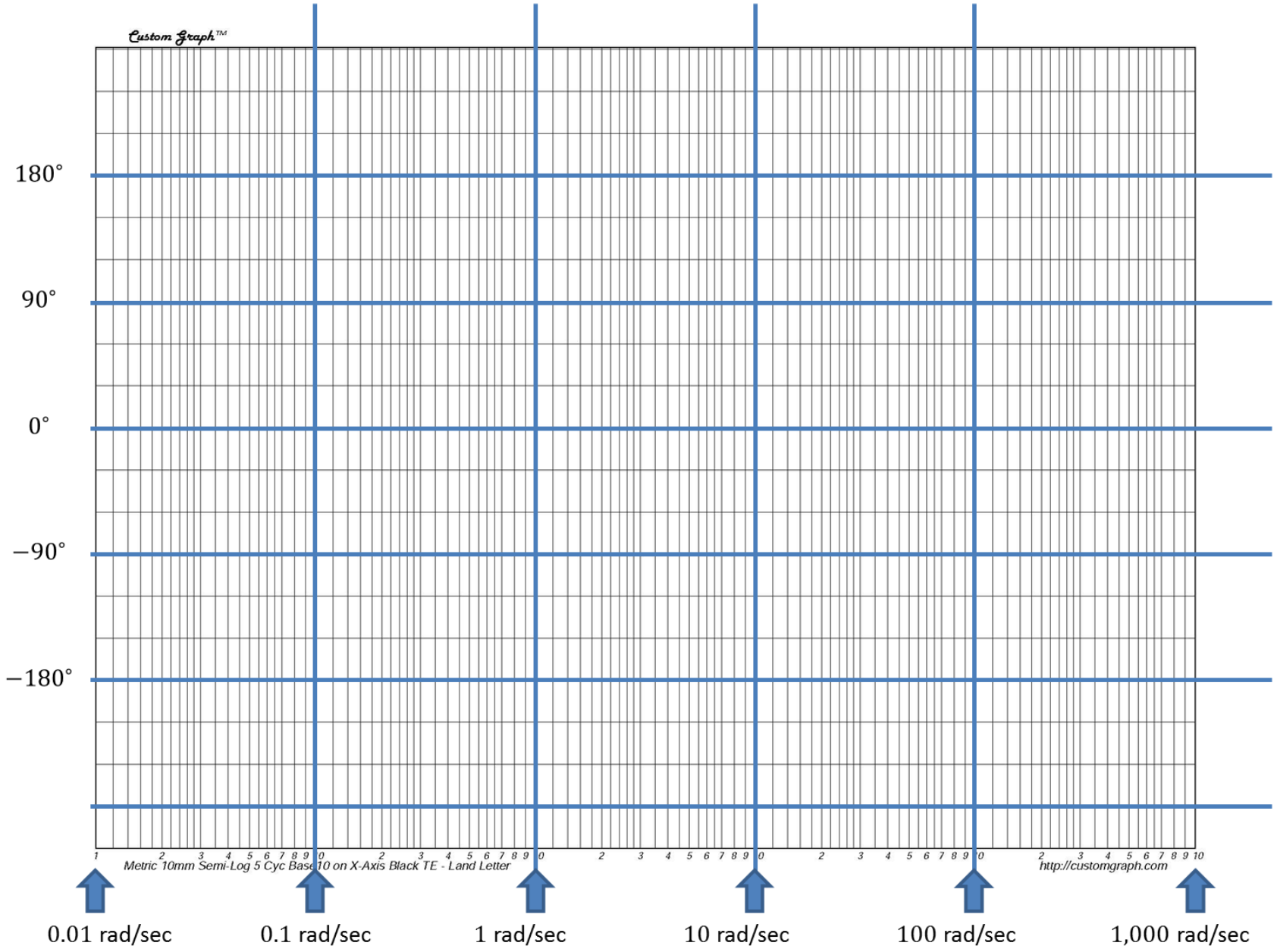


Write your answer here:

a. $\boldsymbol{H}(\omega) =$ _____

b. Plot the phase plot on the attached semilog paper

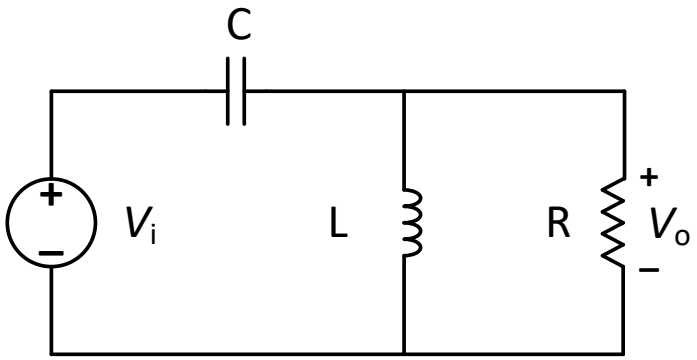
Problem 3 score: [ ]/10


Custom Graph™
180°
90°
0°
−90°
−180°
Metric 10mm Semi-Log 5 Cyc Base 10 on X-Axis Black TE - Land Letter
http://customgraph.com
0.01 rad/sec
0.1 rad/sec
1 rad/sec
10 rad/sec
100 rad/sec
1,000 rad/sec

4. Given the circuit below
   a. (5 points) Find the transfer function $\boldsymbol{H}(\omega) = \boldsymbol{V}_o/\boldsymbol{V}_i$. Express your solution with separate terms expressed in **standard Bode form**

$$\underline{\textbf{For example}}: \boldsymbol{H}(\omega) = K(1 + \frac{j\omega}{\omega_c})(j\omega)^2 \left(1 + \frac{2\zeta\omega}{\omega_k} + \left(\frac{\omega}{\omega_k}\right)^2\right)$$

   b. (5 points) Find $|\boldsymbol{H}(\omega)|$ at $\omega = 0$ and $\omega \to \infty$ and $\angle\boldsymbol{H}(\omega)$ at $\omega = 0$ and $\omega \to \infty$



Write your answer here:

a. $\boldsymbol{H}(\omega)$ _____

b. $|\boldsymbol{H}(\omega)|$ at $\omega = 0$ _____

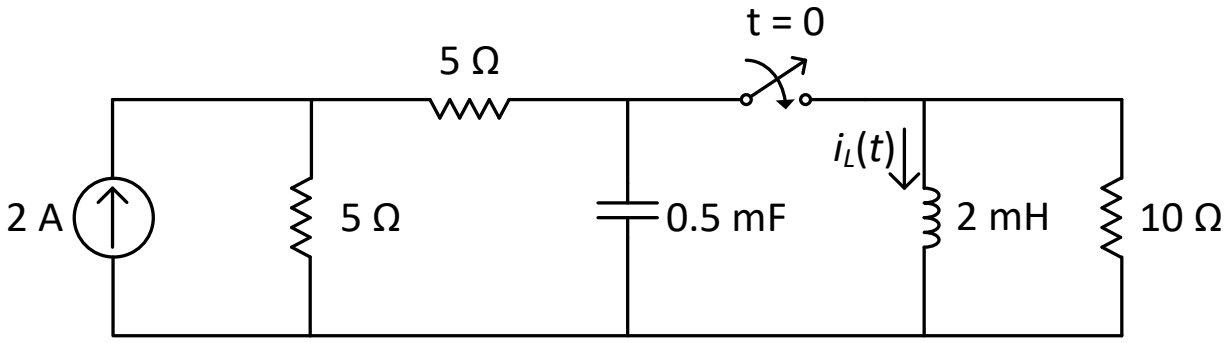
$\angle\boldsymbol{H}(\omega)$ at $\omega = 0$ _____

$|\boldsymbol{H}(\omega)|$ at $\omega \to \infty$ _____

$\angle\boldsymbol{H}(\omega)$ at $\omega \to \infty$ _____

Problem 4 score: [ ]/10

5. The switch in the circuit below has been open for a very long time, and it closes at $t = 0$.
   a. (1 point) Determine the initial value for i_L at $t = 0$.
   b. (1 point) Determine the final value for i_L at $t \to \infty$.
   c. (8 points) Solve for $i_L(t), t \geq 0$.



Write your answer here:

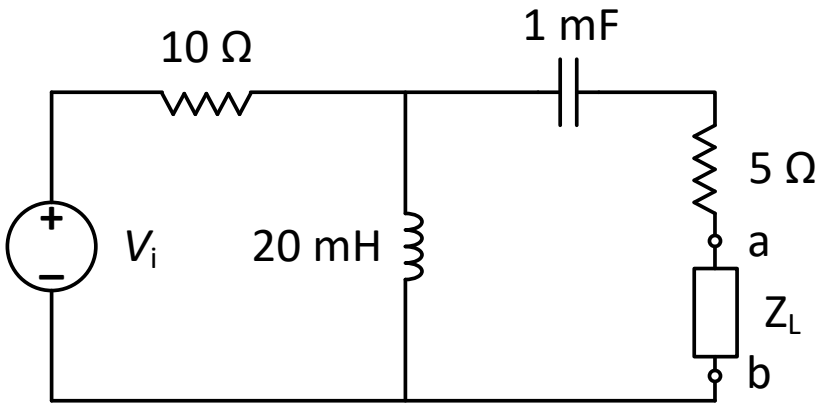
a. $i_L$at $t = 0$: _____

b. i_L at $t \to \infty$: _____

c. $i_L(t), t \geq 0 =$ _____

Problem 5 score: [ ]/10

6. For the circuit below, $v_i = 20\cos 100t$ V.
   a. (6 points) Remove Z_L and then find both V_{oc} (in polar form) and Z_{TH} (in rectangular form) between terminals a and b.
   b. (2 points) Determine the value for Z_L so the power dissipated by the load is maximized.
   c. (2 points) For the Z_L you found in (b), what average power is dissipated by the load?



Write your answer here:

a. $V_{oc} =$ _____

$Z_{TH} =$ _____

b. $Z_L =$ _____

c. $P_{avg} =$ _____

Problem 6 score: [ ]/10