

ECE 2100 Circuit Analysis
Spring 2018
Final Exam

NAME: _____

INSTRUCTIONS:

1. **THIS EXAM IS CLOSED BOOK AND CLOSED NOTES.**
A “Potentially Useful Facts” sheet is provided.
2. **NO ELECTRONIC DEVICES ARE ALLOWED.**
3. Work each problem in the provided space.
4. **Show ALL work** required to arrive at a solution for either full or partial credit.
5. READ the entire question before answering.
6. **CIRCLE YOUR ANSWERS.**
7. Have your student ID on your desktop for inspection by the instructor.
8. **SIGN** the honesty pledge at the bottom of the page. Exams without a signature will receive no credit.

I have neither given nor received assistance from anyone in regards to completion of this exam. I have followed the instructions as provided on this sheet. I HAVE VERIFIED THAT THIS EXAM HAS (8) PAGES.

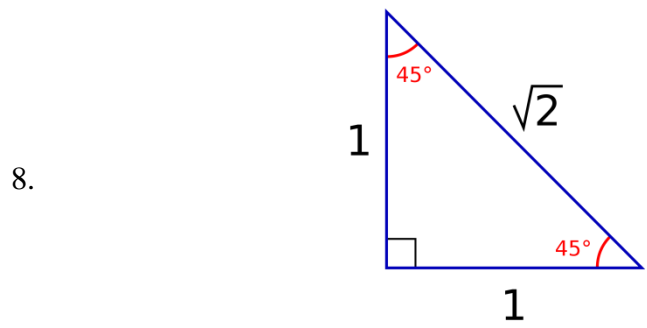
SIGNATURE: _____ DATE: _____

Note: some problems might be adapted from the course text or other sources. Schematics prepared using LTspice (linear.com).

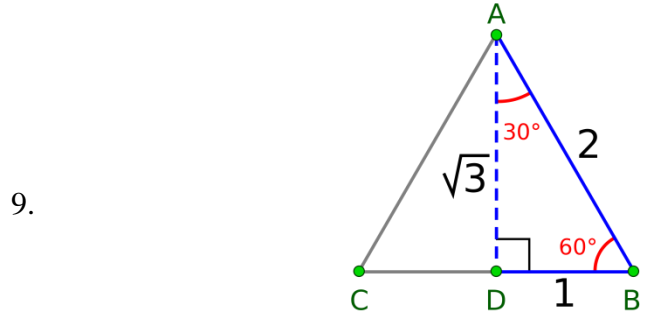
Potentially Useful Facts (updated 6 January 2017)

1. $A \angle \theta = Ae^{j\theta} = A \cos \theta + A \sin \theta j$
2. $v = L \frac{di}{dt}$ (follows passive sign convention)
3. $i = C \frac{dv}{dt}$ (follows passive sign convention)
4. $\vec{Z}_L = j\omega L$
5. $\vec{Z}_C = \frac{1}{j\omega C}$
6. $\vec{S} = \vec{V}_{\text{RMS}} (\vec{I}_{\text{RMS}})^*$ (follows passive sign convention)

7.
$$V_{\text{RMS}} = \sqrt{\frac{1}{T} \int_0^T v^2(t) dt}$$



source (released to public domain):
<https://commons.wikimedia.org/wiki/File:45-45-triangle.svg>



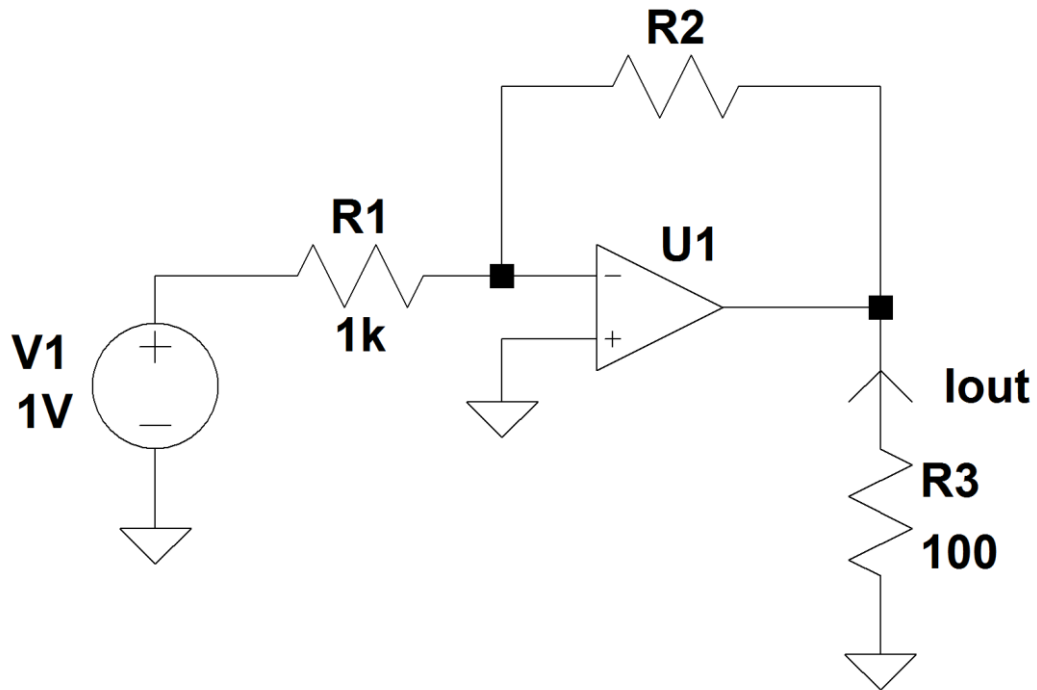
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10. first-order DC circuit (natural and forced) response

$$x(t) = x(\infty) + [x(0) - x(\infty)]e^{-t/\tau}$$

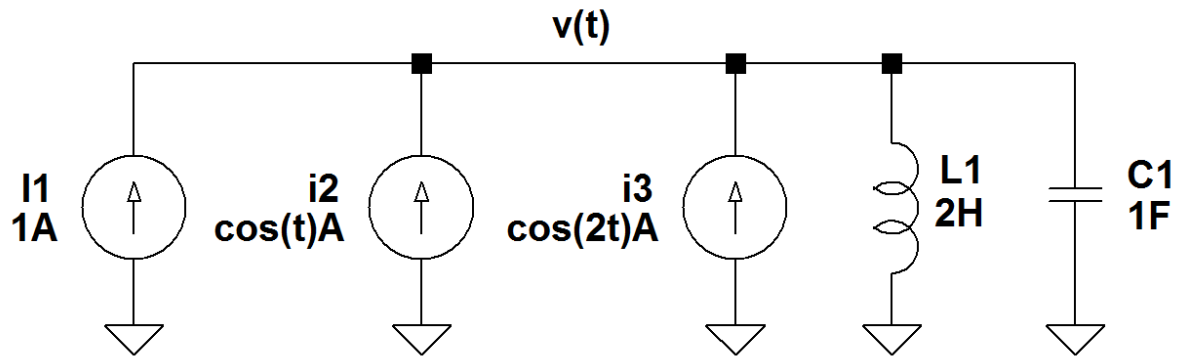
Maximum exam score is 31 points.

1. (5 points) The op-amp is ideal. Find the value of R_2 so that $I_{out}=100\text{mA}$.

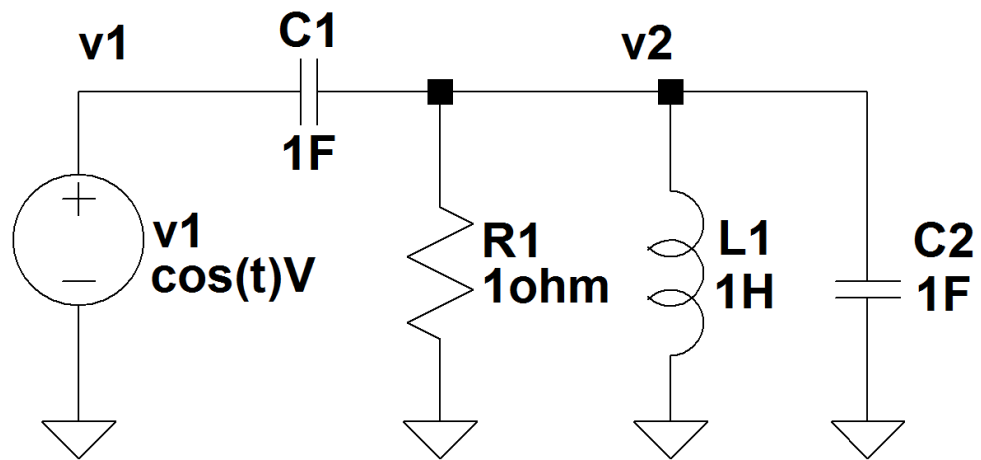


2. (5 points) The complex power of a load is $\vec{S}=1 - 10j$ VA. If the load voltage is 1V RMS and the frequency is 1 rad/s, find the value of a component to put in parallel with the load to obtain a unity power factor.

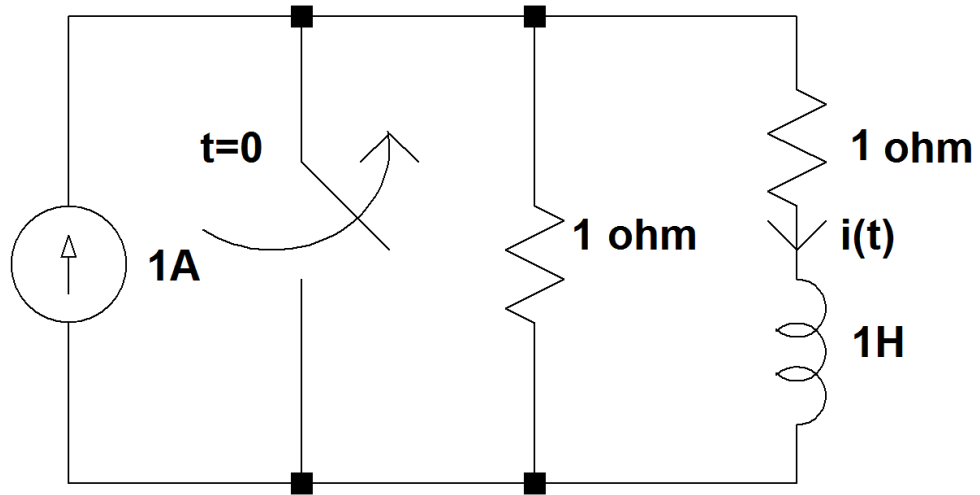
3. (6 points) Find node voltage $v(t)$ in the sinusoidal steady state using the superposition principle.



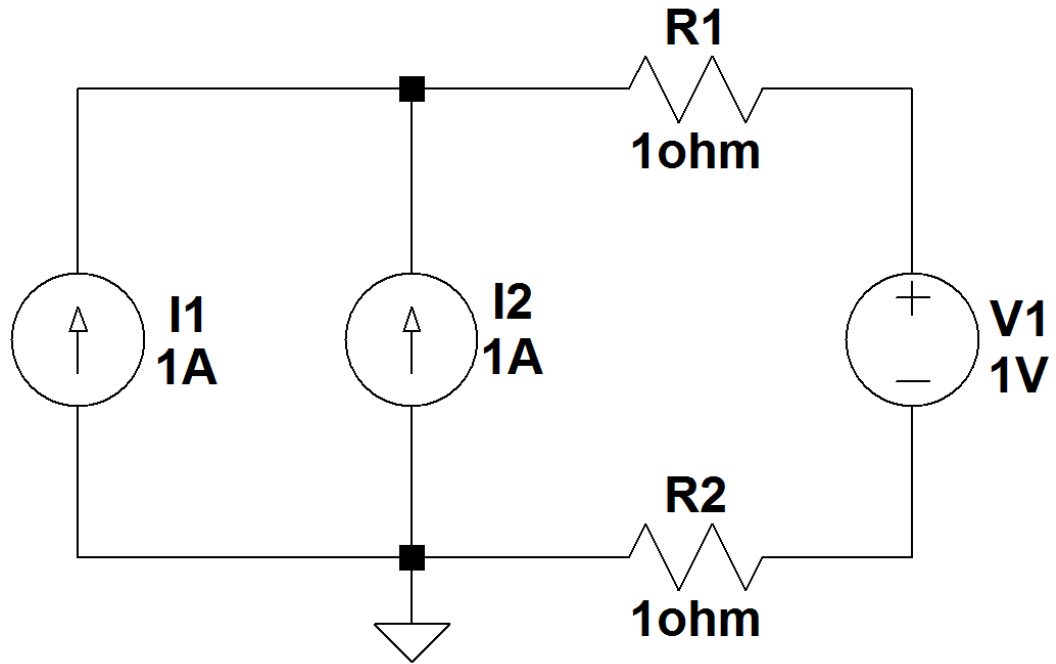
4. (5 points) Find node voltages $v_1(t)$ and $v_2(t)$ in the sinusoidal steady state using **nodal analysis**.



5. (5 points) The switch is opened at $t=0$ after being closed for a long time. Find $i(t)$ for $t \geq 0$.



6. (5 points) Find the power of each circuit element.
 You **must** show the voltage (with polarity) across EACH element.
 You **must** show the current (with direction) through EACH element.
 Answers without supporting work **will receive no credit**.
 Put answers in table.



ELEMENT	POWER
I1	
I2	
V1	
R1	
R2	