ECE 2100 Circuit Analysis
Summer I 2015
Final Exam

NAME: _____

INSTRUCTIONS:

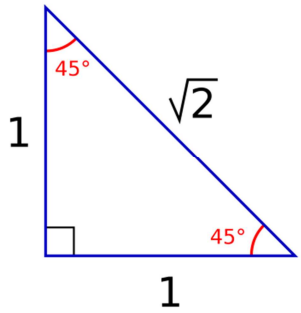
1. **THIS EXAM IS CLOSED BOOK AND CLOSED NOTES**. A "Potentially Useful Facts" sheet is provided.
2. **NO ELECTRONIC DEVICES ARE ALLOWED**.
3. Work each problem in the provided space.
4. Show ALL work required to arrive at a solution for either full or partial credit.
5. READ the entire question before 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.

SIGNATURE: _____ DATE: _____

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

Potentially Useful Facts

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. $\overrightarrow{\boldsymbol{Z_L}} = j\omega L$
5. $\overrightarrow{\boldsymbol{Z_C}} = \frac{1}{j\omega C}$
6. $\vec{\boldsymbol{S}} = \overrightarrow{\boldsymbol{V_{RMS}}}\left(\overrightarrow{\boldsymbol{I_{RMS}}}\right)^*$ (follows passive sign convention)
7. $V_{\text{RMS}} = \sqrt{\frac{1}{T}\int_0^T v^2(t)dt}$
8. 

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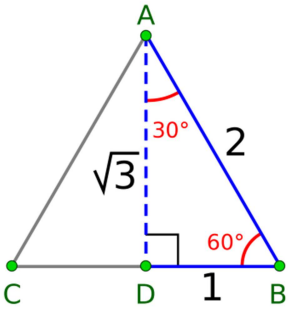
9. 

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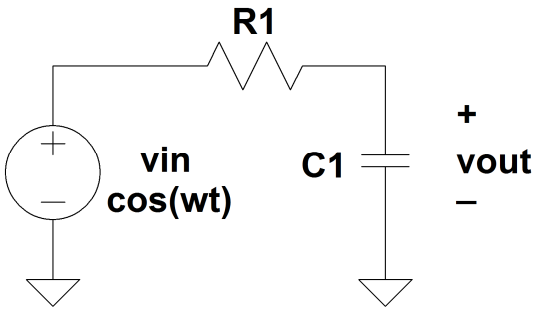
10. first-order circuit (natural and step) response
$x(t) = x(\infty) + [x(0) - x(\infty)]e^{-t/\tau}$

Maximum exam score is 35 points.

1. (2 points) What kind of filter is this?

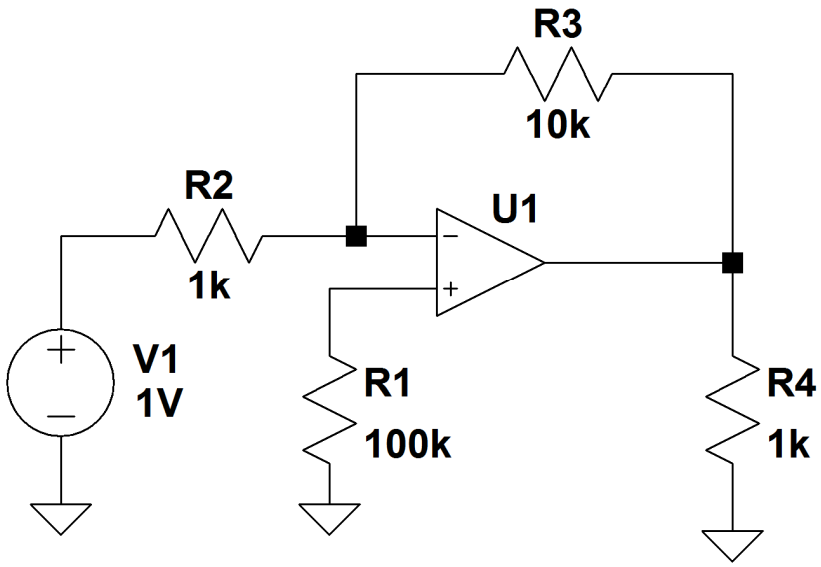


2. (2 points) What is the ideal input resistance of a voltmeter? Justify your response using an example of the effects of an ideal and non-ideal voltmeter on measuring the voltage provided by a Thevenin equivalent circuit.

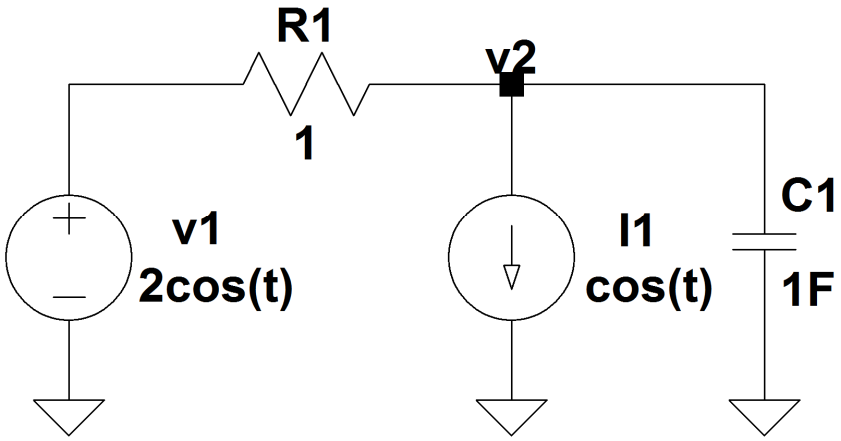
3. (1 point) What is the average real power of a capacitor in the sinusoidal steady state?

4. (5 points) A meter movement has a series resistance of 1Ω and a full scale current of 10mA. Use this meter movement to design a 1A full scale ammeter. Be sure to show a schematic of your design.

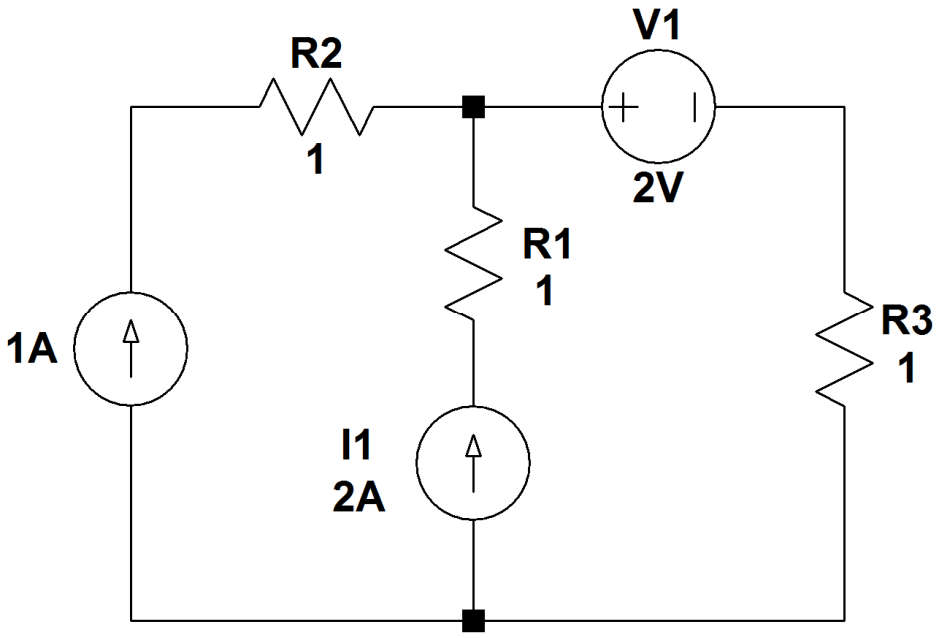
5. (5 points) Find the power of V1 **and** R4 assuming an ideal op-amp.



6. (5 points) Find voltage v2(t) in the sinusoidal steady state using nodal analysis.



7. (5 points) Find the power of each circuit element.



8. (5 points) The complex power of a load is 1- j VA. If the load frequency is 1 rad/s and the voltage across the load is 10V RMS, find the value of a component to be placed in parallel with the load to obtain a unity power factor.

9. (5 points) Assume that there is no energy in capacitor at t=0. Find the current i(t) for **ALL** t.