ECE 2100 Circuit Analysis
Spring 2017
Final Exam

NAME: _____

INSTRUCTIONS:

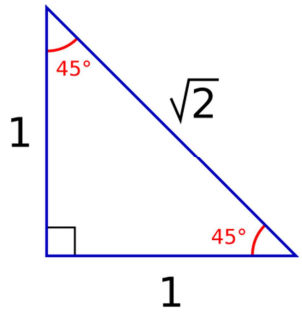
1. **THIS EXAM IS CLOSED BOOK AND CLOSED NOTES**. A "Potentially Useful Facts" sheet is provided.
2. **NO ELECTRONIC DEVICES ARE ALLOWED**.
3. Work each problem in the provided space.
4. Show ALL work required to arrive at a solution for either full or partial credit.
5. READ the entire question before 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 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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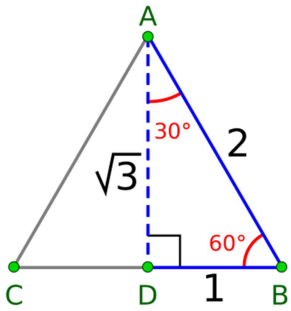
9. 

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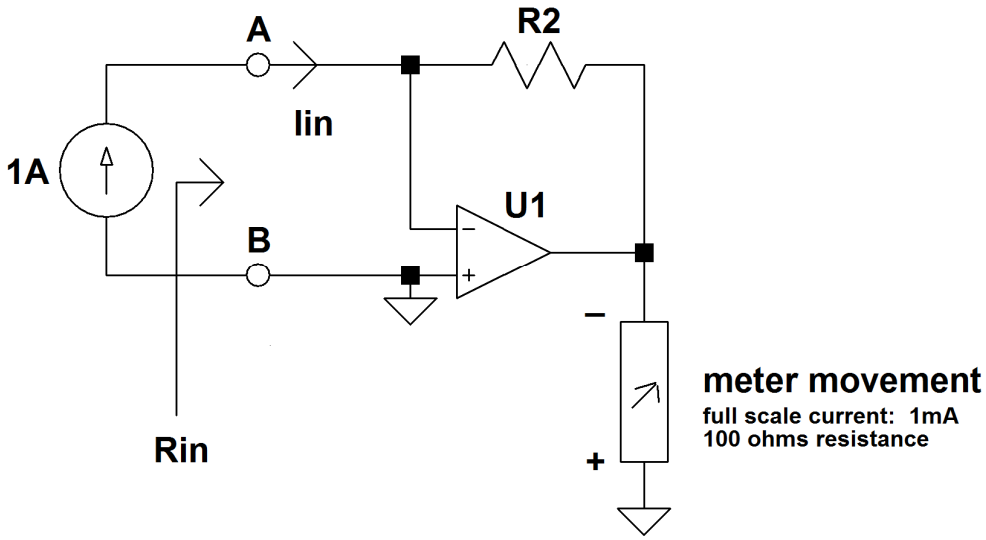
https://commons.wikimedia.org/wiki/File:30-60-90.svg
10. first-order circuit (natural and step) response
$x(t) = x(\infty) + [x(0) - x(\infty)]e^{-t/\tau}$

Maximum exam score is 30 points.

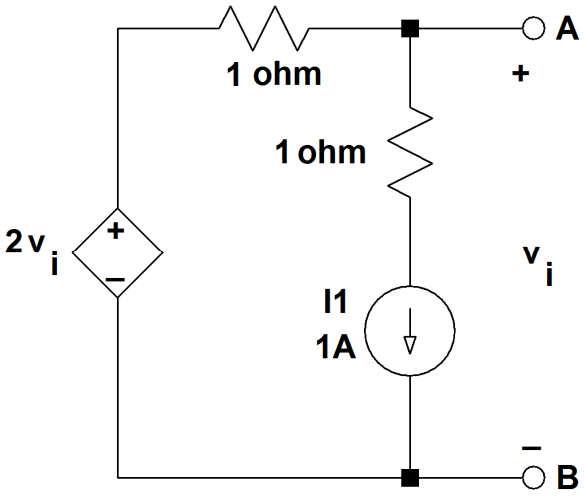
1. (5 points) The meter movement has a full scale current of 1mA and a resistance of 100 ohms.

    a. Find the value of R2 so that the meter movement displays a full scale current if *Iin*=1A. Note the polarity markings of the meter movement.

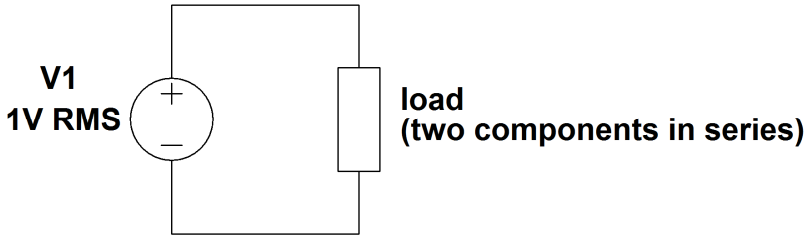
    b. What is the input resistance Rin "seen" by the 1A current source?
    Hint: What is the ideal resistance of an ammeter?



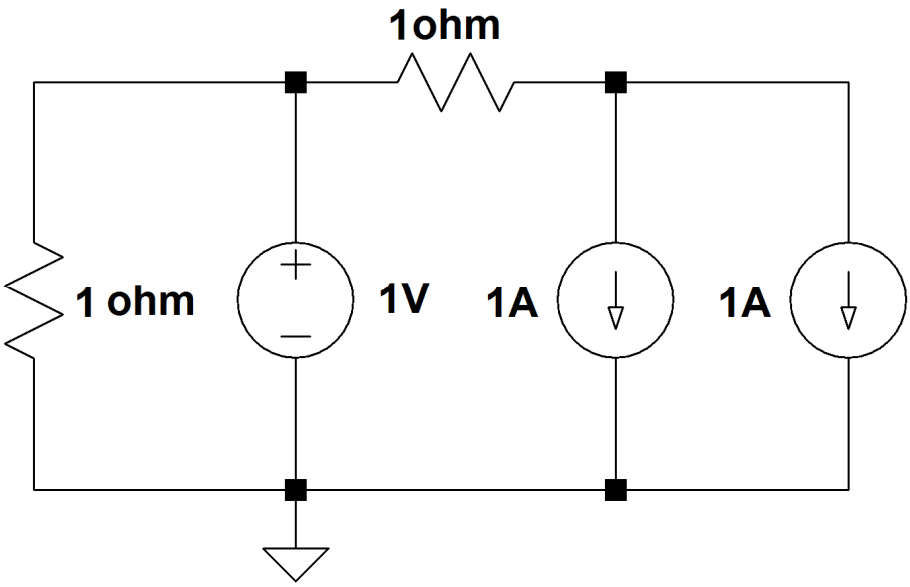
2. (5 points) Thevenize the following circuit "looking into" terminals A-B. Be sure to sketch the Thevenin equivalent circuit. The voltage v_i is across terminals A-B as indicated.



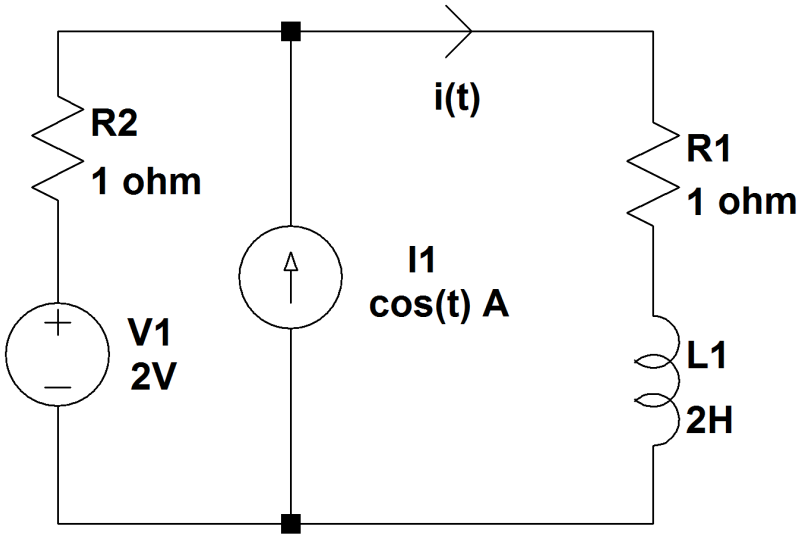
3. (5 points) The complex power of the load is $\vec{S}$=1 + j VA. The voltage across the load is 1V RMS at a radian frequency 1 rad/s. If the load is composed of two elements connected in series, find the values of the two series connected components.



4. (5 points) Find the power of each circuit element.



5. (5 points) Find current *i(t)* in the sinusoidal steady state using the superposition principle.



6. (5 points) The switch is closed at t=0 after being open for a long time. Find $i(t)$ for t>0.