

ECE 2100 Circuit Analysis
Summer I 2017
Exam #2

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

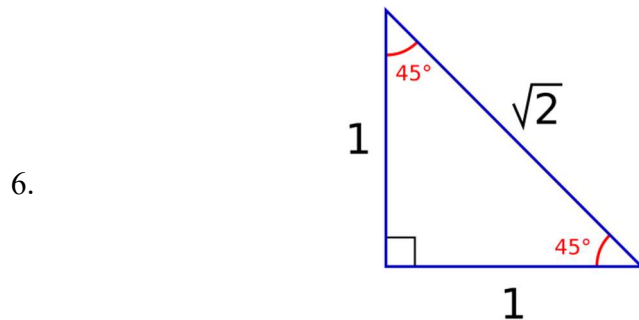
1. $A \angle \theta = Ae^{j\theta} = A \cos \theta + A \sin \theta j$

2. $\vec{Z}_L = j\omega L$

3. $\vec{Z}_C = \frac{1}{j\omega C}$

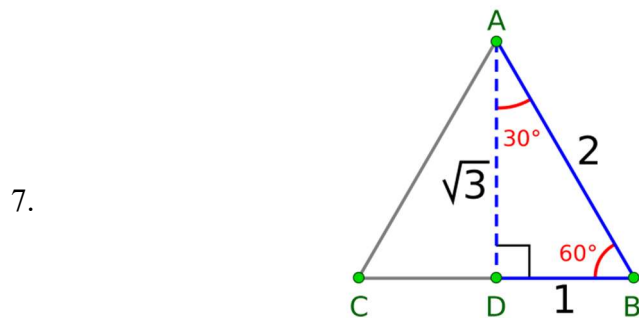
4. $\vec{S} = \vec{V}_{\text{RMS}} (\vec{I}_{\text{RMS}})^*$ (follows passive sign convention)

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



source (released to public domain):

<https://commons.wikimedia.org/wiki/File:45-45-triangle.svg>



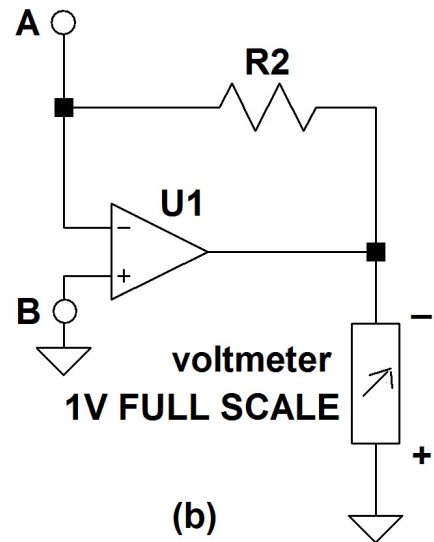
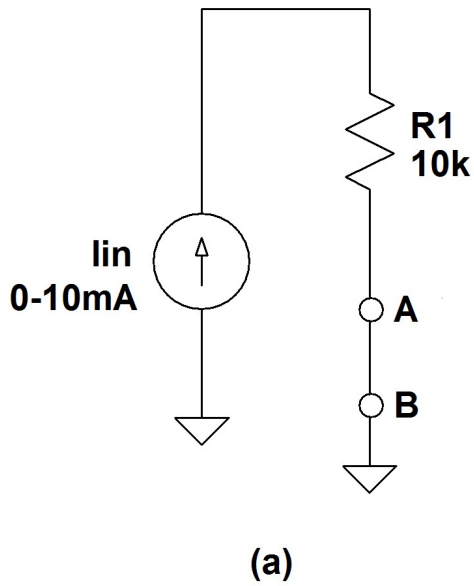
source (released to public domain):

<https://commons.wikimedia.org/wiki/File:30-60-90.svg>

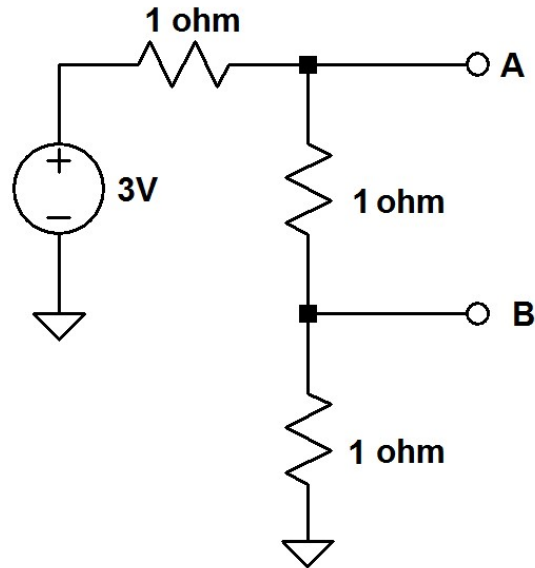
Maximum exam score is 30 points.

1. (5 points) The op-amp ammeter circuit (b) will be used to measure I_{in} of circuit (a). I_{in} varies from 0 to 10mA.

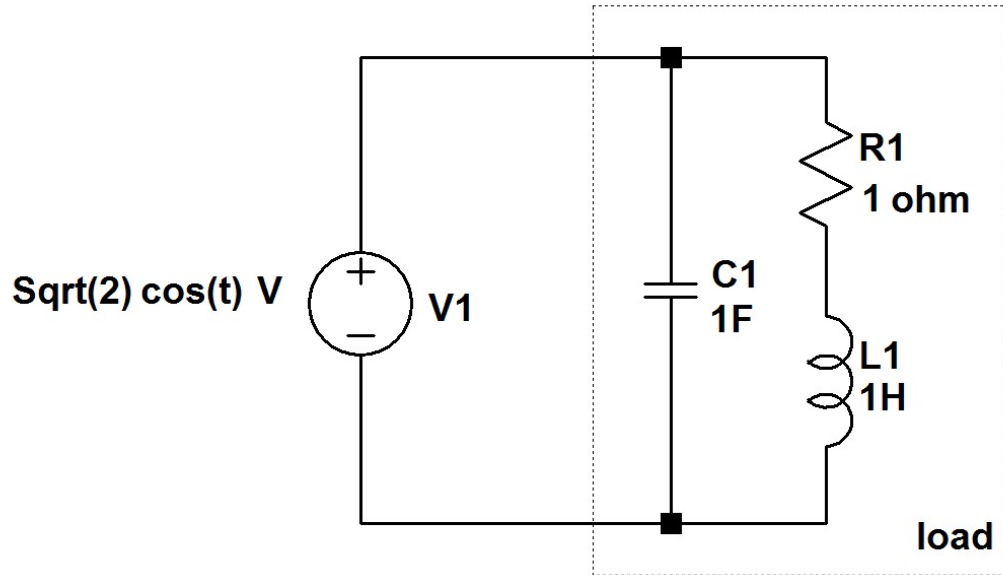
- a. If the short between terminals A and B in circuit (a) is removed and the op-amp ammeter circuit is connected to A and B as indicated, find the value of R_2 so that the voltmeter reads a full-scale voltage of 1V for $I_{in}=10\text{mA}$.
- b. Is the input resistance of the op-amp ammeter ideal? Explain.



2. (5 points) Thevenize the following circuit “looking into” terminals A-B. Be sure to sketch the Thevenin equivalent circuit.

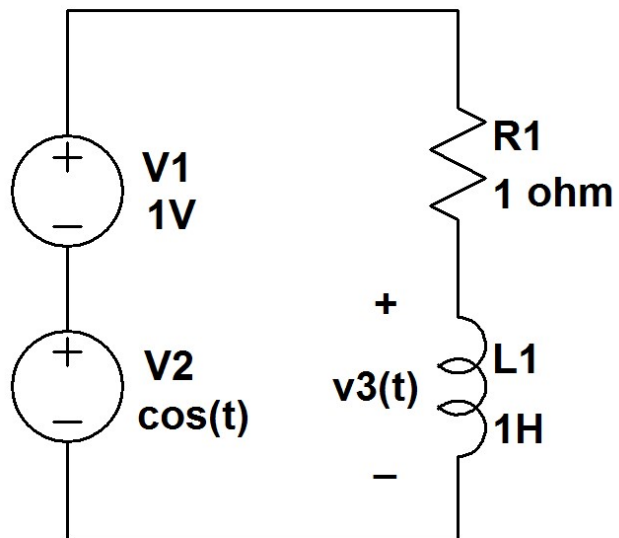


3. (5 points) Consider the following circuit. Find the complex power of the load (consisting of $C1$, $R1$, and $L1$).



4. (5 points) The complex power of a load is $\vec{S}=10 - 10j$ 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.

5. (5 points) Find voltage $v_3(t)$ in the sinusoidal steady state using the superposition principle.



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

