ECE 214 — Exam #2

Estimated time for completion: $\leq$ 1.25 hour
18 April 2019

Rules of the Exam

Rule 1: The examination period begins at 11:00 am on Tuesday, 18 April 2019 and ends at 12:15 pm on Tuesday, 18 April 2019.

Rule 2: The exam is worth 15 points.

Rule 3: There are three problems. Each problem is worth 6 points, and the maximum score is 18 out of 15.

Rule 4: The exam is closed book and closed notes. You may use your ECE 214 Laboratory Notebook, a ruler, and a calculator.

Rule 5: To receive credit for an answer, include the units along with the numerical answer.

Rule 6: Show all work - answers without supporting work will not receive credit. Please circle your final answer or write the answer on the line provided.

Rule 7: Do not leave the room until you have completed the exam.

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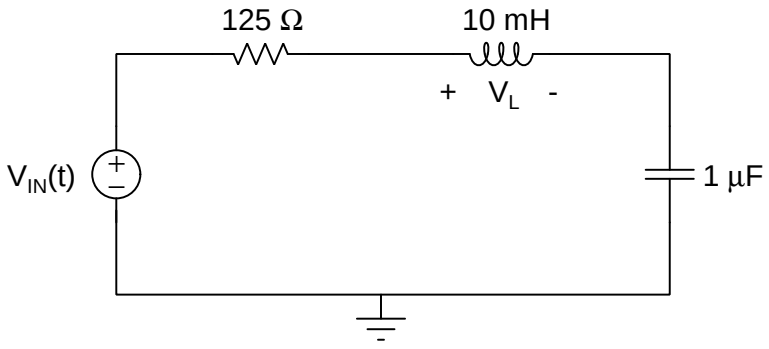
Name

Problem 1: Consider the series RLC circuit shown below. Assume all circuit elements are ideal.



(a) $V_{IN}(t) = 2\cos(1000t + 45°)$. What is $V_L(t)$ at $t = 0.1$ ms? _____

(b) $V_{IN}(t)$ is a 2 V step function applied at $t = 0$. Assume no energy is stored in the circuit at $t = 0$. What is $V_L(t)$ at $t = 0.1$ ms?

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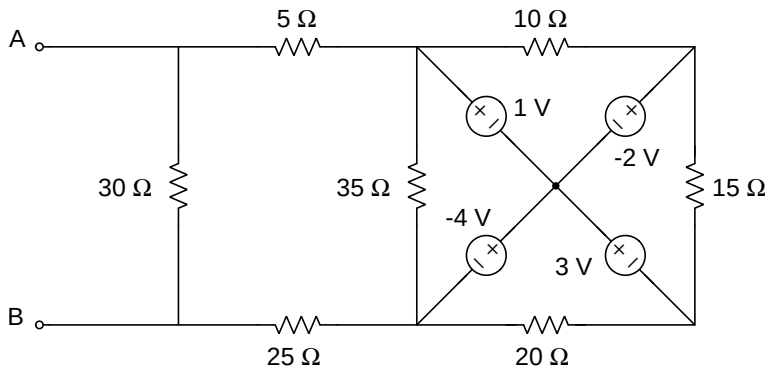
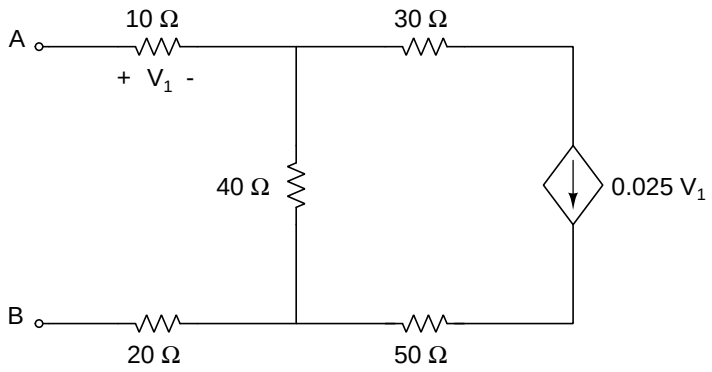
Problem 2(a): Consider the circuit shown below.



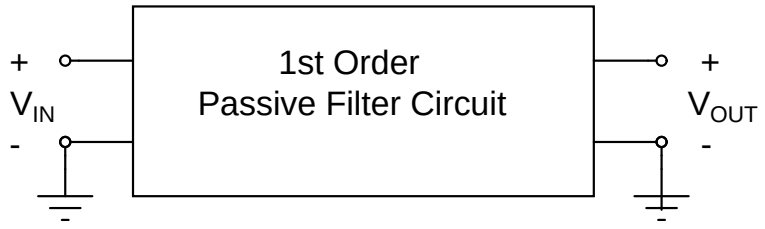
(a) Draw the Thévenin equivalent circuit with respect to terminals **A** and **B**.

Problem 2(b): Consider the circuit shown below.



(b) Calculate the Thévenin equivalent impedance between terminals **A** and **B**. _____

Problem 3: Consider the 1st order ideal passive filter circuit shown below:



1. V_{IN} is a square wave with a 50% duty cycle and a frequency of 25 kHz. V_{OUT} is a sinusoidal waveform with a single frequency of 100 kHz. What type of filter could be used to generate V_{OUT} (low pass, band pass, band reject, high pass, or no filter can produce this output)?

2. V_{IN} is a square wave with a 75% duty cycle and a frequency of 20 kHz. V_{OUT} is a sinusoidal waveform with a single frequency of 40 kHz? What type of filter could be used to generate V_{OUT} (low pass, band pass, band reject, high pass, or no filter can produce this output)?

3. V_{IN} is a square wave with a 50% duty cycle and a frequency of 15 kHz. The filter is a high pass filter with a cutoff frequency of 9 kHz. What is the relative amplitude of the 5th harmonic to the fundamental frequency at the output of the filter?

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4. V_{IN} is a square wave with a 50% duty cycle and a frequency of 9 kHz. The filter is a high pass filter with a cutoff frequency of 9 kHz. What is the relative amplitude of the 5th harmonic to the fundamental at the output of the filter?

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5. V_{IN} is a square wave with a 50% duty cycle and a frequency of 3 kHz. The filter is a high pass filter with a cutoff frequency of 9 kHz. What is the relative amplitude of the 5th harmonic to the fundamental at the output of the filter?

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6. V_{IN} is a square wave with a 50% duty cycle and a frequency of 1 kHz. The filter is a high pass filter with a cutoff frequency of 9 kHz. What is the relative amplitude of the 5th harmonic to the fundamental at the output of the filter?

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