ECE 214 — Exam #1

Estimated time for completion: $\leq$ 1.25 hour
6 March 2018

Rules of the Exam

Rule 1: The examination period begins at 11:00 am on Tuesday, 6 March 2018 and ends at 12:15 pm on Tuesday, 6 March 2018.

Rule 2: The exam is worth 15 points.

Rule 3: There are a total of 18 answers. Each answer is worth 1 point. 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.

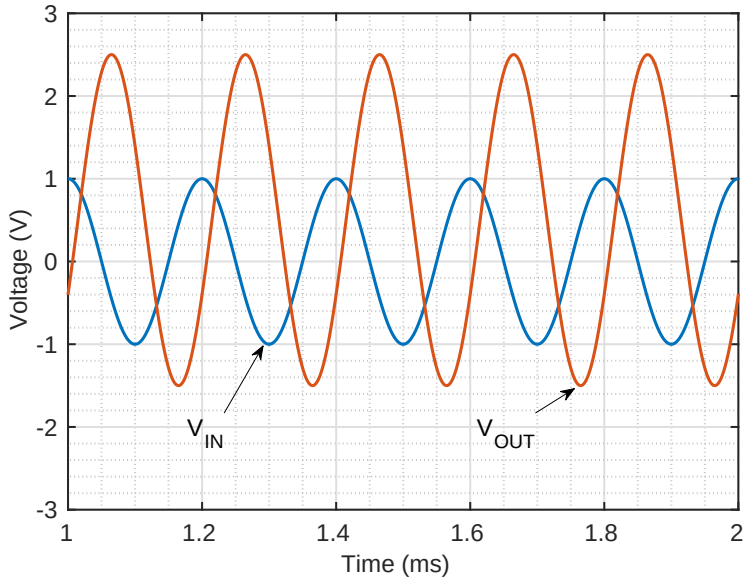
Rule 6: Show all work - answers without supporting work will not receive credit.

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

_____

Name

Problem 1: The input and output signals from an amplifier circuit are shown below:



The input signal is described by:

$$\mathrm{V_{IN}}(t) = V_1 \cos(\omega t) \tag{1}$$

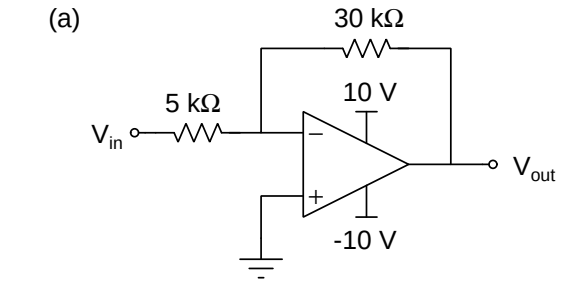
and, the output signal by:

$$\mathrm{V_{OUT}}(t) = V_2 \cos(\omega t + \phi) + V_{2_{DC}} \tag{2}$$

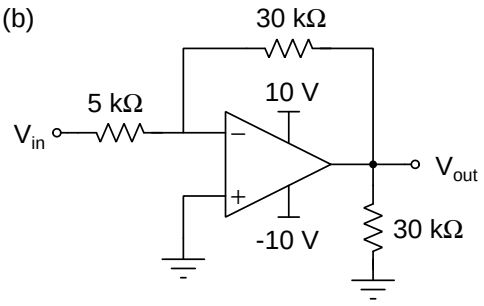
1. What is V_1? _____
2. What is the voltage gain $= \left|\frac{V_2}{V_1}\right|$? _____
3. What is ω? _____
4. What is ϕ? _____
5. What is $V_{2_{DC}}$? _____
6. When $\mathrm{V_{IN}}(t)$ is measured by a DVM set to measure an ac voltage, what value would the DVM indicate? _____

Problem 2: For the OpAmp circuits below, calculate the output voltage, V_{out}, when the input voltage $V_{in} = 1$ V. The OpAmps are ideal.

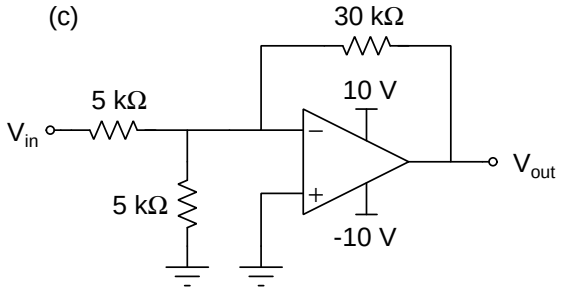
(a)



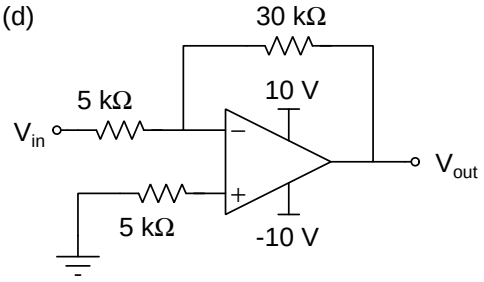
(b)



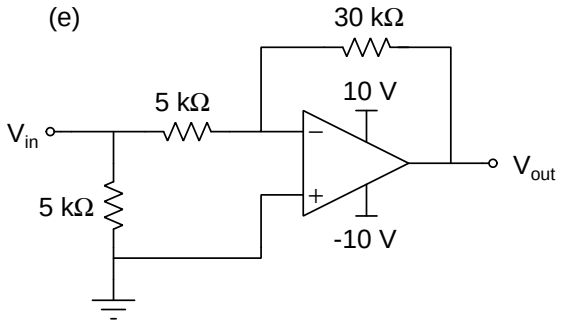
(c)



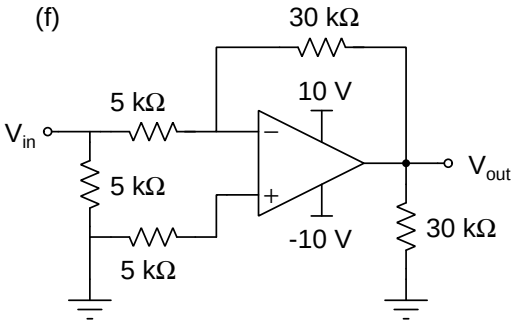
(d)



(e)

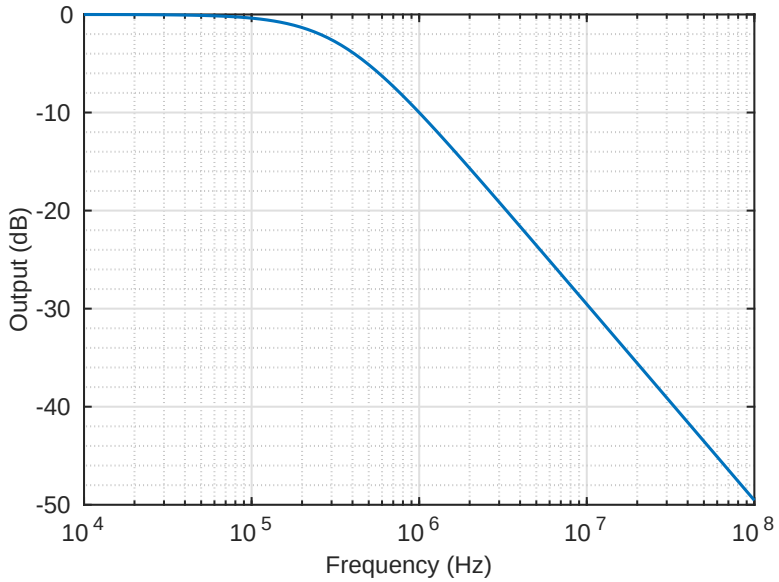


(f)



OpAmp	V_{out}	OpAmp	V_{out}
(a)		(b)	
(c)		(d)	
(e)		(f)	

Problem 3: The frequency response of a filter is shown below.



1. What type of filter is this?
   (a) Low pass filter
   (b) High pass filter
   (c) Band pass filter
   (d) Band reject filter
   (e) None of the above
2. What order filter is this?
   (a) 1st order filter
   (b) 2nd order filter
   (c) 3rd order filter
   (d) none of the above
3. What is the cut-off frequency? _____

4. When the input signal is a square wave with a period of 1 μs, what is the magnitude of the 3rd harmonic relative to the fundamental frequency at the output of the filter? _____

5. When the input signal is a square wave with a period of 10 μs, what is the magnitude of the 3rd harmonic relative to the fundamental frequency at the output of the filter? _____

6. When the input signal is a square wave with a period of 100 μs, what is the magnitude of the 3rd harmonic relative to the fundamental frequency at the output of the filter? _____

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Blank page for calculations. Name: _____

Blank page for calculations. Name: _____