ECE 214 — Final Exam

Estimated time for completion: <2 hours
7 May 2013

Rules of the Exam

Rule 1: The examination period begins at 8:00am on Tuesday 7 May 2013 and ends at 10:00am on Tuesday 7 May 2013.

Rule 2: There are three problems. Each problem has equal weight.

Rule 3: The exam is closed book and closed notes but you may use your ECE 214 Laboratory Notebook, a ruler, and a calculator.

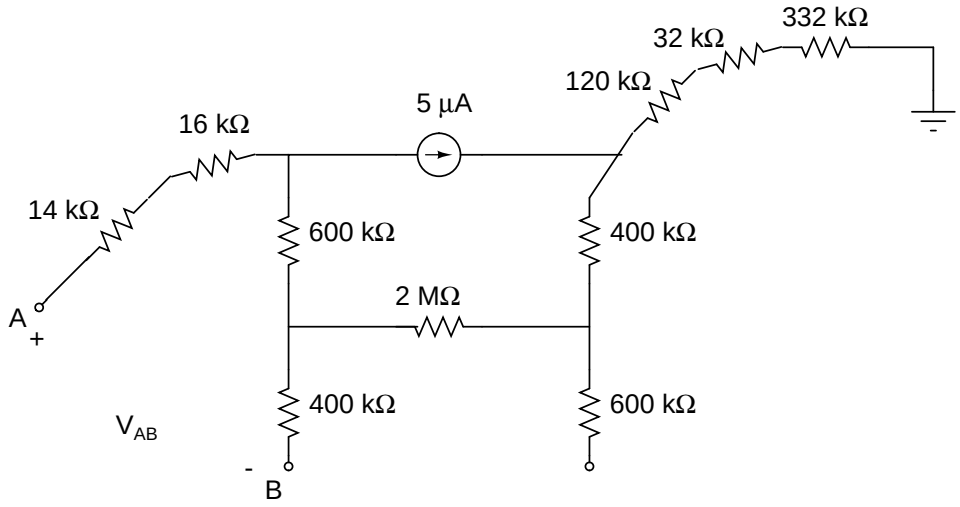
Rule 4: Hand in your ECE 214 Laboratory Notebook with the exam.

Rule 5: Have a good Summer.

_____

Name

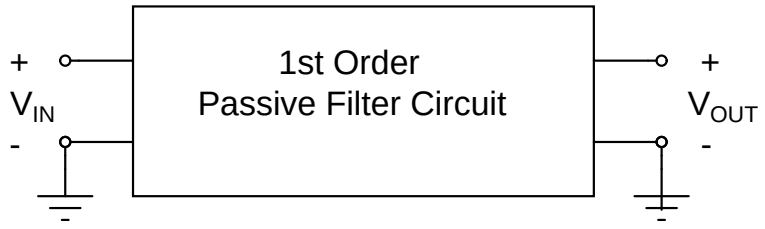
Problem 1 Consider the circuit shown below:



What is the Voltage V_{AB} in this circuit? _____

If a Digital Volt Meter (DVM) having an input Resistance of 1 MΩ is placed across terminals "A" and "B," what voltage V_{AB} is measured? _____

Problem 2: Consider the 1st order ideal passive filter circuit shown below:



For the questions below circle the most correct answer:

1. V_{IN} is a square wave with a 75% duty cycle, a frequency of 25 kHz, and a peak–to–peak voltage of 5 V. V_{OUT} is a sinusoidal waveform with a single frequency of 50 kHz. What type of filter could be used to generate V_{OUT}?

   (a) low pass filter
   (b) band pass filter
   (c) band reject filter
   (d) high pass filter
   (e) none of the above

2. V_{IN} is a square wave with a 75% duty cycle, a frequency of 25 kHz, and a peak–to–peak voltage of 5 V. V_{OUT} that is a sinusoidal waveform with a single frequency of 75 kHz? What type of filter could be used to generate V_{OUT}?

   (a) low pass filter
   (b) band pass filter
   (c) band reject filter
   (d) high pass filter
   (e) none of the above

3. V_{IN} is a square wave with a 50% duty cycle and a frequency of 20 kHz. The filter is a low pass filter with a cutoff frequency of 80 kHz. What is the relative amplitude of the 3rd harmonic to the fundamental at the output of the filter?

   (a) -22.08 dB
   (b) -19.08 dB
   (c) -16.08 dB
   (d) -12.54 dB
   (e) -9.54 dB
   (f) -6.54 dB
   (g) none of the above

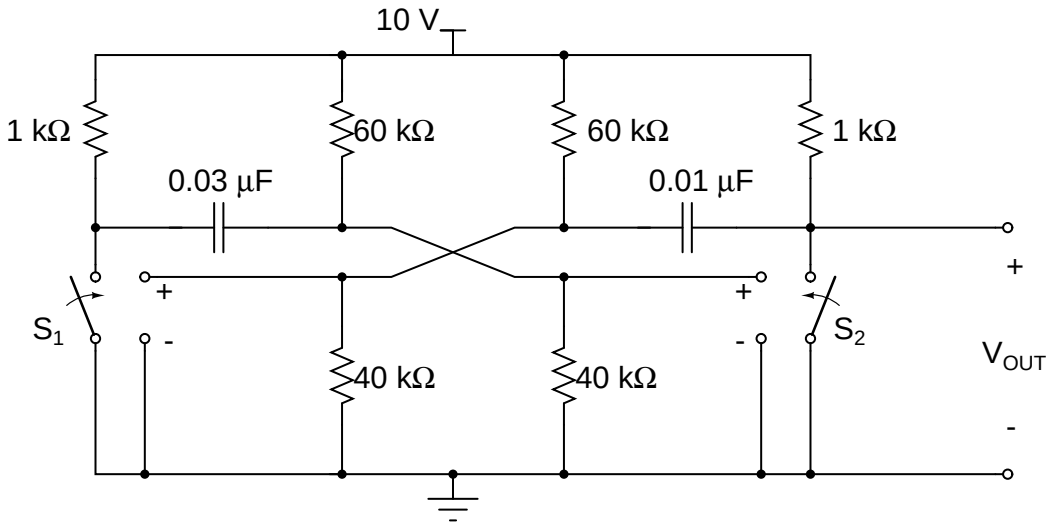
4. V_{IN} is a square wave with a 50% duty cycle and a frequency of 20 kHz. The filter is a high pass filter with a cutoff frequency of 80 kHz. What is the relative amplitude of the 3rd harmonic to the fundamental at the output of the filter?

   (a) -22.08 dB
   (b) -19.08 dB
   (c) -16.08 dB
   (d) -12.54 dB
   (e) -9.54 dB
   (f) -6.54 dB
   (g) none of the above

5. V_{IN} is a square wave with a 50% duty cycle and a frequency of 20 kHz. The filter is a low pass filter with a cutoff frequency of 60 kHz. What is the relative amplitude of the 3rd harmonic to the fundamental at the output of the filter?

   (a) -22.08 dB
   (b) -19.08 dB
   (c) -16.08 dB
   (d) -12.54 dB
   (e) -9,54 dB
   (f) -6.54 dB
   (g) none of the above

Problem 3: In the circuit below, the voltage–controlled switches, S_1 and S_2, are closed when the control voltage is > 2 V and open when the control voltage is < 2 V



1. What is the shape of the output waveform?
   (a) square waveform with a 50 duty cycle
   (b) square waveform with $< 50\%$ duty cycle
   (c) square waveform with $> 50\%$ duty cycle
   (d) triangular waveform
   (e) sinusoidal waveform
   (f) None of the above
2. What is the maximum value of V_{OUT}? _____
3. What is the frequency of the output waveform? _____
4. What is the duty cycle of the output waveform? _____
5. Estimate the power dissipated by this circuit _____

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