

Electronics
EECE2412 — Fall 2016
Exam #1

Prof. Charles A. DiMarzio
Department of Electrical and Computer Engineering
Northeastern University

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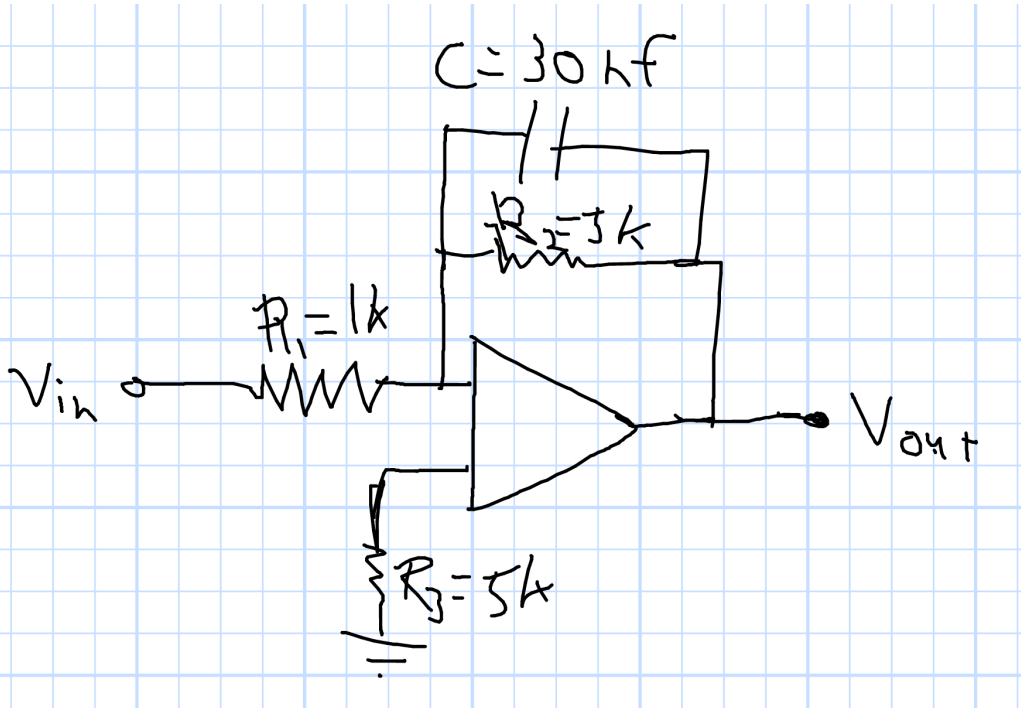
Name: _____ : Row # _____ : Seat # _____

General Rules:

- Write your name, row number, and seat number above. Row #1 is at the front. Seat #1 is to the left as viewed by the students.
- You may make use of two sheets of notes, 8.5-by-11 inches, using both sides of the page.
- You may use a calculator.
- Present your work as clearly as possible. I give partial credit if I can figure out that you know what you are doing. I do not give credit for putting down everything you know and hoping I will find something correct in it.
- Each question has a vertical black bar providing space for your work and a line for numerical answers. Please write your answer to each question clearly. If it happens to be correct, I give you points quickly and move on to the next problem. Please show your work in the space provided, or on extra pages, clearly labeled with the problem number. If the answer is wrong, this will make it easy for me to find ways to give you partial credit.
- Avoid any appearance of academic dishonesty. Do not talk to other students during the exam. Keep phones, computers, and other electronic devices other than calculators secured and out of reach.

1 Ideal Operational Amplifiers

The figure below shows an operational amplifier circuit. The Op-Amp is an ideal one with infinite open-loop gain. However, the amplifier receives its power from ± 12 Volt power supplies.



1.1 Gain

What is the low-frequency voltage gain of this circuit in decibels?

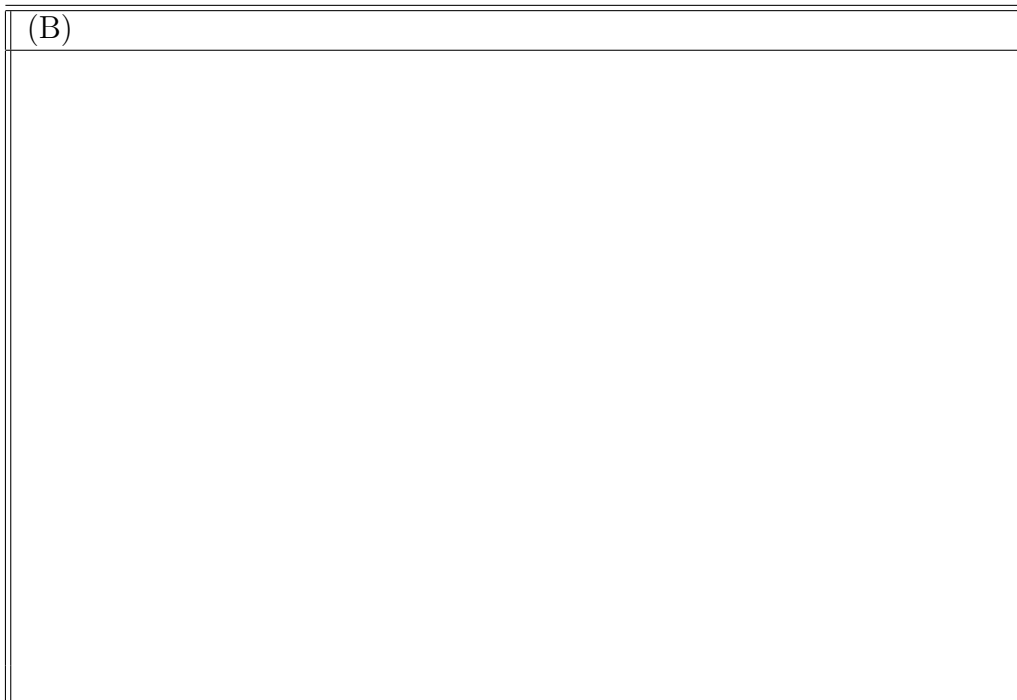
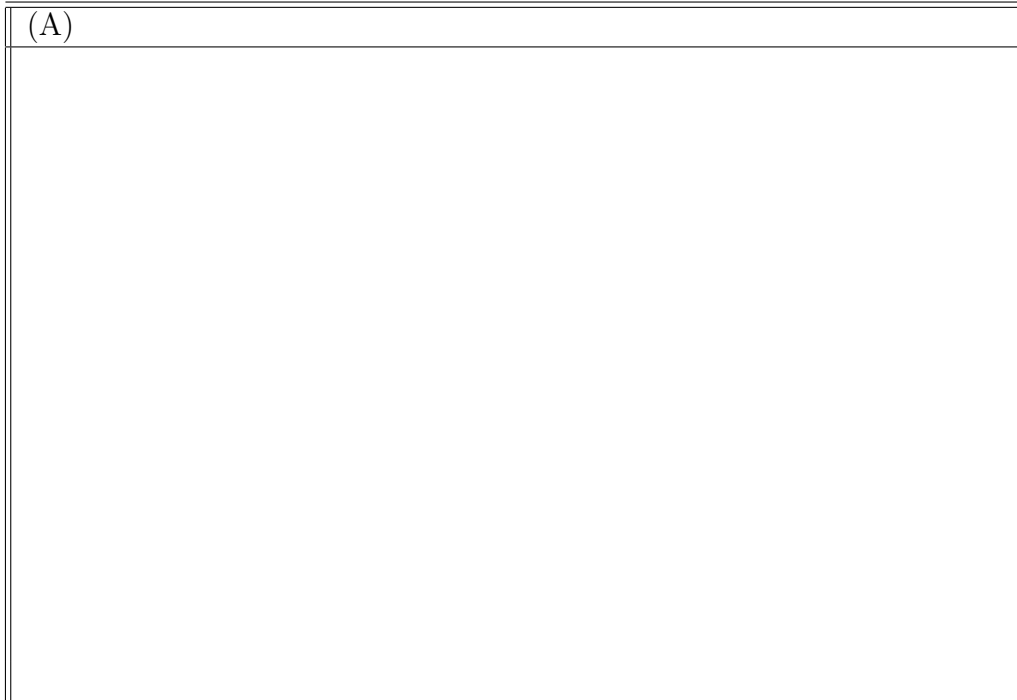
Gain: _____ dB

1.4 Output Waveforms

Plot a couple cycles of each output waveform, $v_{out}(t)$ if the input is

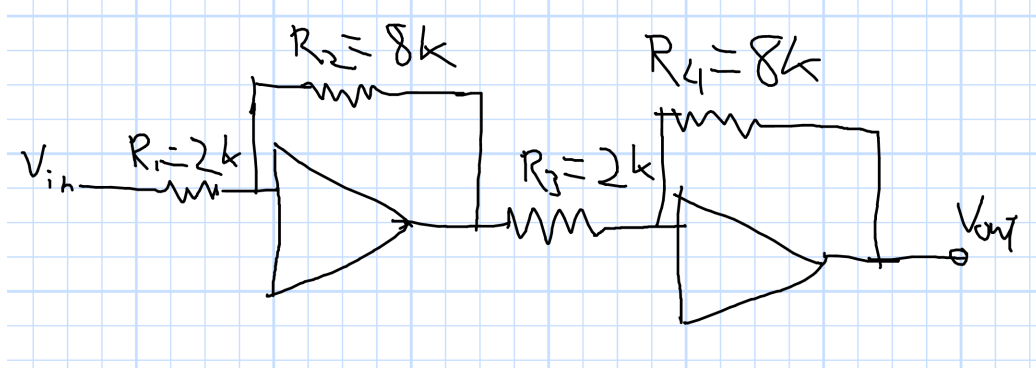
$$v_{in}(t) = (4 \text{ V}) \times \sin(2\pi ft)$$

where (A) $f = 10 \text{ Hz}$ and (B) $f = 3 \text{ kHz}$. Be sure to include numbers of seconds and volts on the axes.



2 Real Operational Amplifiers

The figure below shows a pair of operational amplifiers in a circuit. Each Op-Amp in this case has an open-loop gain of 10^5 , has a gain-bandwidth product of 1 MHz.



2.1 Gain of Stage

What is the gain of each stage in dB?



Gain: _____ dB

2.2 Bandwidth of Stage

What is the bandwidth of each stage?



Bandwidth: _____

2.3 Total Gain

What is the total gain in dB?



Gain: _____ dB

2.4 Bandwidth

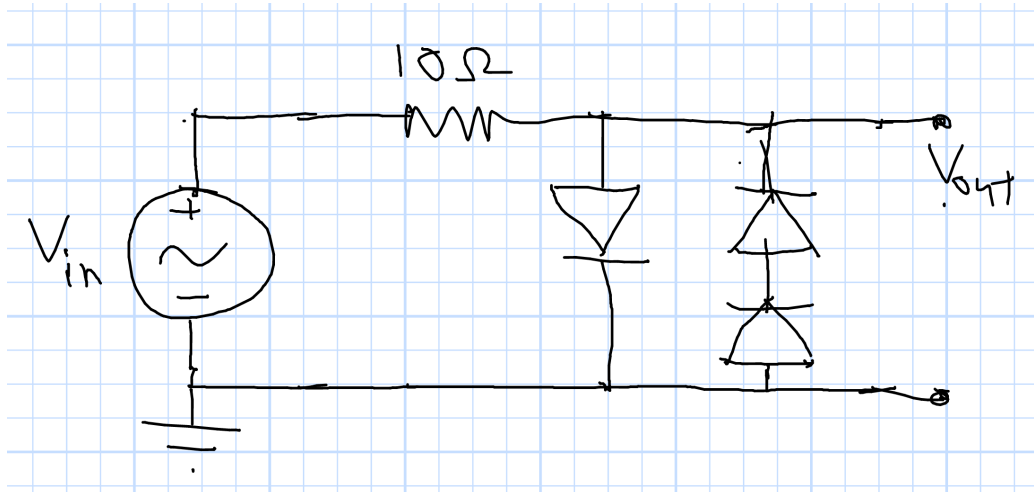
What is the approximate bandwidth of the complete circuit?



Bandwidth: _____

3 Diode Circuit with AC Input

The diode circuit below has a sinusoidal input voltage of 5 Volts, peak-to-peak, at 1 kHz.

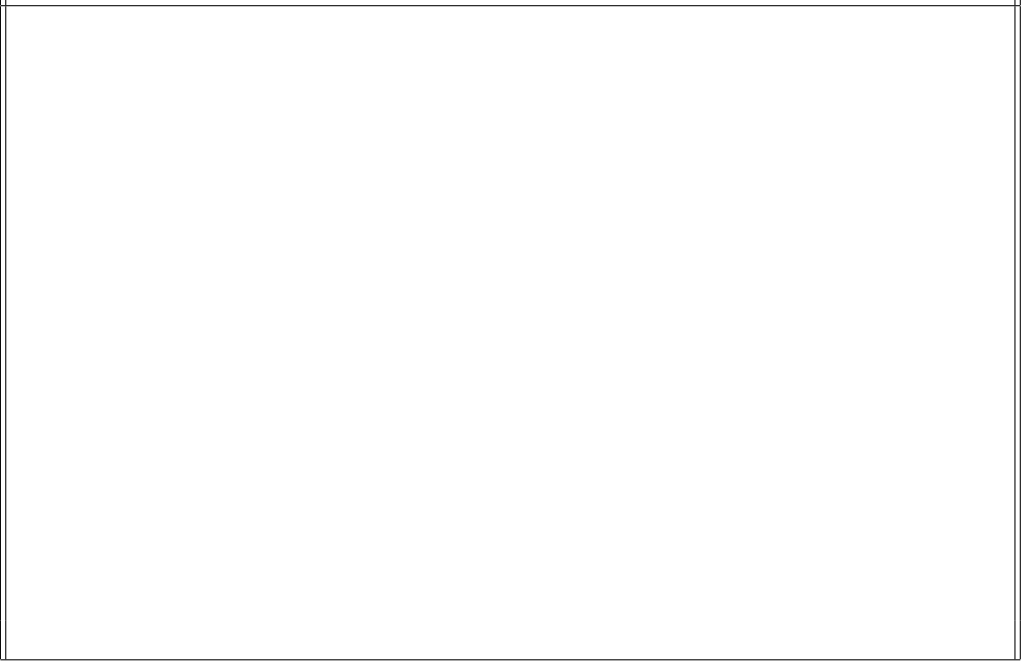


3.1 Function

What does this circuit do?

3.2 Transfer Characteristic

Plot the transfer characteristic, v_{out} as a function of v_{in} . Be sure to label axes and include numbers.

Transfer Characteristic Plot:


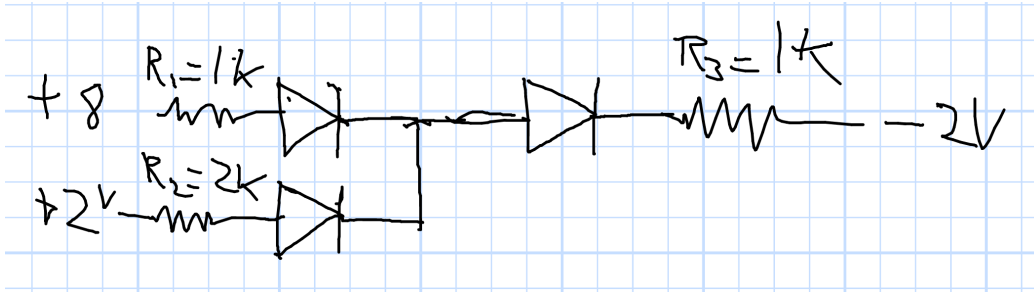
3.3 Output

Plot the output as a function of time for a couple of cycles. Be sure to label axes and include numbers.

Output Plot:


4 Multiple Diodes

The circuit below has 3 diodes. Assume that all can be modeled with the simplest model, namely the piecewise linear approximation with a short circuit or open circuit.



Which diodes are on and off?

Top Left: _____ Bottom Left: _____ Right: _____

What is the voltage at the center node?

Voltage: _____ Volts.

What is the current in each diode?

Top Left: _____ Bottom Left: _____ Right: _____

What is the voltage across each diode?

Top Left: _____ Bottom Left: _____ Right: _____