Electronics 2

FINAL

Professor Cliver ENT-2156

(EEET-221 36907)

Name: ______________________________

Class time (ex. 1 p.m.): ______________________________

1. If $I_{B+} = 214$ nA and $I_{B-} = 188$ nA determine the input offset current (I_{OS})

   (a) 26 nA

   (b) 214 nA

   (c) 402 nA

   (d) 201.00 nA

2. If $V_{IN1} = 7V, V_{IN2} = 1V, V_{O(SAT)} = \pm 15V and,\ R_L = 5K\Omega$ in figure 1, determine the output current I_L of the comparitor (the current through R_L).

   (a) 1.20 mA

   (b) 0.80 mA

   (c) -3.00 mA

   (d) 3.00 mA

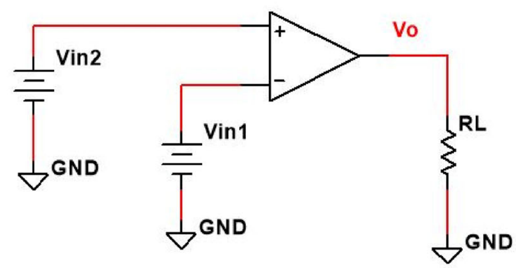


Figure 1: Comparitor

3. An op-amp has a slew-rate of $4\frac{V}{\mu s}$ and is configured as a non-inverting amplifier $R_F = 9.9K\Omega \; and \; R_I = 3.2K\Omega$. If a 8.00mV peak sine wave is applied to the non-inverting input, determine the slew rate limiting frequency (maximum sine wave frequency).

   (a) 19.4 MHz

   (b) 79.6 MHz

   (c) 122.1 MHz

   (d) 246.2 MHz

4. An op-amp has a unity gain frequency of 4 MHz and is configured as a non-inverting amplifier $R_f = 9.8K\Omega \; and \; R_i = 3.2K\Omega$. Calculate the rise time (t_{CL}) associated with the amplifier.

   (a) 4.00 ns

   (b) 1015.63 ns

   (c) 0.98 ns

   (d) 355.47 ns

5. Find V_{-} (voltage at the inverting input) if V_{in}=1.06V, R_i=62KΩ, R_f=18KΩ and R_L=134KΩ in Figure 2.

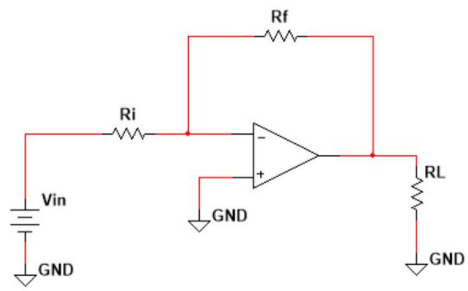


Figure 2: Inverting Amplifier

6. Find I_f (current in R_f) if V_{in}=0.20V, R_i=2KΩ, R_f=5KΩ and R_L=133KΩ in Figure 3.

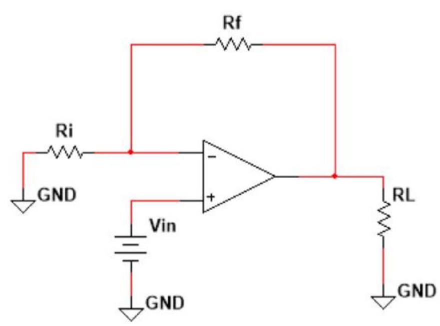


Figure 3: Non-Inverting Amplifier

7. Find V_{-} (voltage at the inverting input) if V_{in}=0.22V, R_i=40KΩ, R_f=12KΩ and R_L=141KΩ in Figure 4.

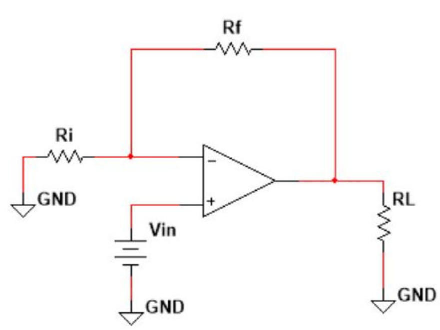


Figure 4: Non-Inverting Amplfier

8. Find the noise gain if V_{in}=0.54V, R_i=14KΩ, R_f=17KΩ and R_L=151KΩ in Figure 5.

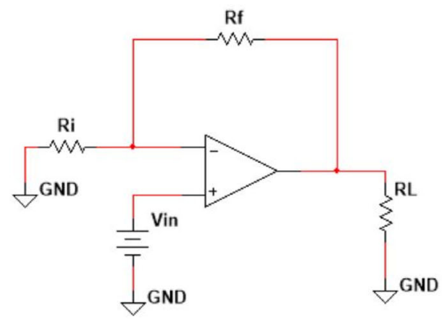


Figure 5: Amplifier

9. Find I_L (current in R_L) if V_{in}=0.58V, R_i=65KΩ, R_f=21KΩ and R_L=139KΩ in Figure 6.

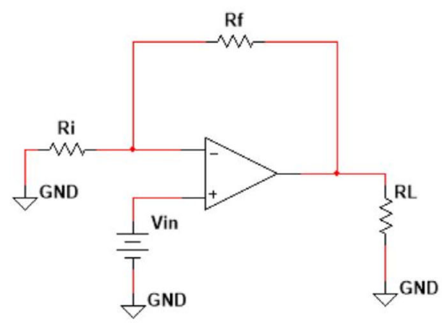


Figure 6: Non-Inverting Amplifier

10. Find V_L if V_{io}=4mV, R_i=2KΩ, R_c=2KΩ and R_f=153KΩ in Figure 7.

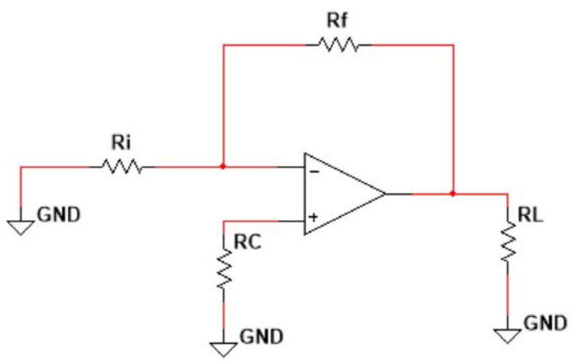


Figure 7: Input Offset Voltage

11. Find the closed loop 3-dB bandwidth for a non-inverting amplifier if the unity gain frequency B=3MHz, R_i=2KΩ and R_f=177KΩ.

The problems on this page both use the same figure.

12. Sketch the input-output characteristic curve given $R_1 = 9.3K\Omega, R_2 = 3.9K\Omega \; and \; V_{O(SAT)} = \pm 12V$ in Figure 8.

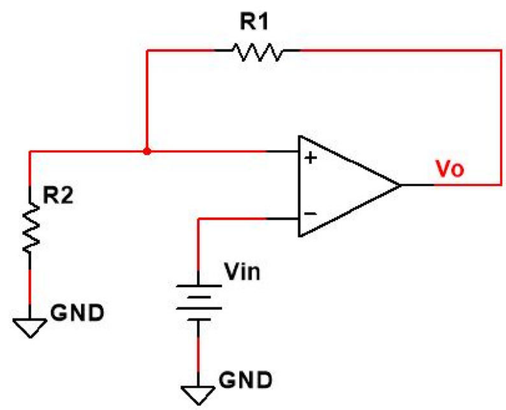


Figure 8: Inverting Schmitt Trigger

13. Sketch the output curve given the input curve in Figure 9 and $R_1 = 9.5K\Omega, R_2 = 3.5K\Omega \; and \; V_{O(SAT)} = \pm 13V$ in Figure 8.

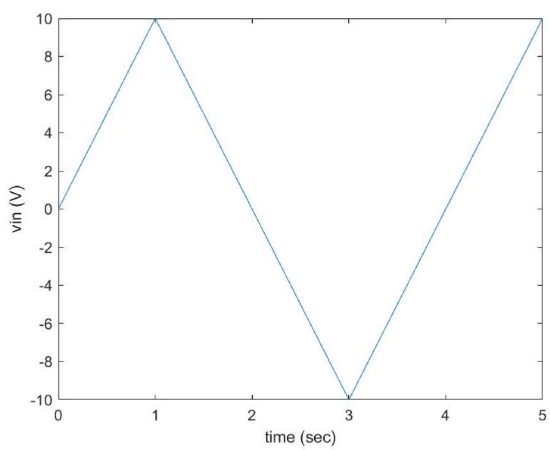
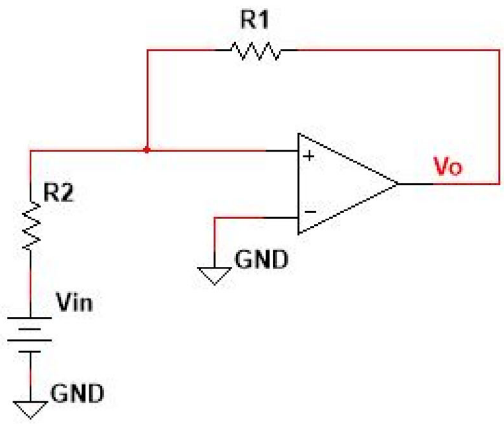


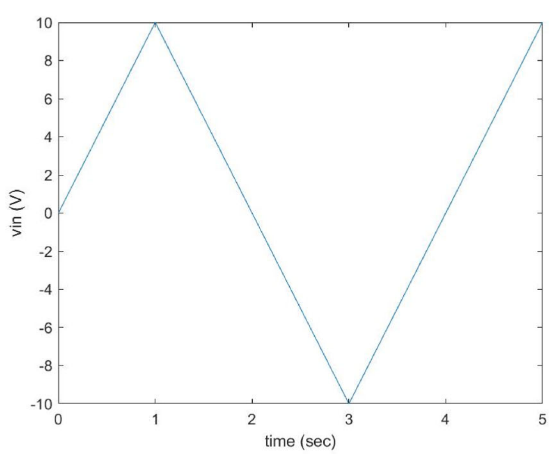
Figure 9: Input Output Curve

The problems on this page both use the same figure.

14. Sketch the input-output characteristic curve given $R_1 = 9.7K\Omega, R_2 = 3.2K\Omega$ and $V_{O(SAT)} = \pm 14V$.

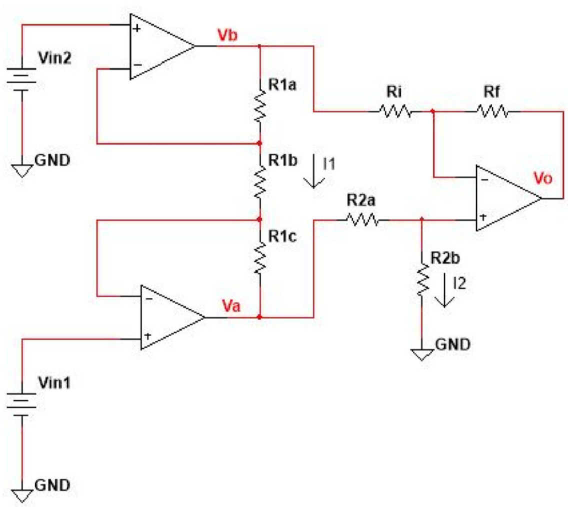


15. Sketch the output curve given the input curve and $R_1 = 8.1K\Omega, R_2 = 4.7K\Omega$ and $V_{O(SAT)} = \pm 14V$.



The problems on this page both use the same figure.

16. Determine the current I_1 given all resistors are $= 2.0K\Omega$ except R_{1b} that is $= 4.6K\Omega$ and $V_{in1} = 6V$ and $V_{in2} = 13V$.



17. Using the same circuit and values, determine I_2.

18. A 4-pole high-pass Butterworth filter has a 3-dB cutoff of 6 MHz. Use figure 8-7 to determine the decibel response at 2 MHz.

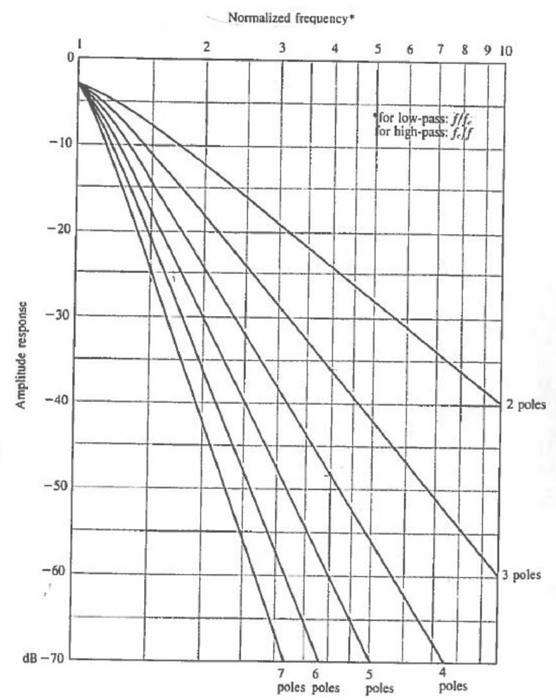
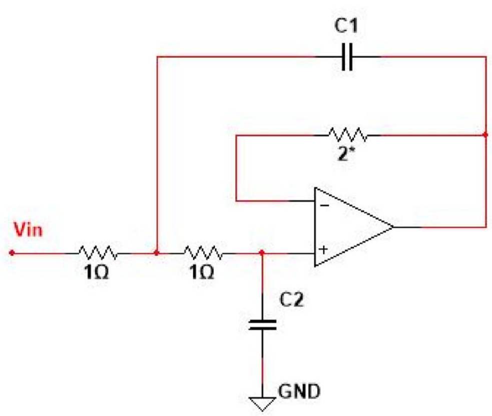


FIGURE 8–7
Stop-band amplitude response of Butterworth filters.

19. Design a two-pole low-pass Butterworth active filter using the unity-gain amplifier (below) to achieve a 3dB frequency of 6 KHz. Select the two filter resistances at 12KΩ each. Starting values for C_1 and C_2 are 1.414 and 0.7071, respectively.



20. What is the minimum order needed for a high-pass filter that has:

(a) relative amplitude $\leq$ 0.100 dB for f $\geq$ 4.0 KHz.

(b) relative amplitude $\geq$ 30.0 dB for f $\leq$ 0.600 KHz.

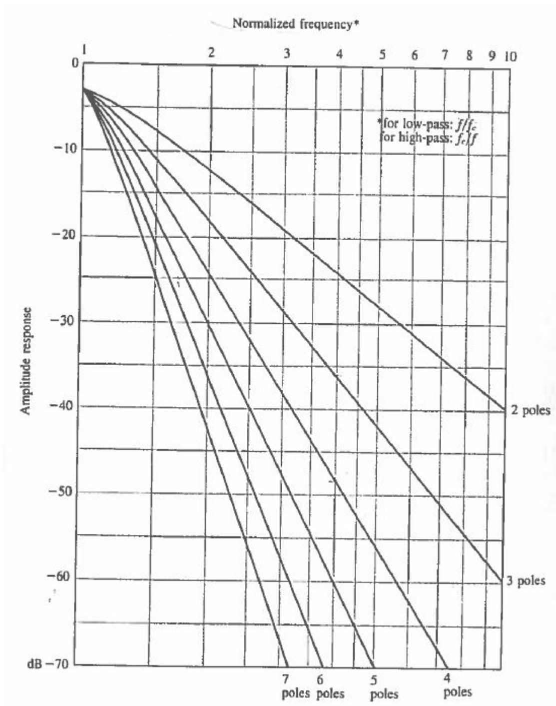


FIGURE 8–7
Stop-band amplitude response of Butterworth filters.

TABLE 8–1
Data for determining pass-band relative amplitude response for Butterworth filters

Amplitude Response (dB)	f/f_c for Low-Pass f_c/f for High-Pass					
	$n = 2$	$n = 3$	$n = 4$	$n = 5$	$n = 6$	$n = 7$
−0.01	0.219	0.363	0.468	0.545	0.603	0.648
−0.02	0.261	0.408	0.511	0.584	0.639	0.681
−0.05	0.328	0.476	0.573	0.640	0.690	0.727
−0.1	0.391	0.534	0.625	0.687	0.731	0.764
−0.2	0.466	0.601	0.683	0.737	0.775	0.804
−0.5	0.591	0.704	0.769	0.810	0.839	0.860
−1	0.713	0.798	0.845	0.874	0.894	0.908
−2	0.875	0.914	0.935	0.948	0.956	0.962
−3.01	1	1	1	1	1	1

21. What has been the most confusing point so far in the class?