Thursday Sep 12th?

CS375 Programming Assignment

In Java, write a program to sum the following sequence.

Use the appropriate Java data type to get 32 bit *floating point.*

1.0/1.0 + 1.0/2.0 + 1.0/3.0 + 1.0/4.0 + 1.0/5.0 + ... + 1.0/x where x = 150,000,000.0

Compute the sum twice. Once in a loop starting with the first term i.e., 1.0/1.0 +1.0/2.0+...

The second time, sum the loop from 1.0/x back towards 1.0/1.0.

i.e., 1.0/150000000.0+1.0/149999999.0+...

In a separate attached typed document compare and explain your results.

Did you get the same sum when processing the sequence in both directions?

If not, why not?

If your sums are not the same, which of your two sums is the most accurate?

If one is more accurate than the other, why is it more accurate?

Turn in your Java program, the program's output (a screen shot is ok) and the typed explanation.

Adam Stammer

4, 2, 8, 11, 14, 16, 21, 23

24/28

~~4.) $V_{BE} = .7$ $I_B = .1mA$ $30°C$~~

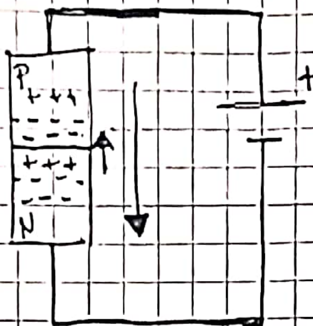
~~$V_{BE} = ?$ at $180°C$ 2mV drop / degree increase~~

~~$180 - 30 = 150°$ increase~~

~~$150° \cdot (2mV) = 300mV$ drop~~

~~So $V_{BE} \cong .4$ Volts~~

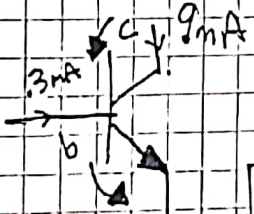
2.)



✓ Reverse Biased Emitter-Base Junction
(~.7V drop from base to emitter)

Forward Biased Collector-Base Junction
such that current will actually flow
from collector to emitter

8.) $i_C = 9mA$ $i_B = .3mA$ Find i_E, α, β be forward
bc reverse



$i_E = \beta i_B = i_C + i_B = 9.3mA$

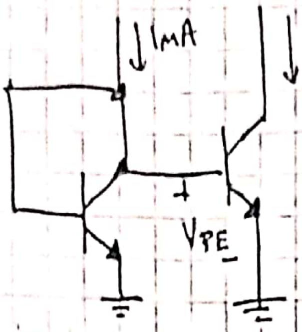
$\boxed{i_E = 9.3mA}$ $9mA = \beta(.3mA)$

$\boxed{\beta = 30}$ ✓

~~$\frac{\alpha}{\alpha - 1} = 30$ $30\alpha - 30 = \alpha$~~
~~$1 - \alpha$ $29\alpha = 30$~~
~~$\alpha = 1.0345$~~

$$\boxed{\alpha = \frac{\beta}{\beta + 1} = \frac{30}{31} \cong .97}$$

11.)



$I_{E1} = 10fA = 10^{-14} A$

$\beta = 100$ Find V_{BE} and I_{C2}

$1mA = I_{B2} + I_{B1} + I_{C1} \rightarrow 1mA = I_{B2} + I_{B1} + 100 I_{B1}$

$100 = \frac{i_C}{i_B} \rightarrow i_{C1} = 100 i_{B1}$

$1mA = I_{B2} + I_{B1} + 100 I_{B1}$ $\quad I_{B1} = I_{B2}$

$1mA = 102 I_{B1} \rightarrow I_{B1} = \frac{1mA}{102} = 9.8 \mu A$

$i_{C1} = 100 i_{B1} = 100(9.8) = 980 \mu A = .98 mA = i_{C2}$

$\cancel{i_C = \alpha I_{ES}\left[\exp\left(\frac{V_{BE}}{V_T}\right) - 1\right]}$ $\quad \alpha = \frac{\beta}{\beta+1} = \frac{100}{100+1} \approx .99$

$i_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right)$ $\quad I_S = \alpha I_{ES}$

$9.8\mu A = \alpha \cdot 10^{-14} \exp\left(\frac{V_{BE}}{26mV}\right)$

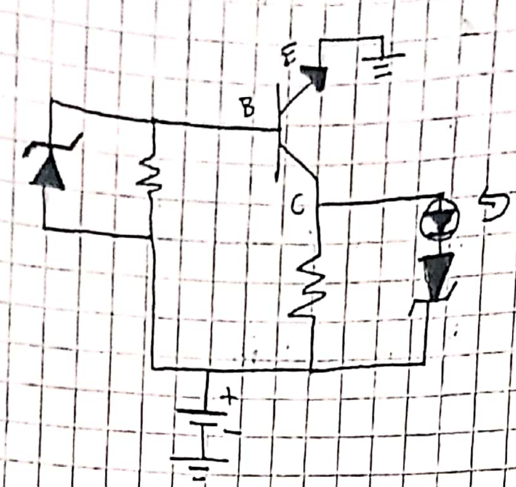
9.9E-15

$\ln\left(\frac{9.8e-6}{.99 \cdot E-14} + 1\right) = \frac{V_{BE}}{26mV}$

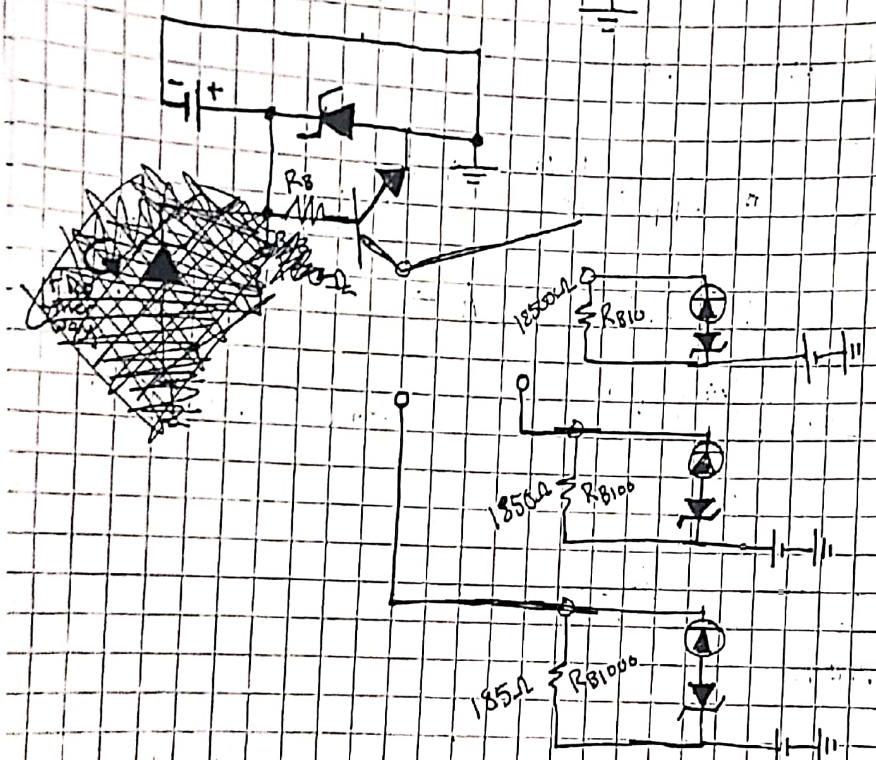
seems low

$\boxed{V_{BE} \approx .5385 \text{ Volts}}$

16.) β meter design



β at least meter



β at least 10

β at least 100

β at least 1000

All power sources are the same battery

So let's find our base current.

Our zener diode makes sure we have 4.7 Volts over R_B
So just use Ohm's Law to find that current.

$V = IR$
$4.7 - .7 = I_B(100000)$ ✓ $I_B = \cancel{.054}\,mA = .00004$ Amps
$= .04mA$

Case $\beta \geq 10$

$I_C = \beta I_B \rightarrow I_C = 10(.04mA) = .4mA$

Assuming our LED has a 2.7 Volt drop, we know that R_{B10} should have $2.7 + 4.7V$ across it.
Ohms law again to find R_{B10} since we know the collector current.

$V = IR \rightarrow 7.4 = I_C R_{B10} \rightarrow R_{B10} = \frac{7.4}{.0004} \cong 18{,}500\,\Omega$

Case $\beta \geq 100$

$I_C = \beta I_B \rightarrow I_C = 100(.04mA) = 4\,mA$
$V = IR \quad 7.4 = I_C R_{B100} \quad R_{B100} = \frac{7.4}{.004} \cong 1850\,\Omega$

Case $\beta \geq 1000$

$I_C = \beta I_B \rightarrow I_C = 1000(.04mA) = 40mA$
$V = IR \quad 7.4 = I_C R_{B1000} \quad R_{B1000} = \frac{7.4}{.04} \cong 185\,\Omega$

So now when the current ~~flows~~ through R_B is high enough, thus meeting the voltage requirements to overcome the diodes, the respective LED will turn on indicating the β is at least enough.

This meter doesn't really meet specs and nobody would buy it, but it's something.

So are the LED's Exclusive or summative? eg how many LED's will light if $\beta \approx 150$?

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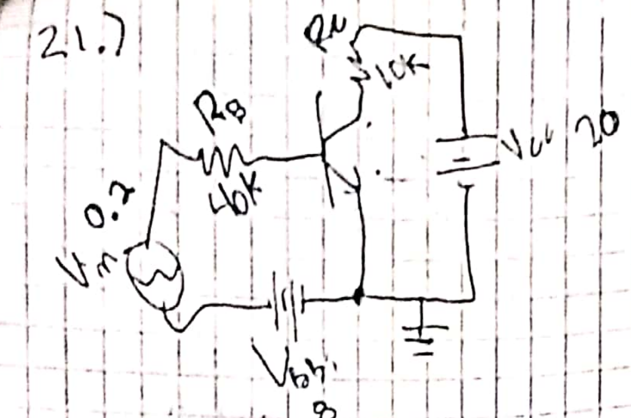
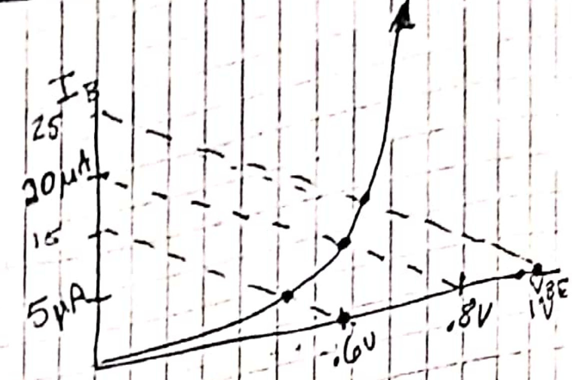
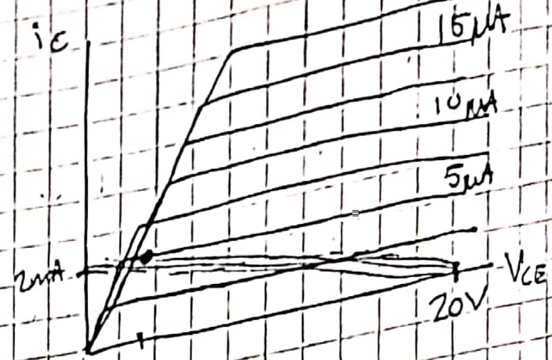
21.7







Q point

$V_{BB} - I_B(R_B) = V_{BE}$

$.8 - I_B(40k) = V_{BE}$

$V_{BE} = .8V$ at $I_B = 0$

$I_B = \frac{.8}{40k} = 20\mu A$ at $V_{BE} = 0$

$V_{BE} = .8 \pm .2 = 1V, .6V$

$I_B = \frac{.8 \pm}{40k} = 25\mu A, 15\mu A$

$V_{CC} - I_C(R_C) = V_{CE}$

$20 - I_C(10000) = V_{CE}$

$I_{C_0} = \frac{20}{10000} = .002A = 2mA$

$V_{CE_0} = 20$

$(2\mu A \rightarrow 10\mu A)$

Since much of this falls in the saturation region, much of this waveform gets clipped at the upper bounds.

Based on the characteristic graphs above It look likes anything above the q point will get clipped.

in what variable? V_{BE} or I_C?

.2 peak to peak input → .4
output → 12

~12.2v to ~.2v

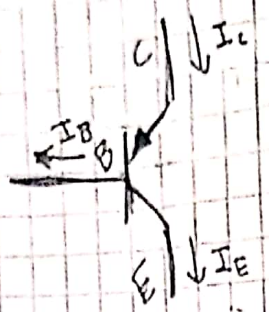
$\frac{12V}{.4} = 30$ gain

I don't know if we should call this an X gain with ~50% upper clipping or a ~50% X gain so to speak.

sketch the waveform and decide then.

Is it a 30 gain or a ~60 gain that's half clipped?

23.)



Adam Stammer

Electronics
Ch 3 51, 56, 78

Due Friday 25th, Oct

51) $I = 1mA$, $V_D = 0.6 Volts$, 300K Find I_S at n=1 and n=2

12/12

$I = I_S(\exp(\frac{V_D}{nV_T}) - 1)$

$.001 = I_S(\exp(\frac{.6}{.026}) - 1)$

$I_S \cong 9.5021 * 10^{-14}$ ~~at~~ when $n = 1$

$.001 = I_S(\exp(\frac{.6}{2(.026)}) - 1)$

$I_S \cong 9.743 * 10^{-9}$ ~~at~~ when $n = 2$

✓

56) $n = 1$, $I = 2mA$, $V_T = 26mV$
Find equivalent resistance for diode and compare results.
do the same with 2 in parallel

$R = \frac{nV_T}{I_D} = \frac{1(.026)}{.002} \cong 13\Omega$

✓

Two in parallel cuts current down to 1mA

so $R = \frac{1(.026)}{.001} = 26\Omega$

2 26Ω resistors in parallel have an equivalent resistance as a 13 Ω resistor. It would seem that this modeling hold true in diode equivalent resistances.

18.) $n=1$ $T=300k$

$I=I_s\left(\exp\left(\frac{V_D}{nV_T}\right)-1\right)$ $I=1mA$ $V_D=600mV$

How much does voltage need to increase to

a) double current b) increase current by 1 order of mag.

do these questions again when $n=2$

$I=I_s\left(\exp\left(\frac{V_D}{nV_T}\right)-1\right)$

Let's first find I_s. $I_s=\frac{.001}{\exp\left(\frac{.6}{.026}\right)-1}\doteq 9.502*10^{-14}$

$.001=I_s\left(\exp\left(\frac{.60}{.026}\right)-1\right)$

Now let's double current and solve for V_D. I'm expecting a relationship based on the exponent $e^y=2$ $\ln(2)\doteq .6931$

$n=1$

$.002=I_s\left(\exp\left(\frac{V_D}{.026}\right)-1\right)$ $\left(\frac{.618}{.6}\right)$

$\ln\left(\frac{.002}{I_s}+1\right)(.026)=V_D\doteq .618$ Volt V_D increased by ~3%

$.01=I_s\left(\exp\left(\frac{V_D}{.026}\right)-1\right)$ $\left(\frac{.65987}{.6}\right)$

$\ln\left(\frac{.01}{I_s}+1\right)(.026)=V_D\doteq .65987$ Volt V_D increased by ~10%

d

$n=2$

$.002=I_s\left(\exp\left(\frac{V_D}{2(.026)}\right)-1\right)$ $\left(\frac{.636}{.6}\right)$

$\ln\left(\frac{.002}{I_s}+1\right)(.026)(2)=V_D\doteq 0.6360$ V_D increased by ~6%

$.01=I_s\left(\exp\left(\frac{V_D}{2(.026)}\right)-1\right)$ $\left(\frac{.7197}{.6}\right)$

$\ln\left(\frac{.01}{I_s}+1\right)(.026)(2)=V_D\doteq .7197$ V_D increased by ~20%

When n doubled, so did our proportional increases ✓

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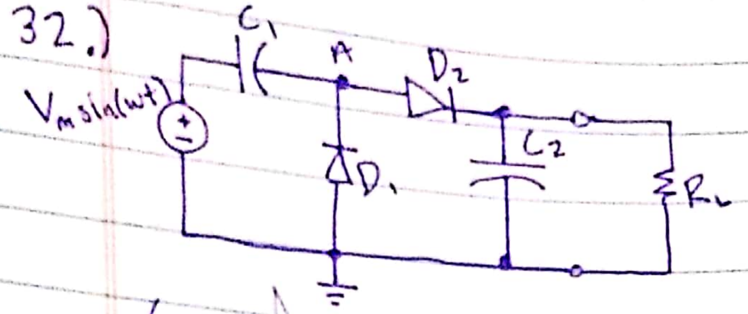
12/12

Electronics
Ch3 32, 33, 46

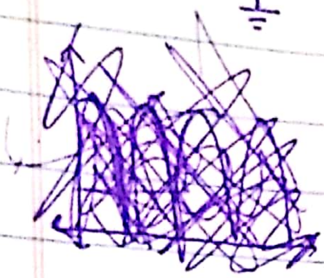
Adam Stammer

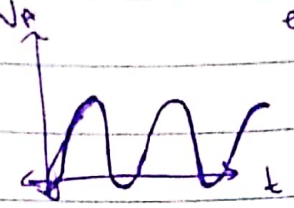
Due Wed. Oct 22nd

32.)



- Sketch voltage of point A against time
- Find Voltage across R_L
- Why Called Voltage Doubler?
- Find peak inverse voltage across each diode in terms of V_m

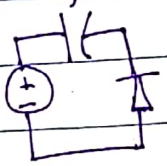




$$V_{R_L} \cong 2V_m - (V_{D1} + V_{D2}) = V_m + V_{C_1} - V_{D_1} - V_{D_2}$$

↳ if our input peaks at 5 Volts, our output will be roughly 8.8 Volts

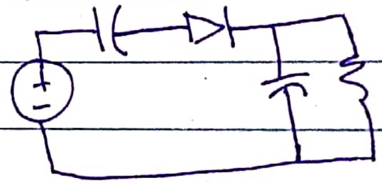
When input is in the negative cycle, D_2 is reverse biased and closed as seen here



with D_1 open and forward biased

This acts as a half bridge rectifier charging C_1 to $V_m - V_{D_1}$.

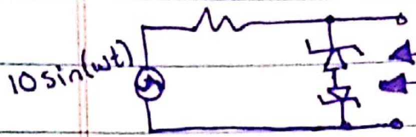
Then in the positive cycle D_1 is reversed biased and closed with D_2 forward biased and open. We then see the input voltage + $V_{C_1} - V_{D_2}$ to fall on the R_L which is our output. This effectively doubles our voltage minus the voltage drop of our diodes.



I believe C_2 serves to smooth out the rectified signal.

33) Design Clipper Circuit (3V, −5V)
input [-10, 10] assume 0.7V drop
design for peak current of 1mA

$V=IR \rightarrow 5=(.001)R \rightarrow R=\frac{5}{.001}=\boxed{5000\,\Omega}$

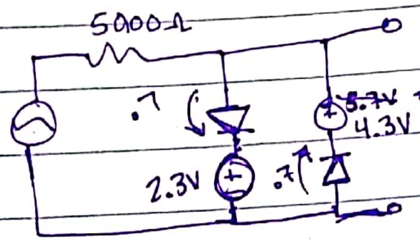


$3-.7=\boxed{2.3}$ Volt Reverse Breakdown

$-5-.7=\boxed{-5.7}$ Volt Reverse Breakdown

This much obvious doesn't work considering the negative breakdown voltage

So let's try something else

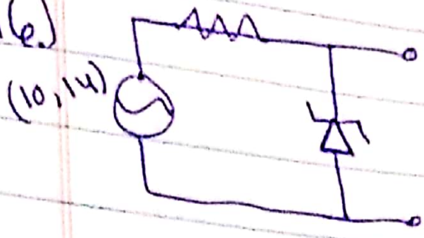


~~3~~ $3-.7=2.3$ Volts

~~$-5-.7=-5.7$~~ $-5+.7=-4.3$ Volts

✓

4b.)



5V Zener voltage regulator limit to 5mA

Load Voltage 10-14V

Load Current 0-10mA

Determine resistance to limit diode current

So look at peak case(s)

(10-14V) and (0-10mA)

This tells us that we do need to limit the current on ocassion

$V=IR$

$14=.005(R)$

$R=\frac{14}{.005}=\underline{2800}$

since 10V will cause a smaller current across a constant resistor it is not a peak ~~case we care about.~~

R should be at least 2800 Ω to limit the current but current will drop when the voltage is not at peak 14 Volts

This is all assuming all the voltage is lost on the resistor which isn't the case. The diode will take either the reverse biased 5 Volts or a forward biased .7 Volts. Let's work in the extreme that puts most voltage on the resistor.

So $V_R = 14\text{ Volts} - .7\text{ Volt} = 13.3\text{ Volt}$

$V=IR \rightarrow 13.3=.005(R)$ $\quad R=\frac{13.3}{.005}=2660$

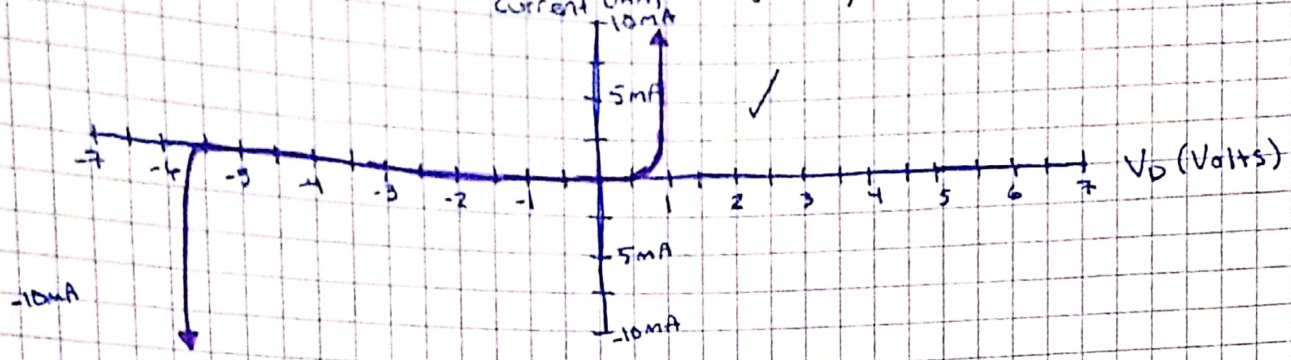
So in forward bias we would want $R=2660\,\Omega$.
In reverse bias it could be smaller but we need to design for the worst case.

This design however severly limits the load current. This particular design might have the voltage to charge a phone, but at <5mA Load current, I'd hardly even call it a trickle charge.

ectronics HW5

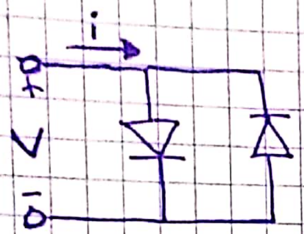
Ch 3: 3,5,7,8,10,15,19,20,24 36/36 Adam Stammer

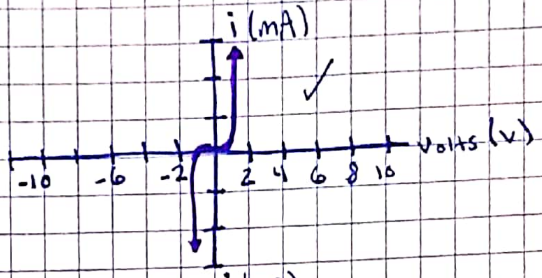
3.) Zener Diodes are intended to operate in an engineered/specified breakdown region. Usually they are used when the reverse bias voltage needs to remain constant. Sometimes they are called avalanche diodes or tunneling diodes depending on the breakdown voltage and the effect/phenomena that allows them to work the way they do.



✓

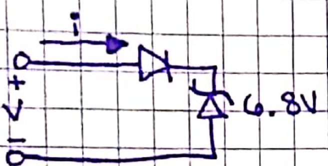
5.) a)

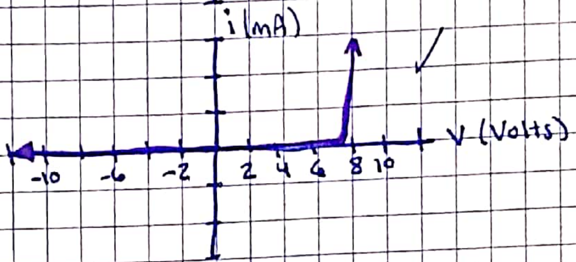




✓

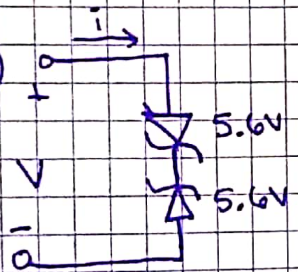
b)

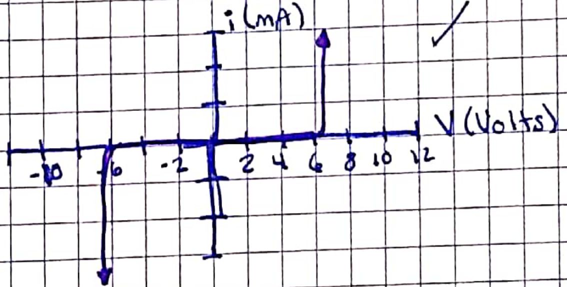




✓

c)





✓

7.) 25°C → 100mA → .65 Volts → 650mV $\frac{-2mV}{1K}$ $= \frac{(650-450)}{xK}$

x°C → —— → .45 Volts → 450mV

x ≅ +100 Kelvin

✓

decrease by 2mV/K

Since Celcius and Kelvin have a direct relationship, $\Delta C^\circ = \Delta K^\circ$ so ~~yep~~

x = 125°C this seems hot to me.

think about Rectifier w/ Heat Sink!

9) How many diodes in series to achieve 3 Volt reference voltage?

$$\frac{3\text{Volts}}{.6\text{Volts}} = 5$$: 5 diodes of .6 forward bias voltage drop could be used in series to achieve 3 Voltage reference

What percentage does this change when the temp goes up by 10° C?

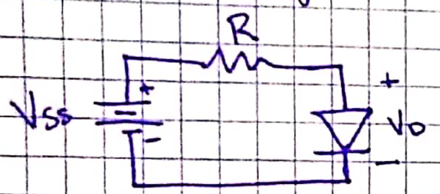
$$\frac{-2mV}{1K} \rightarrow \frac{x\ mV}{10K} = \frac{-2}{1}(10) = \boxed{-20mV}$$

however this change in voltage drop would apply to each diode so the real $\Delta V_{DF} = -20mV * 5 \equiv -100mV$

$$3\text{Volts} - 100mV = \boxed{2.9\text{Volts output}}$$

$$\frac{3-2.9}{3} = \frac{-.1}{3} \cong \boxed{-3.3\overline{3}\%}$$ change in the output

10.) Using Figure 3.7 as diode characteristics



Load Line Analysis at $V_{SS} = 1\text{Volt}$ and $R = 500\Omega$

Repeat for $V_{SS} = .5\text{Volt}$ and $R = 500\Omega$

$V_{SS} - RI_D - V_D = 0 \qquad V_{SS} = 1\text{Volt} \quad R = 500\Omega$

@ $I_D = 0$, $V_{SS} = V_D = 1\text{Volts}$

@ $V_D = 0$, $V_{SS} = RI_D$

$I_D = V_{SS}/R = 1\text{Volt}/500 = 2mA$

$V = IR$

$R = \frac{V}{I}$

$\frac{1}{R} = \frac{I}{V}$

$$m_1 = \frac{2mA}{1\text{Volt}} = \frac{.002}{1} = .002 = \frac{1}{500} = \frac{1}{R}$$

$V_{SS} - RI_D - V_D = 0$

@ $I_D = 0$, $V_{SS} = V_D = .5\text{Volt}$

@ $V_D = 0$, $V_{SS} = RI_D$

$I_D = V_{SS}/R = .5/500 = .001mA$

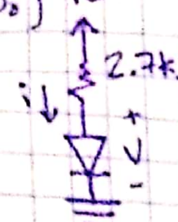
$$m_2 = \frac{.001}{.5} = .002 = \frac{1}{500} = \frac{1}{R}$$

V_{SS} does not seem to have an effect on the load line of our diode in this circuit. We can see both quantitatively and qualitatively that the slope for this circuit's load line is $\frac{1}{R}$. We've seen this kind of relationship in electronics before, I think. (When we used LEDs)

Solve the I and V of the circuits
Assume ideal diodes.

15.)

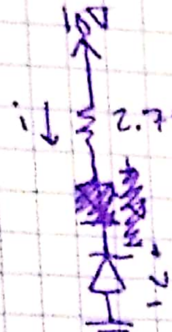
a)



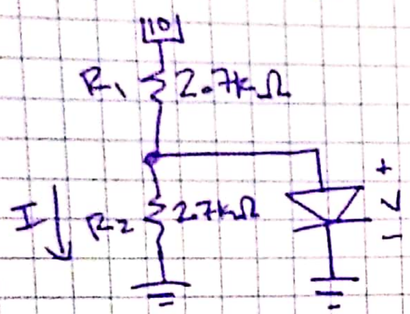
$V = IR \qquad I = \frac{V}{R} = \frac{10\,\text{Volts}}{2.7k\Omega} \approx \frac{1}{270} \approx .0037 = 3.7\,mA$

No Voltage drop over ideal diode. $V = 0$ Volts

b)

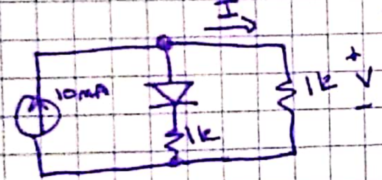


ideal diodes are just opencircuits with reverse bias, so no current will flow.
This does however put $V_D = 10$ Volts.



ideal diodes close circuit with forward bias so "all" the current will go through the diode instead of R_2. That makes this circuit identical to circuit a

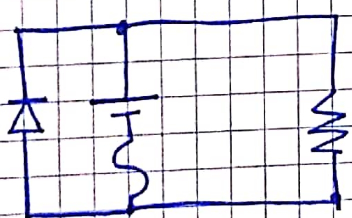
$I_D \cong 3.7\,mA \qquad I = 0\,mA \qquad V = 0$ Volts



Forward bias so diode closes. Circuit is 2 1kΩ resistors in parallel. Current will split so $I = 5\,mA$ and $V = IR$ so

$V = .005(1000) = 5$ Volts

19. Build battery protection circuit to avoid reverse polarity causing damage. Use diode(s) and a fuse.

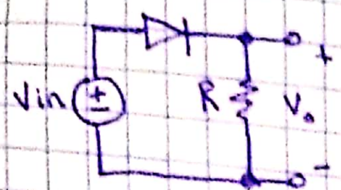


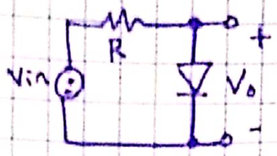
A fuse in series with the battery and a diode in parallel should protect the circuit.

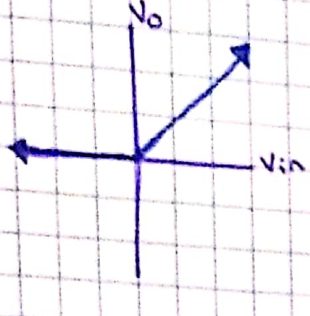
When the battery is placed correctly, the diode is reverse biased and open circuits. The circuit acts as expected, powering the load.

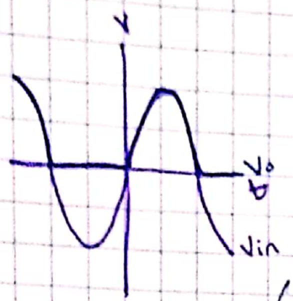
When the battery is placed backwards, the diode is forward biased, conducts electricity, short circuiting the battery and burns out the fuse, which would then need to be replaced.

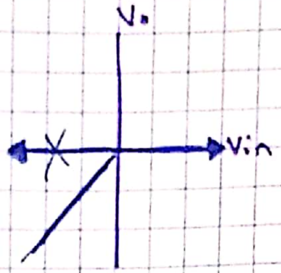
20.) Sketch transfer functions for the circuits and Plot V_o against time for $V_{in}(t) = 10\sin(200\pi t)$. Ideal diodes.

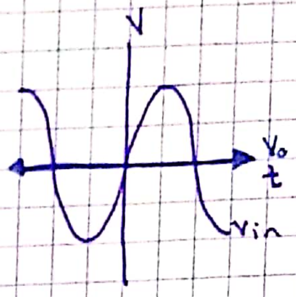




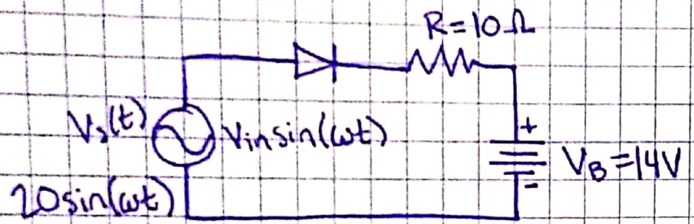


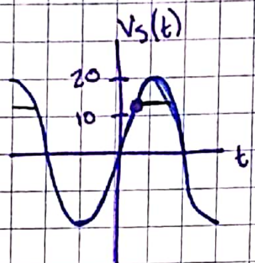


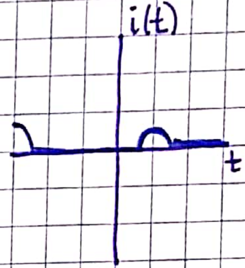




24.) Find the peak current, assume ideal diodes, Find percentage of cycle the diode is on (conducting), Sketch $V_s(t)$ and $i(t)$ to scale against time







An ideal diode is on for ~~the~~ any forward bias which would be ~~...~~ half of the time for a sin wave. So 50%

The battery will charge and current will flow only when the voltage is above 14V, as seen by the black line

We can solve for the ωt value at the dot marked above. It is the first time $V_{in}\sin(\omega t)$ ~~...~~ reaches 14 Volts. $20\sin(x) = 14 \rightarrow \sin^{-1}\left(\frac{14}{20}\right) = x$

We also know when it drops below 14 Volts will be mirrored on the other side of the peak. We are also using a period of 2π for this calculation. So let's take the time period above 14Volts and divide it by the total time period to get a percentage of ~~...~~ time when current flows and the battery charges.

$$\frac{\left(\left(\frac{2\pi}{4}\right) + \sin^{-1}\left(\frac{14}{20}\right)\right) - \sin^{-1}\left(\frac{14}{20}\right)}{2\pi} \doteq .25 = \boxed{25\% \text{ of the cycle is used to charge the battery}}$$

40 Adam Stammer

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Electronics Exam 1

Notes are allowed on the exam. Calculators are also allowed. Computers or internet-able devices are not allowed. Point values for each question are given in parenthesis.

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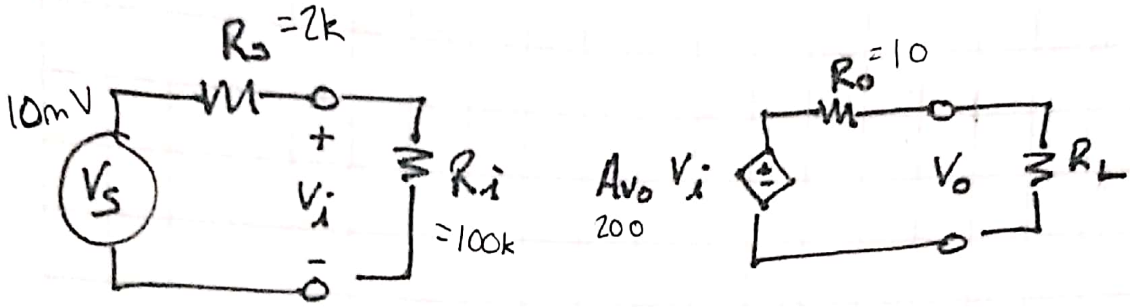
1. **(10) For the amplifier circuit shown, $R_s = 2k$, $R_i = 100k$, $A_{VO} = 200$, and $R_O = 10$ (all resistance values in Ohms). If $V_S = 10mV$, what is the minimum or maximum value of R_L so that *at least* $1.5v$ shows up at the output terminals of the amplifier?**



$V_i = \frac{R_i}{R_s+R_i}(V_s) = \frac{100k}{100k+2k} \approx .0981$ Volts $\approx .0098$ Volts $\approx 9.8mV$

$V_L = \left(\frac{R_L}{R_o+R_L}\right)(A_{vo}V_i) = \left(\frac{R_L}{R_o+R_L}\right)\left(A_{vo}\left(\frac{100k}{100k+2k}(.01)\right)\right)$

+10/10

$= \frac{R_L}{10+R_L}\left(200\left(\frac{100}{102}(.01)\right)\right) = 1.5$ Volts

$= \frac{R_L}{10+R_L}\left(\frac{200}{102}\right) = 1.5$ Volts

~~$\frac{R_L}{1.5}(200(\frac{100}{102})(.01)) = 10+R_L$~~ $10+R_L = \frac{R_L\left(\frac{200}{102}\right)}{1.5} = R_L\left(\frac{200}{153}\right)$

$10 = R_L\left(\frac{47}{153}\right)$ or $\boxed{R_L \approx 32.55\Omega}$

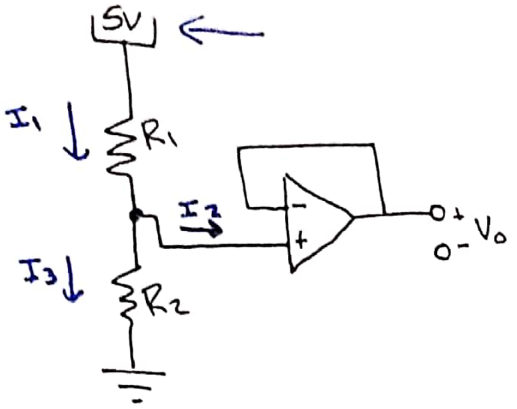
~~$R_L = 10(1.5)(200(\frac{100}{102})(.01)) = 300(\frac{100}{102}) \approx 294.1176471$~~

~~so the minimum resistor value would be roughly 295Ω to achieve 1.5 Volts on R_L~~

So a R_L = 33Ω resistor will put slightly more than 1.5 Volts on R_L. A larger resistor will put more of a portion of $A_{vo}V_i$ on R_L. ✓

10

2. (10) One problem with a voltage divider (that we found in lab) is that the divider's voltage output is sensitive to the amount of current that's pulled from the output. Specifically, if the load resistance the divider feeds is quite small, the voltage the divider supplies will drop. How can you use an op-amp in conjunction with the divider to create a voltage source that's current-independent? Sketch out a circuit to illustrate your answer.



You could use something other than 5 Volts.

Where $V_+ = \frac{R_2}{R_1+R_2}(5V)$

Since no current* will flow into V_+, $I_2 = 0$ which makes

$$I_1 = \cancel{I_2} + I_3 \Rightarrow I_1 = I_3$$

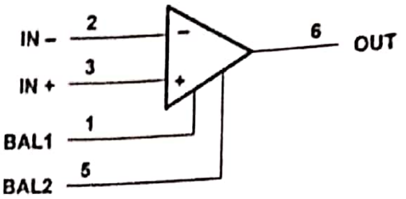
This would avoid extra voltage drop.

This amplifier could then be used as the input to another amplifier, inverting or otherwise, without current dependence.

* forgetting bias current ✓

10

3. (10) You need to amplify a signal by a factor of $A_{v0} = 30$. Your incoming source is v_s. You have only 1k and 10k resistors available. You also have a single LF411 op-amp (schematic shown).
   a. Sketch out a schematic,
   b. also sketch out the wiring diagram connections you'd make to the LF411.
   c. You also want to make measurements of the output current from the op-amp. Show how and where the current sensor would be wired.
   d. Show where the output voltage would be available.

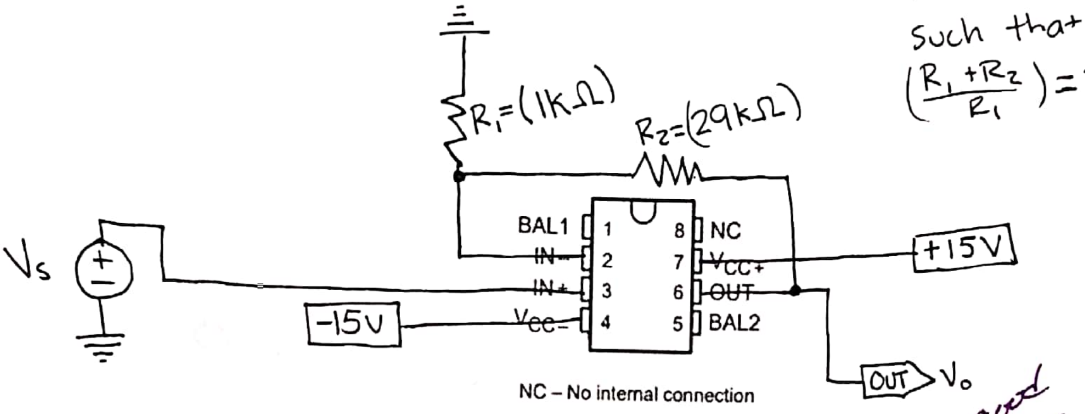


if $R_1 = 1k$, $R_2 = 29k = 9(1k) + 2(10k)$

So $\boxed{R_1 \text{ is } 1k}$

$\boxed{R_2 \text{ is 9 1k resistors in series with 2 10k resistors}}$

Such that $\left(\frac{R_1 + R_2}{R_1}\right) = 30$



good

R_1: 1kΩ

2×10k in parallel gives 5k

R_2: 1kΩ + 1kΩ + 1kΩ + 1kΩ + 1kΩ + 1kΩ + 1kΩ + 1kΩ + 1kΩ + 10K + 10KΩ = 29kΩ

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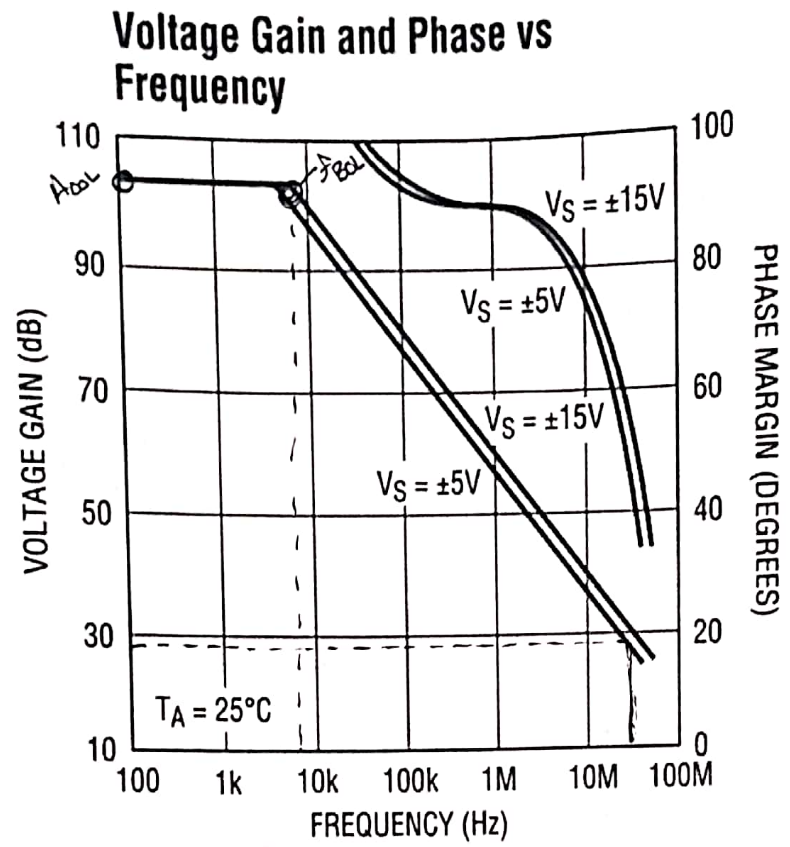
4. A graph of open-loop frequency gain vs frequency for a Linear Technologies LT1226 op-amp ($6.91 each at DigiKey) is shown.



a. (2) What is the gain-bandwith product,

ok.

1.4 GHz

$GBP = f_{BOL} \cdot A_{OOL} \doteq 8 kHz \cdot 105 dB$

$\mathcal{H}(t) =$

$= 8000 Hz \cdot 10^{105/20} \simeq \boxed{1423623528}$

b. (2) the open-loop bandwidth,

$\boxed{f_{BOL} \doteq 8 kHz}$ ✓

c. (2) and what bandwidth do you expect to see from this op-amp if it is designed with a closed-loop gain of $A_{CL} = 30$?

$20 \log(30) \doteq 29.54 dB$

Using the graph above, this corresponds to ✓ $\boxed{\approx 40MHz}$

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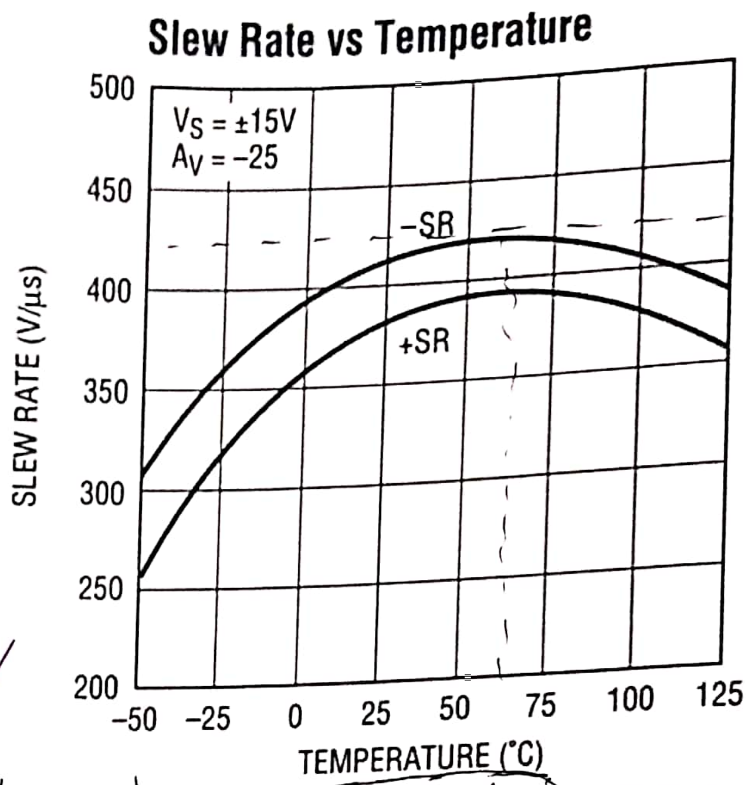
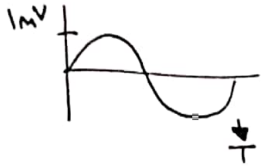
d. (6) Here is another figure from the same LT1226 spec sheet. If you wanted to amplify a 1mV amplitude sine wave with a closed loop gain of 30, what is the highest frequency you could amplify before the outputted sine wave suffers substantial distortion? Show your work.



$f = \frac{1}{T}$



At ~~??~~ room temperature our slew rate is roughly 380V/μs at ✓ its ~~?~~ worst. 1mV amplitude will take us ~~30~~ $\frac{380V}{1\mu s} \Rightarrow \frac{1mV}{x\,\mu s} = \frac{.001V}{x\,\mu s}$ $x = \frac{1}{380}(.001)\mu s = \boxed{2.63*10^{-6}\mu s}$

The rise is half of a slew cycle so I'll multiply this time by ~~2~~ two to get the period. $T \cong 5.26*10^{-6}\mu S = \boxed{5.26*10^{-12}\text{ seconds}}$

I think you're low by ≈10x ~~?~~ the derivative is greater I think.

So $f = \frac{1}{T} \Rightarrow \frac{1}{5.26*10^{-12}} \cong$ 190,000Hz so roughly 190kHz.

Anything faster than this will suffer distortion. Again, this is assuming room temperature and since electronics tend to warm I would consider this to be a high approximation and a dangerous assumption. How much of a problem slew distortion is would depend heavily on the application of the circuit. To be conservative I'd probably use a different op amp for any signal above 150kHz.

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