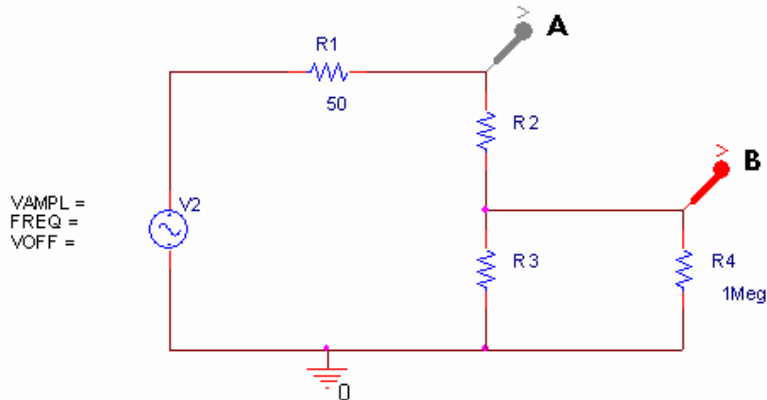


Questions on Instrumentation, Sine Waves and PSpice

These topics will be on the quiz in some form. They may be part of any of the four questions on the first quiz.

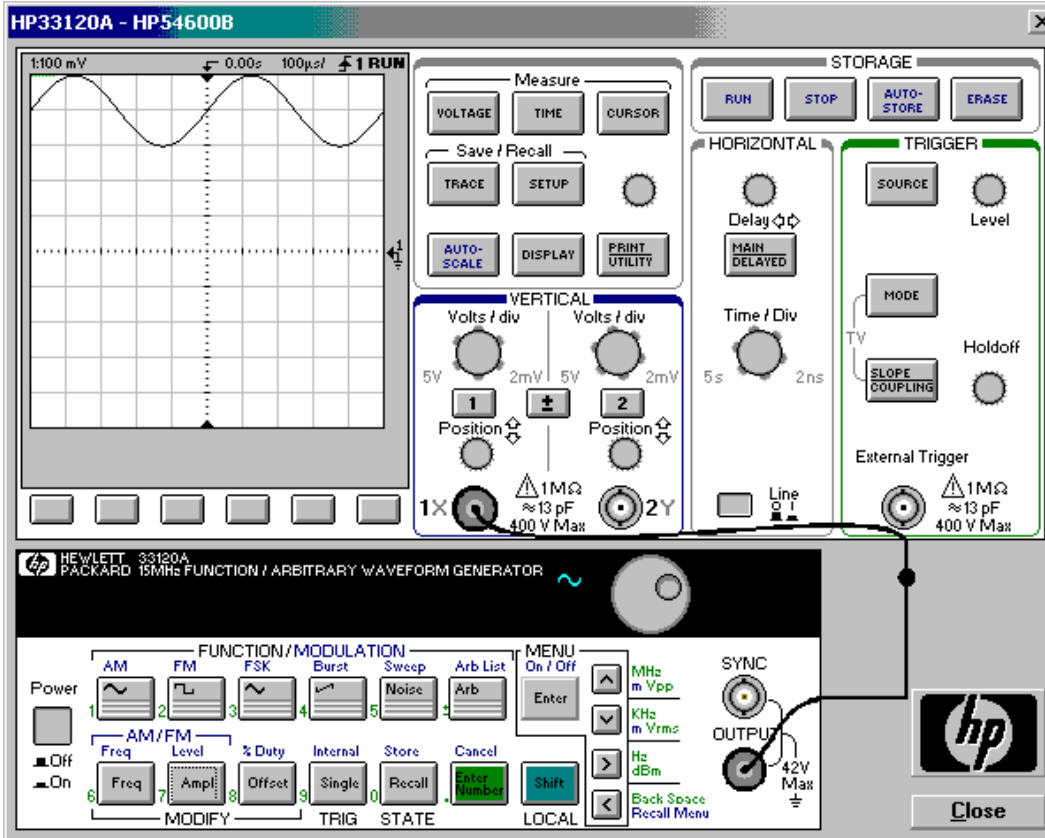
Spring 2004

5) Instrumentation and PSpice (20 points)



The circuit above shows a model of voltage divider circuit created in PSpice where $R2=2K$ ohms and $R3=2K$ ohms. Below is a picture of the 'scope and function generator'. It shows the input signal measured at marker A.

1:100mV 0.00s 100µs/ 1 RUN (The text at left is copied from the top of the 'scope display)



1) About what must be the parameters of the VSIN source to create the signal at A? (3 points)

VAMPL =

FREQ =

VOFF =

2) We want to create the actual circuit using the function generator, two resistors and both channels of the 'scope. Be as specific as possible in your answers.

a) How would you physically wire the circuit and connect it to the equipment? (5 points)

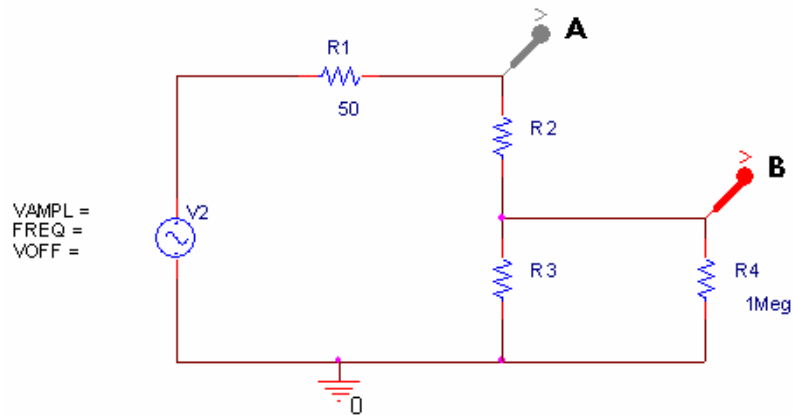
b) How would you manually set up the function generator to display the signal represented by V2? (5 points)

c) How would you manually adjust the 'scope to display the input signal shown? (5 points)

d) Sketch the output signal at marker B on the screen on the previous page. (2 points)

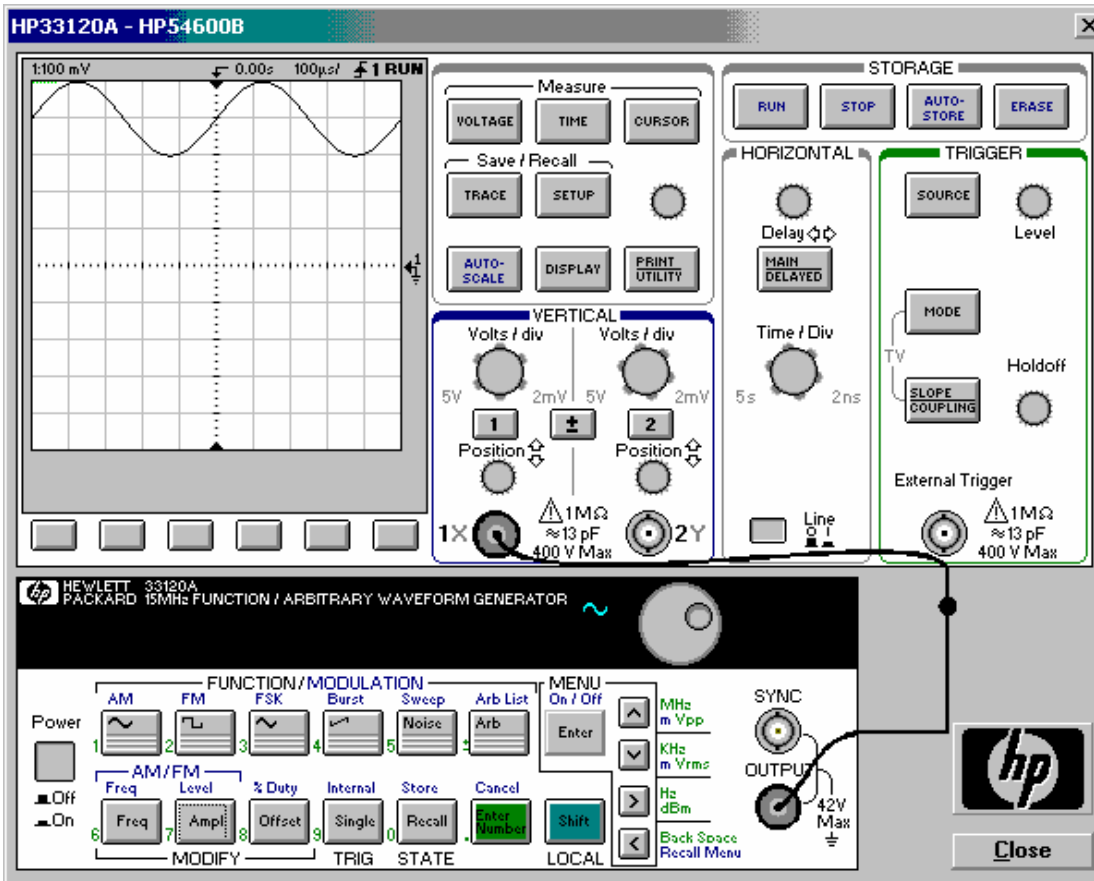
Spring 2004 solution

5) Instrumentation and PSpice (20 points)



The circuit above shows a model of voltage divider circuit created in PSpice where $R2=2K$ ohms and $R3=2K$ ohms. Below is a picture of the 'scope and function generator. It shows the input signal measured at marker A.

1:100mV 0.00s 100 μ s/ 1 RUN (The text at left is copied from the top of the 'scope display)



1) About what must be the parameters of the VSIN source to create the signal at A? (3 points)

$$V_{AMPL} = 100\text{mV} \quad FREQ = 1/(5 * 100 * 10EE-6) = 2\text{K} \quad VOFF = 400\text{mV}$$

2) We want to create the actual circuit using the function generator, two resistors and both channels of the 'scope. Be as specific as possible in your answers)

e) How would you physically wire the circuit and connect it to the equipment? (5 points)

Note that R1 is the internal resistance of the function generator and R4 is the internal resistance of the 'scope. They are not resistors in the circuit.

A. Wire the circuit

1. Use an alligator clip to connect one end of R2 to one end of R3.
2. Connect a "T" to the output of the function generator.
3. Connect a BNC cable to one end of the "T"
4. Connect a mini-grabber connector to the other end of the BNC cable.
5. Connect the red lead of the mini-grabber to the free end of R2
6. Connect the black lead of the mini-grabber to the free end of R3

B. Connect the 'scope

1. Connect the other end of the "T" in the output of the function generator to a BNC cable.
2. Connect the other end of this cable to channel 1 of the 'scope.
3. Connect another BNC cable to channel 2 of the 'scope.
4. Connect a mini-grabber connector to the end of this BNC cable.
5. Connect the red lead from the mini-grabber to the end of R3
which is in direct contact with R2.
6. Connect the black lead from the mini-grabber to the end of R3 which
is connected via a black lead directly to the function generator.

Answers may vary

f) How would you manually set up the function generator to display the signal represented by V2? (5 points)

1. Set the Frequency by pressing the “Freq” button and turning the dial until the display on the function generator reads 2K.
2. Set the amplitude by pressing the “Ampl” button and turning the dial until the display on the function generator reads 100mV p-p [which is equivalent to 100mV amplitude – ½ desired]
3. Set the DC offset by pressing the “Offset” button and turning the dial until the display on the function generator reads 200mV [which is equivalent to 400mV – ½ desired]

g) How would you manually adjust the ‘scope to display the input signal shown? (5 points)

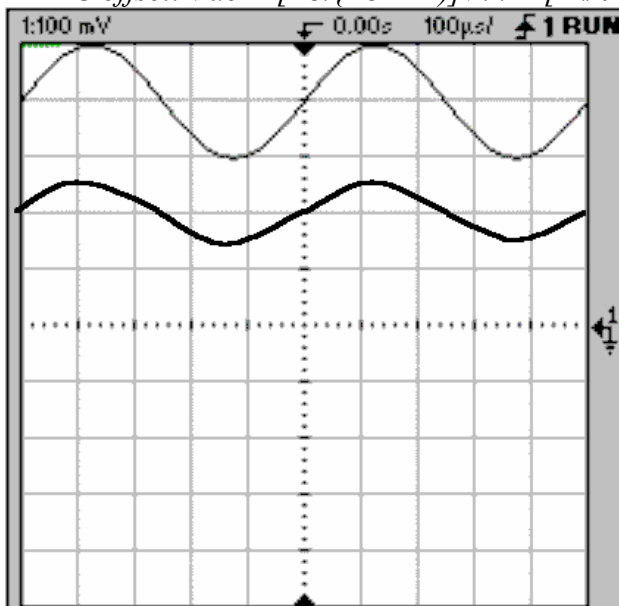
1. Set the vertical scale by pressing the “1” key for channel 1 and turning the “Volts/div” dial until the display in the upper left corner of the screen reads 1:100mV.
2. Set the horizontal scale turning the “Time/Div” dial until the display in the center right of the screen reads 100µs/.
3. Turn the position knob for channel 1 until the <--1 arrow aligns with zero.

h) Sketch the output signal at marker B on the screen on the previous page. (2 points)

[A only]

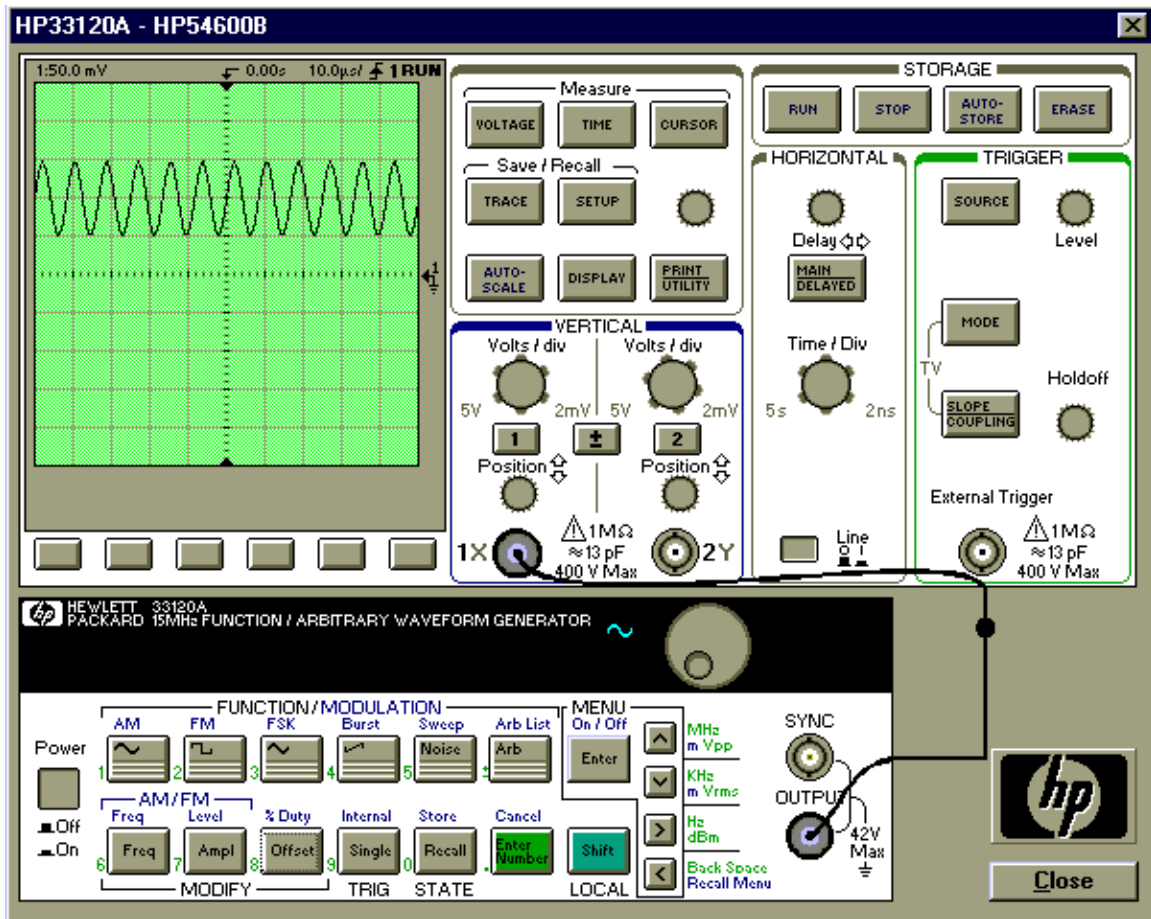
$$\text{Amplitude: } V_{out} = [R3 / \{R3 + R2\}] V_{in} = [2k / 4k] 100mV = 50mV$$

$$\text{DC offset: } V_{dc} = [R3 / \{R3 + R2\}] V_{in} = [2k / 4k] 400mV = 200mV$$



Fall 2003

5. Instrumentation and Sine Waves (20 points)



a) Explain as simply as possible how to set up the function generator and 'scope to display the signal shown. (Use of Autoscale is NOT allowed). **Give specific values.** (8 points)

b) If you were to attach another function generator to channel 2 of the 'scope, what would you set the frequency of the signal output by the second function generator to in order to generate a Lissajous pattern that looks like an upright figure eight? (Assume channel 1 is on the x axis) (2 points)

How would you set up the 'scope to display this signal? (2 points)

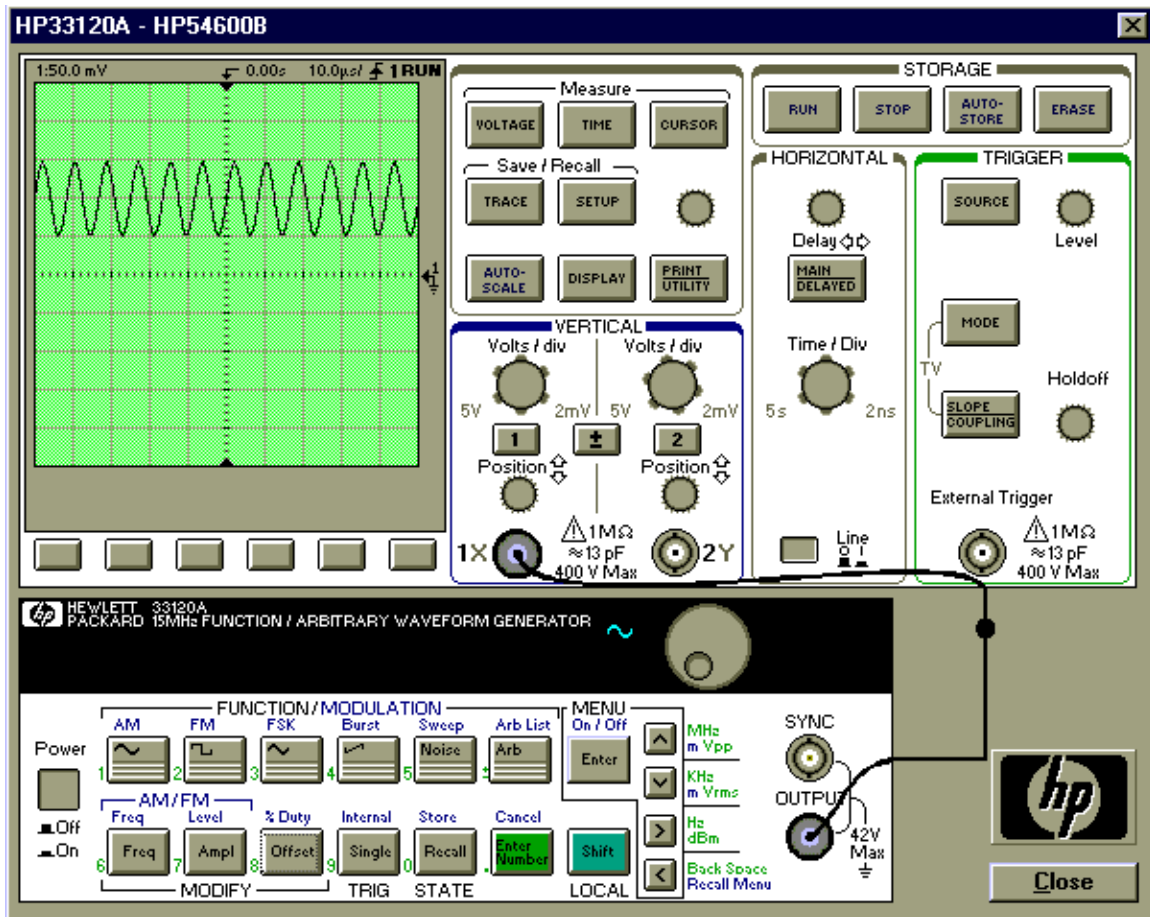
c) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct?

(2 points)

Why? (6 points)

Fall 2003 solution

5. Instrumentation and Sine Waves (20 points)



a) Explain as simply as possible how to set up the function generator and 'scope to display the signal shown. (Use of Autoscale is NOT allowed). **Give specific values.** (8 points)

- 1) Turn on the 'scope and the function generator.
- 2) Connect a BNC cable from the function generator output to channel 1 of the 'scope.
- 3) Push the Freq button on the function generator.
- 4) Turn the dial until the frequency reads 120K Hz. (6 cycles/5x10 μ s)
- 5) Push the Ampl button on the function generator.
- 6) Turn the dial until the peak-to-peak voltage on the function generator display reads 50 mV (or Amplitude reads 25mV). (This is 1/2 observed on 'scope.)
- 7) Push the Offset button on the function generator.
- 8) Turn the dial until the DC offset on the function generator display reads 50 mV.
- 9) Adjust the volts/div for channel 1 to 1:50 mV.
- 10) Adjust the time/div for the horizontal trigger to 10.0 μ s/
- 11) Turn the position knob for channel 1 until the arrow lines up with the zero mark.

b) If you were to attach another function generator to channel 2 of the 'scope, what would you set the frequency of the signal output by the second function generator to in order to generate a Lissajous pattern that looks like an upright figure eight? (Assume channel 1 is on the x axis) (2 points)

How would you set up the 'scope to display this signal? (2 points)

$X:Y = 1:2 = \text{sideways figure 8 (on crib sheet)}$

You want an upright figure 8. Therefore, $X:Y = 2:1$

$X:Y = 120K:Y = 2:1 \quad 2Y = 120K \quad Y = 60KHz$

Set other function generator to 60K Hz.

To get a Lissajous figure. Press the Main/Delayed button and then press the XY soft key.

c) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct?

(2 points)

Why? (6 points)

The function generator reads half of the scope. The scope is correct.

The function generator expects a 50 ohm load. It has an internal impedance of 50 ohms. When it outputs a voltage, it assumes that that 50 ohm load is there and it has a voltage divider which divides the voltage in half. To account for this, the function generator displays half of what it is actually putting out. When you put a large load like the 'scope on the function generator, you no longer have a voltage divider that divides the voltage in half. The load is so big relative to the 50 ohm impedance of the function generator, that the output is more or less equal to the amount that the function generator is actually putting out. The function generator has no way of knowing this, therefore, it still displays half of what it puts out and the display reads incorrectly.

Spring 2003

3. Instrumentation and Sine Waves (20 points)

You follow this procedure in the studio:

- 1) Turn on the 'scope and the function generator.
- 2) Connect a BNC cable from the function generator output to channel 1 of the 'scope.
- 3) Push the Freq button on the function generator.
- 4) Turn the dial until the frequency reads 2K Hz.
- 5) Push the Ampl button on the function generator.
- 6) Turn the dial until the peak-to-peak voltage on the function generator display reads 100 mV.
- 7) Push the Offset button on the function generator.
- 8) Turn the dial until the DC offset on the function generator display reads 50 mV
- 9) Adjust the volts/div for channel 1 to 1:50 mV.
- 10) Adjust the time/div for the horizontal trigger to 200 μ s/
- 11) Turn the position knob for channel 1 until the arrow lines up with the zero mark.

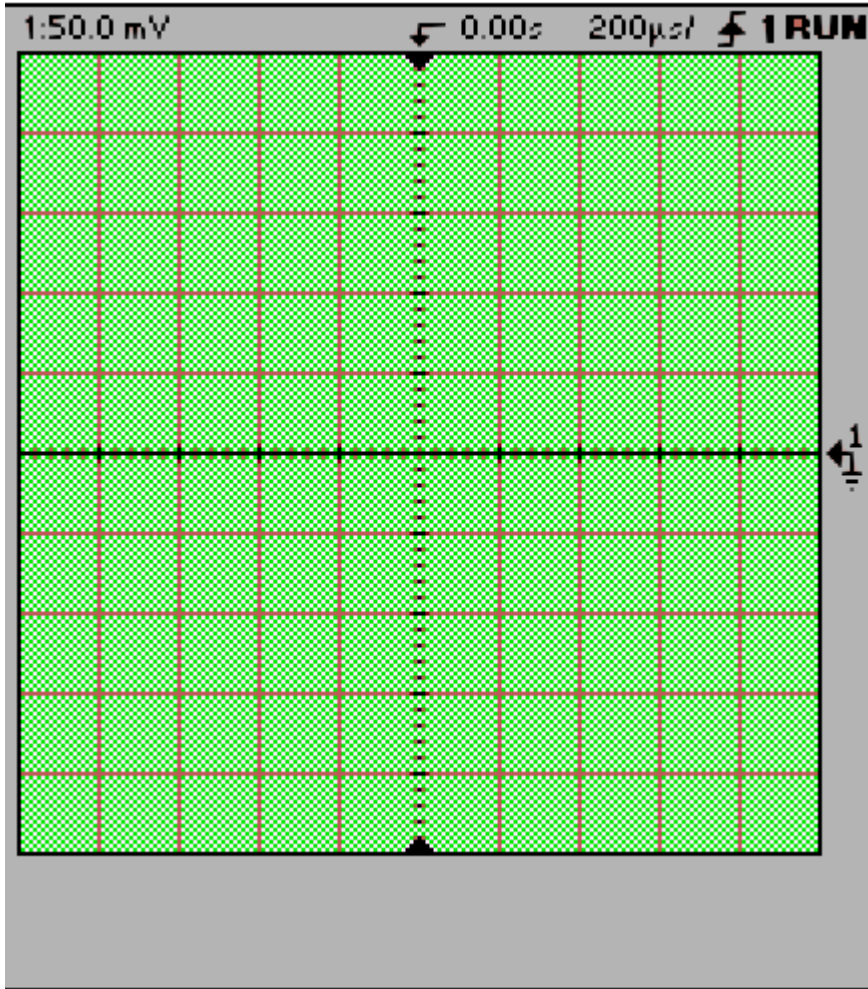
a) (2 points) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct?

b) (8 points) Find the following for the signal you have created (specify all units).

- i) the frequency (f)
- ii) the angular frequency (ω)
- iii) the period (T)
- iv) the peak-to-peak voltage (V_{p-p})
- v) the amplitude (A)
- vi) the DC offset voltage (V_{dc})
- vii) the rms voltage (V_{rms})
- viii) the phase (ϕ)

c) (2 points) Write down the mathematical expression for the trace in the form:
 $v(t) = V_{dc} + A \sin(\omega t + \phi)$.

d) (8 points) Sketch what the output should look like on the display below.



Spring 2003 solution

3. Instrumentation and Sine Waves (20 points)

You follow this procedure in the studio:

- 1) Turn on the 'scope and the function generator.
- 2) Connect a BNC cable from the function generator output to channel 1 of the 'scope.
- 3) Push the Freq button on the function generator.
- 4) Turn the dial until the frequency reads 2K Hz.
- 5) Push the Ampl button on the function generator.
- 6) Turn the dial until the peak-to-peak voltage on the function generator display reads 100 mV.
- 7) Push the Offset button on the function generator.
- 8) Turn the dial until the DC offset on the function generator display reads 50 mV
- 9) Adjust the volts/div for channel 1 to 1:50 mV.
- 10) Adjust the time/div for the horizontal trigger to 200 μ s/
- 11) Turn the position knob for channel 1 until the arrow lines up with the zero mark.

a) (2 points) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct?

The function generator reads half of the scope. The scope is correct.

b) (8 points) Find the following for the signal you have created (specify all units).

i) the frequency (f) $f = 2K Hz$

ii) the angular frequency (ω) $\omega = 2\pi f = 2\pi \times 2k = 4k\pi$
 $\omega = 4k\pi rad/sec = 12566 rad/sec$

iii) the period (T) $T = 1/f = 1/2k = 0.5 ms$ $T = 0.5ms$

iv) the peak-to-peak voltage (V_{p-p}) $V_{p-p} = 200mV$

v) the amplitude (A) $A = 100mV$

vi) the DC offset voltage (V_{dc}) $V_{dc} = 100mV$

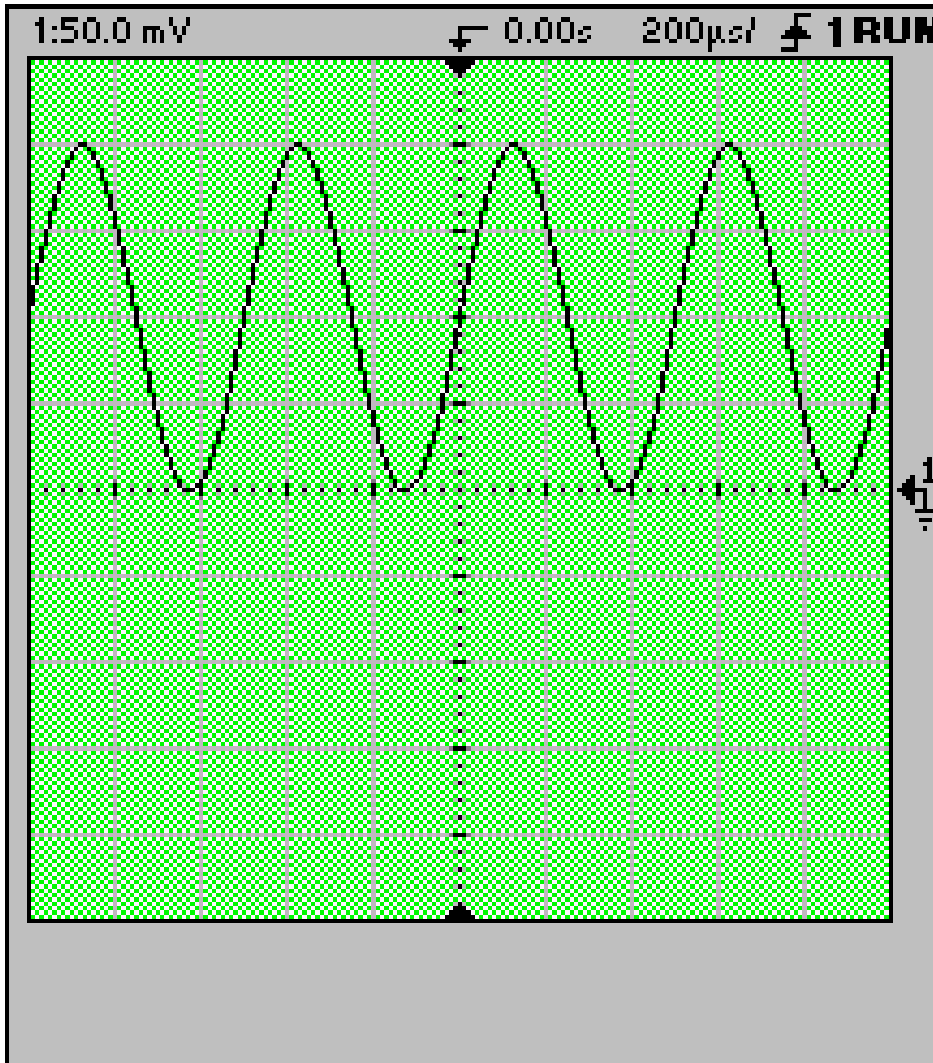
vii) the rms voltage (V_{rms}) $V_{rms} = 100/\sqrt{2}$
 $V_{rms} = 70.7mV$

viii) the phase(ϕ) $\phi = 0$ (scope automatically triggers at 0)

- c) (2 points) Write down the mathematical expression for the trace in the form:
 $v(t) = V_{dc} + A \sin(\omega t + \varphi)$.

$$\underline{v(t) = 100mV + 100mV \sin(4K\pi t)}$$

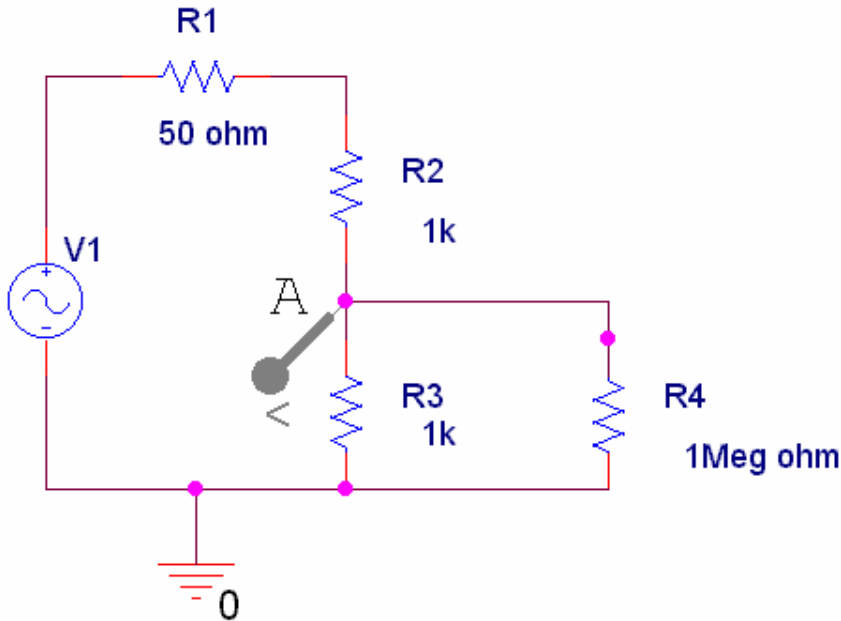
- d) (8 points) Sketch what the output should look like on the display below.



Spring 2003

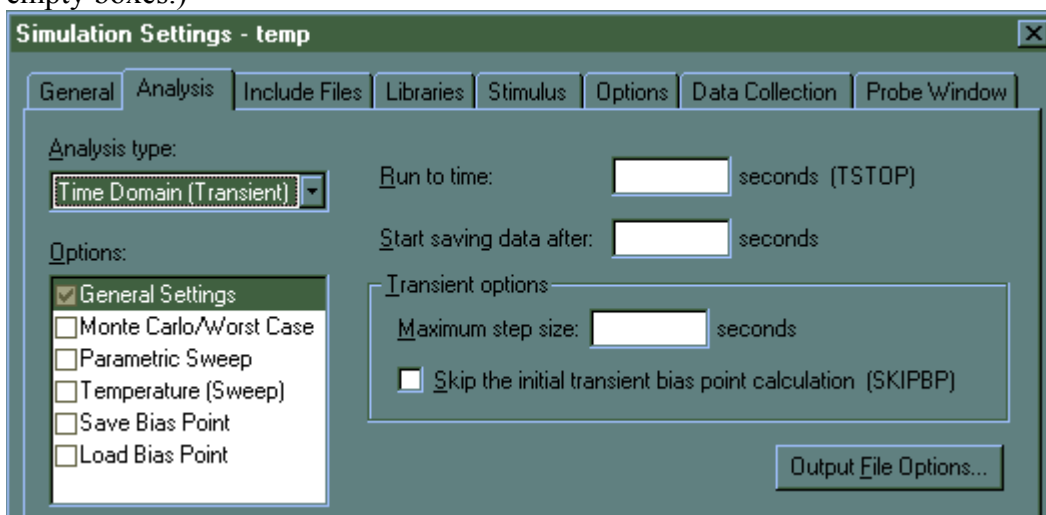
5. Capture/PSpice (20 points)

In experiment 2, you wired a circuit similar to the one below using real components and in PSpice:



a) (6 points) What does this circuit do? What do R1, R2, R3 and R4 represent?

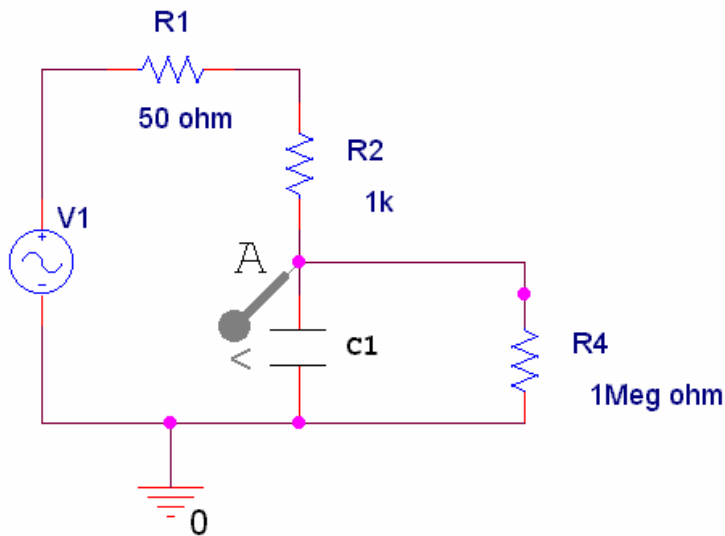
b) (3 points) Suppose V1 has a frequency of 0.5 Hz, an amplitude of 200mV, and a DC offset of 0. You want to run a transient analysis. How would you set up the simulation screen below to show exactly 3 smooth cycles of the output wave? (Fill in the three empty boxes.)



c) (3 points) If you set up this transient simulation, what would be the frequency (in Hz) and the approximate amplitude (in mV) of the signal at point A?

d) (5 points) If you replaced R2 with a resistor with color code orange-black-red-gold, what would be the frequency (in Hz) and the approximate amplitude (in mV) of the signal at point A?

e) (3 points) In experiment 2, you added a capacitor to a circuit in order to create a filter. We have added a capacitor to the circuit in this question.



What type of analysis (simulation) would you have to run to determine if this altered circuit is a high or low pass filter? (Circle the best answer.)

Transient

DC sweep

AC sweep

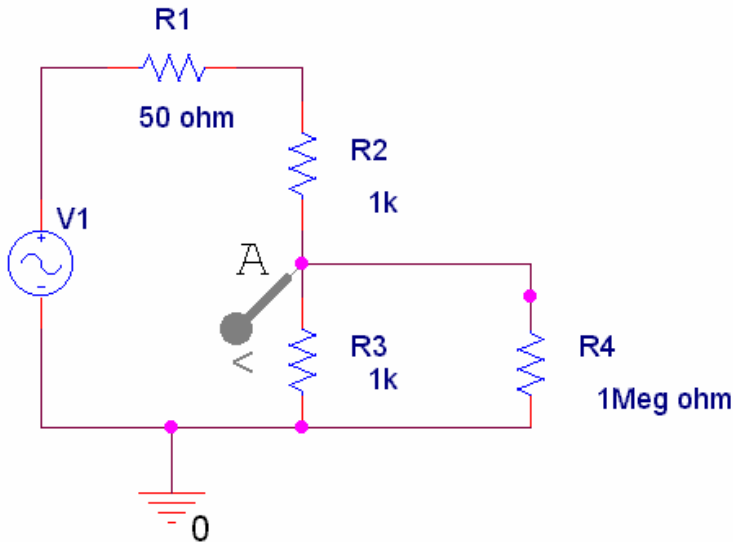
Bias Point

Extra credit (1 point): What type of filter is it and why?

Spring 2003 solution

5. Capture/PSpice (20 points)

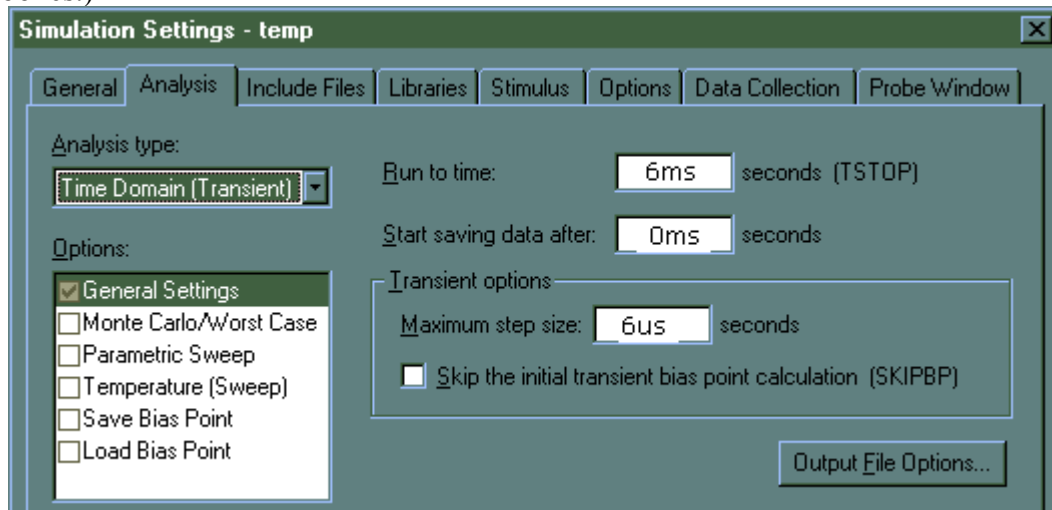
In experiment 1, you wired a circuit similar to the one below using real components and in PSpice:



a) (6 points) What does this circuit do? What do R1, R2, R3 and R4 represent?

The circuit is a voltage divider with the function generator as source and a measuring device attached to the second resistor. R1 is the impedance of the function generator, R2 and R3 are the resistors in the voltage divider, and R4 is the impedance of the measuring device (DMM or 'scope).

b) (3 points) Suppose V1 has a frequency of 0.5K Hz, an amplitude of 200mV, and a DC offset of 0. You want to run a transient analysis. How would you set up the simulation screen below to show exactly 3 smooth cycles of the output wave? (Fill in the three empty boxes.)



Notes on b): Anything is acceptable for run time and start time as long as the difference is 6ms ($3 \times 1/500$). The maximum step size should be somewhere in the range from about 0.06ms (100 points) to 6us (1000 points).

c) (3 points) If you set up this transient simulation, what would be the frequency (in Hz) and the approximate amplitude (in mV) of the signal at point A?

$$\underline{f = 0.5 \text{ Hz} \quad V_A = 100 \text{ mV}}$$

d) (5 points) If you replaced R2 with a resistor with color code orange-black-red-gold, what would be the frequency (in Hz) and the approximate amplitude (in mV) of the signal at point A?

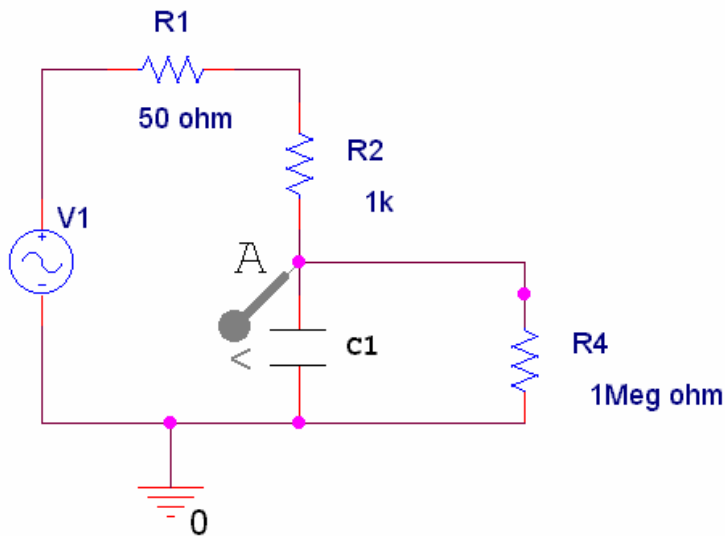
The resistance of the new resistor is $30 \times 100 = 3 \text{ K ohms}$.

$$V_{R3} = V_1 \times R_3 / (R_2 + R_3) = 200 \times 1\text{K} / (1\text{K} + 3\text{K}) = 50 \text{ mV}$$

The frequency will not change.

$$\underline{f = 0.5 \text{ Hz} \quad V_A = 50 \text{ mV}}$$

e) (3 points) In experiment 2, you added a capacitor to a circuit in order to create a filter. We have added a capacitor to the circuit in this question.



What type of analysis (simulation) would you have to run to determine if this altered circuit is a high or low pass filter? (Circle the best answer.)

Transient

DC sweep

AC sweep

Bias Point

Extra credit (1 point): What type of filter is it (at point A) and why?

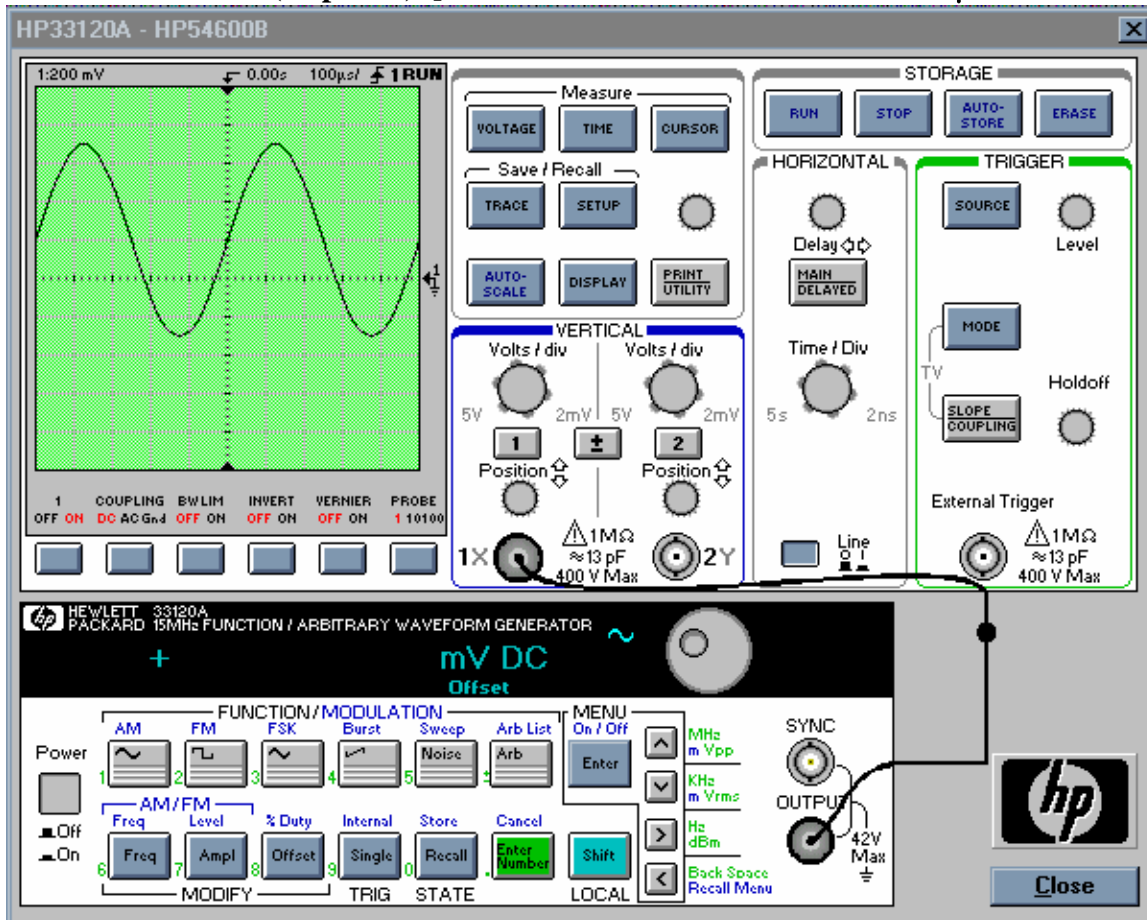
It is a low pass filter. At low frequencies, the capacitor is open, A is equal to V1. At high frequencies, the capacitor is closed, A is attached to ground.

Fall 2002

5. Instrumentation (20 points) [1:200mV

10.00s

100 μ s/ • 1 RUN]



a) Explain as simply as possible how to set up the function generator and scope to display the signal shown. (Use of Autoscale is NOT allowed). **Give specific values.** (8 points)

b) List two ways to obtain the peak-to-peak voltage of the above signal using the oscilloscope (4 points)

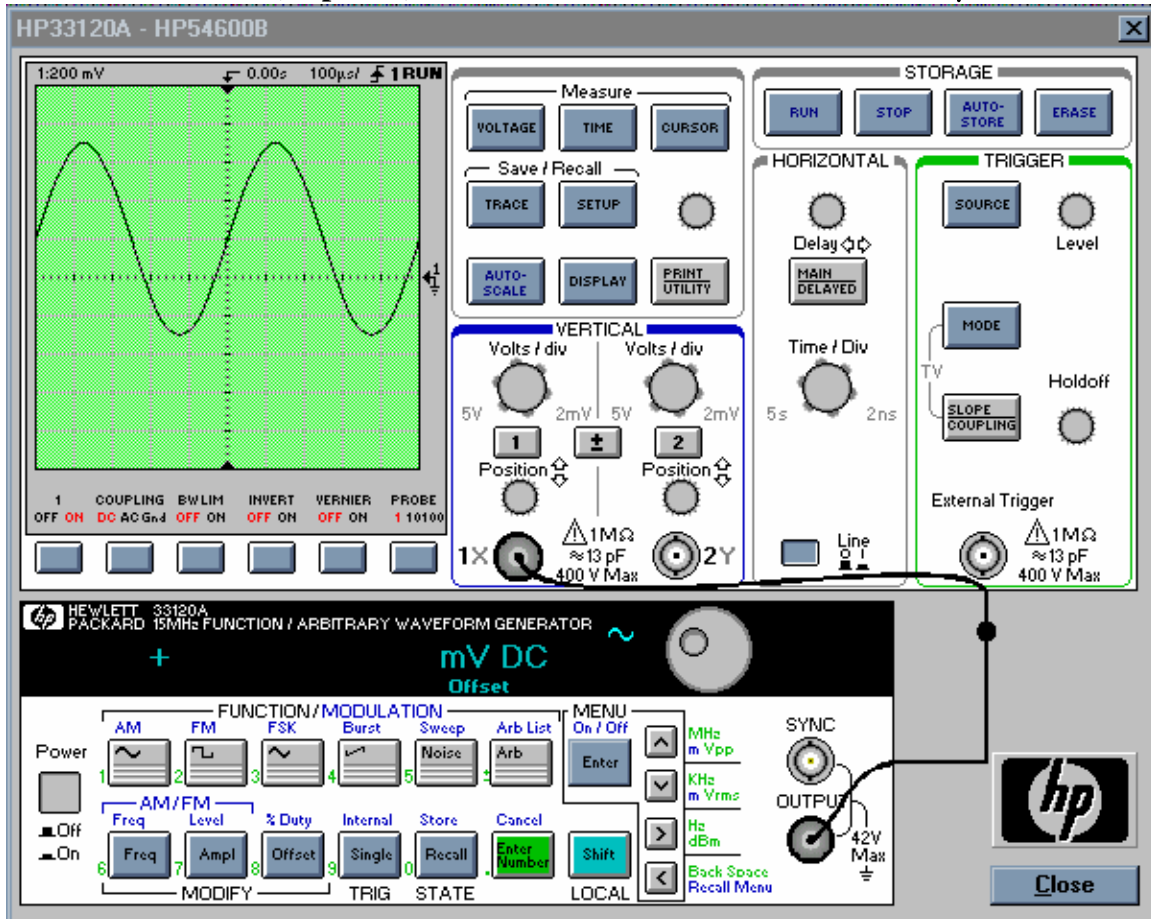
c) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct? (2 points) Why? (6 points)

Fall 2002 solution

5. Instrumentation (20 points) [1:200mV

10.00s

100µs/ • 1 RUN]



a) Explain as simply as possible how to set up the function generator and scope to display the signal shown. (Use of Autoscale is NOT allowed). **Give specific values.** (8 points)

- 1) Push the Freq button on the function generator.
- 2) Turn the dial until the frequency reads 2 K hertz.
- 3) Push the Ampl button on the function generator.
- 4) Turn the dial until the peak-to-peak voltage reaches 500 millivolts [the peak-to-peak voltage on the 'scope will show 1volt]
- 5) Push the Offset button on the function generator.
- 6) Turn the dial until the DC offset on the function generator reaches 100mV [the offset on the 'scope will show 200mV]
- 7) Adjust the volts/div for channel 1 to 1:200mV.
- 8) Adjust the time/div for the horizontal trigger to 100microseconds/
- 9) Turn the position knob on channel 1 until the arrow lines up with the zero mark.

b) List two ways to obtain the peak-to-peak voltage of the above signal using the oscilloscope (4 points)

1) Measure the distance from the minima to the maximum of the sine wave by counting the number of major divisions and multiply by the scale in the upper left corner to get the peak to peak voltage.

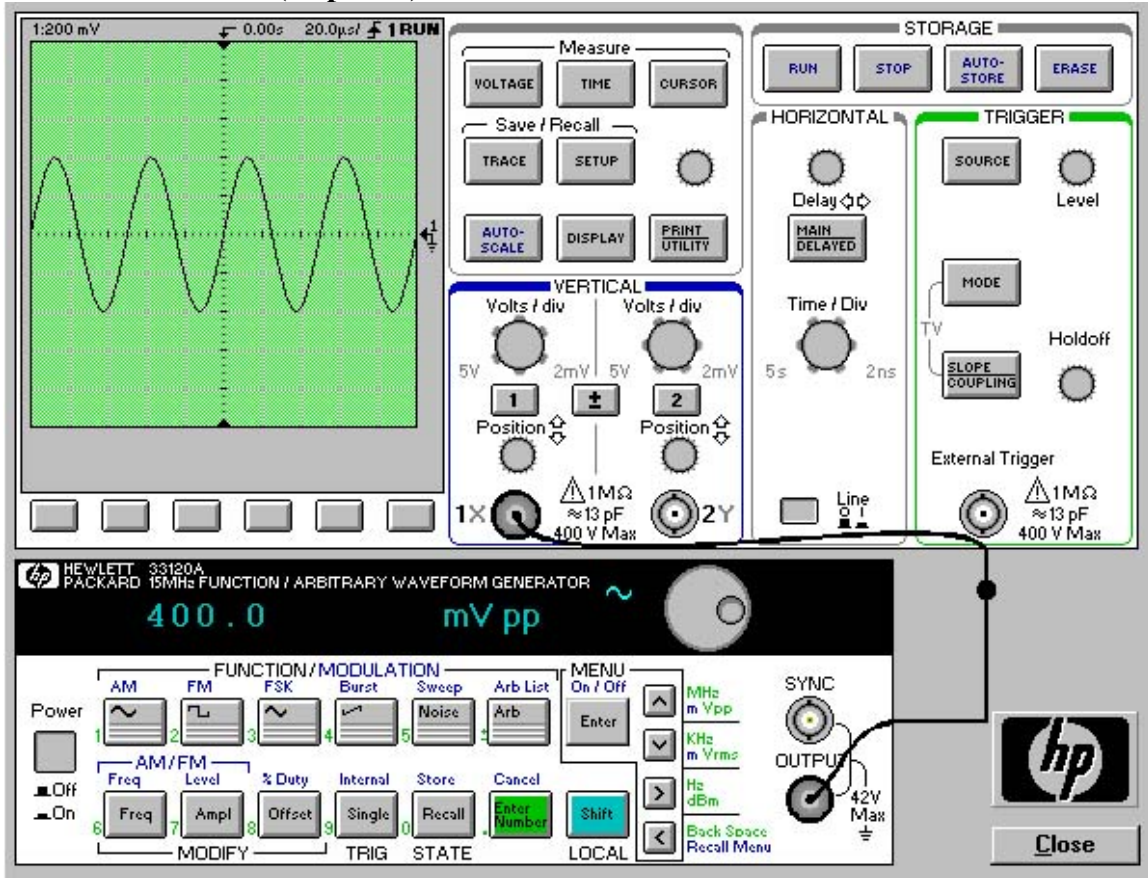
2) Push the voltage button. When the soft keys appear at the bottom of the screen, hit the one corresponding to V_{p-p} .

c) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct? (2 points) Why? (6 points)

The scope will read twice the value of the function generator. The 'scope is correct. The function generator expects a 50 ohm load to match its 50 ohm impedance. With this expectation, it displays a value equal to half of what it puts out. The load of the 'scope, when it is connected directly to the function generator, is 1Meg ohm. The 1Meg ohm resistance is so much higher than 50 ohms, that the vast majority of the voltage goes to the scope, making the voltage at the function generator output essentially equal to what it is putting out (instead of the $\frac{1}{2}$ it expects).

Spring 2002

5. Instrumentation (20 points)

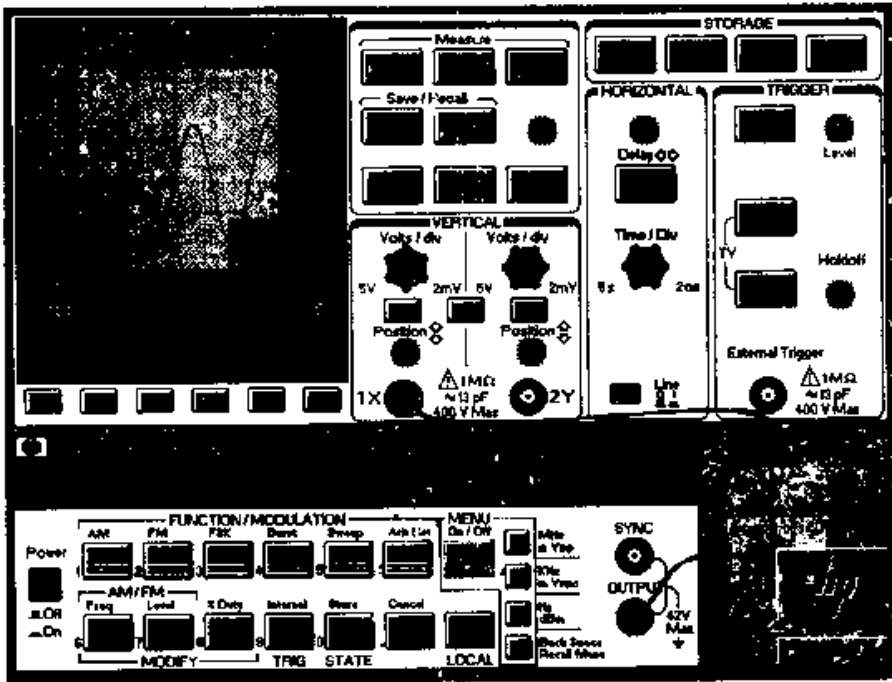


a) List two ways to obtain the peak-to-peak voltage of the above signal using the oscilloscope (4 points)

b) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct? (2 points) Why? (6 points)

c) Explain as simply as possible how to set up the function generator and scope to display the signal shown. (Use of Autoscale is NOT allowed). Give specific values. (8 points)

5. Instrumentation (20 points)



a) List two ways to obtain the frequency of the signal using the oscilloscope (4 points)

- 1) Use TIME button to display frequency of signal.
- 2) Use scale (20ns per division) to find the period (50ns) and take inverse (20 KHz)

b) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct?

(2 points) Why? (6 points)

The scope shows the peak-to-peak voltage as 800mV and the function generator shows 400mV. The scope is right. The function generator expects a 50Ω load, but the load of the scope is 1MΩ. This very large load is so far from the expected load, that the scope ends

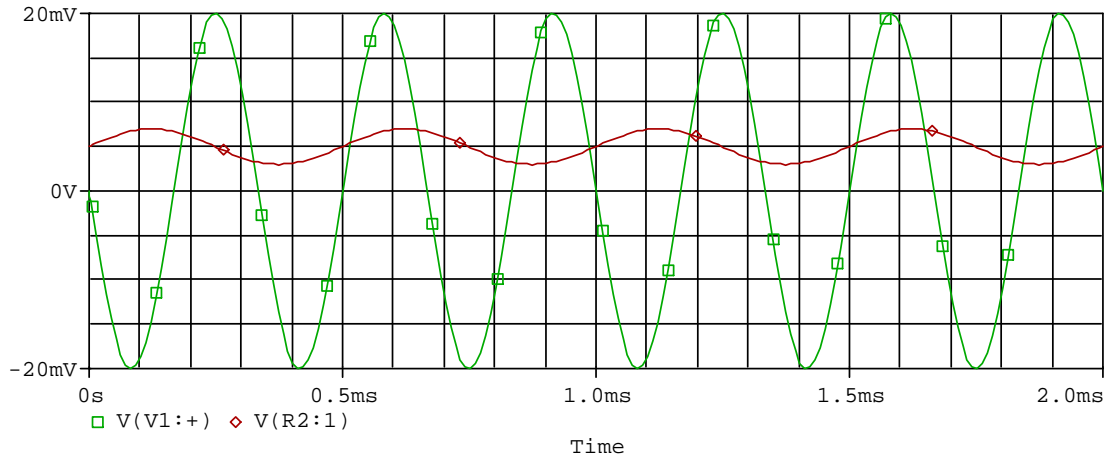
c) Explain as simply as possible how to set up the function generator and scope to display the signal shown. (Use of Autoscale is NOT allowed). Give specific values. (8 points)

- 1) Set FG to 20KHz
- 2) set FG Amp to 400mVp-p
- 3) turn off FG offset
- 4) set volts/div on scope channel 1 to 200mV
- 5) set time/div on scope to 20ns.
- 6) move position of trace to 0-1 on channel 1

up showing true the amount on the generator.

Spring 2002

3. Sine Waves (20 points)



a) Consider trace A in the plot above and give the following values (6 points):

(Do not forget the units.)

frequency:

amplitude:

rms value:

peak-to-peak voltage:

phase shift:

offset voltage:

b) Write down the mathematical expression for A in the form $v(t) = V_{dc} + A \sin(\omega t + \phi)$. (4 points)

c) Consider trace B in the plot above and give the following values (6 points):

(Do not forget the units.)

frequency:

amplitude:

rms value:

peak-to-peak voltage:

phase shift:

offset voltage:

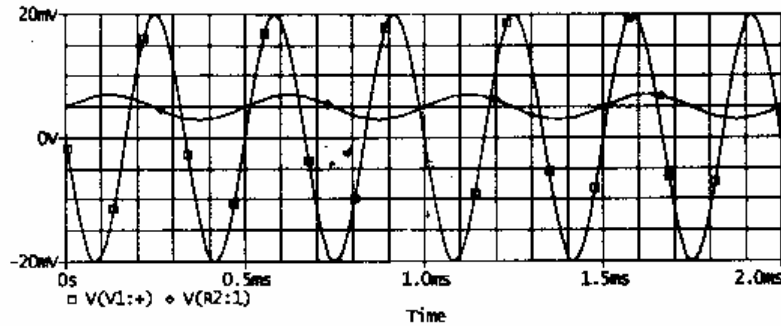
d) Write down the mathematical expression for B in the form $v(t) = V_{dc} + A \sin(\omega t + \phi)$. (4 points)

Spring 2002 solution

ENGR4300 Test 1A
Spring 2002

Name _____
Section _____

3. Sine Waves (20 points)



a) Consider trace A in the plot above and give the following values (6 points):

(Do not forget the units.)

frequency: 2K Hz

amplitude: 2mV

rms value: (see next page)

peak-to-peak voltage: 4mV

phase shift: ϕ rad

offset voltage: 5mV

$$T = 0.5\text{ms} \quad f = \frac{1}{T} = 2\text{K}$$

b) Write down the mathematical expression for A in the form $v(t) = V_{dc} + A \sin(\omega t + \phi)$.

(4 points)

$$v(t) = .005 + .002 \sin(4000\pi t)$$

$$\omega = 2\pi f = (2\pi)(2\text{K})$$

$$= 4\text{K}\pi$$

$$= 12566.37 \text{ rad/s}$$

c) Consider trace B in the plot above and give the following values (6 points):

(Do not forget the units.)

frequency: 3K Hz

amplitude: 20mV

rms value: 14.1mV

peak-to-peak voltage: 40mV

phase shift: $-\pi$ rad/sec or $+\pi$ rad/sec

offset voltage: ϕ volts

$$T = 0.33\text{ms} \quad f = 3\text{K}$$

$$\phi = -\omega t_0 = -2\pi \left(\frac{.165}{.33} \right)$$

$$= -\pi \text{ (or } +\pi)$$

d) Write down the mathematical expression for B in the form $v(t) = V_{dc} + A \sin(\omega t + \phi)$.

(4 points)

$$v(t) = .02 \sin(6000\pi t \pm \pi)$$

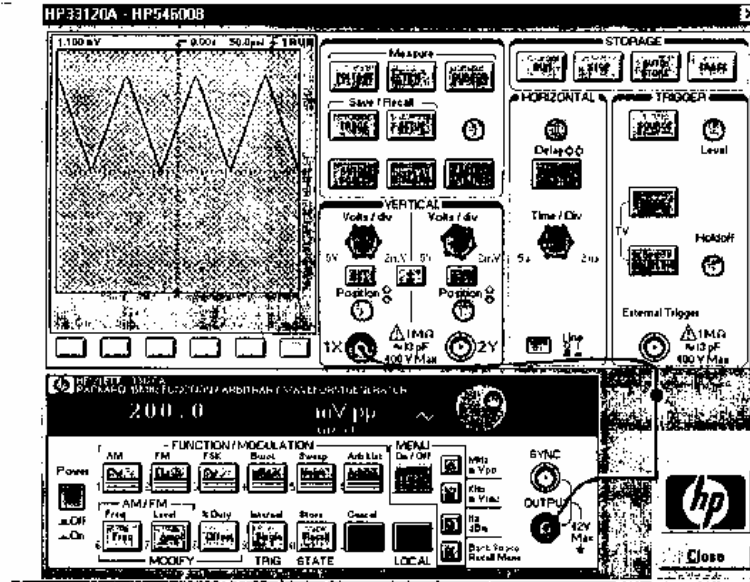
$$\omega = 2\pi f = (2\pi)(3\text{K})$$

$$= 6\text{K}\pi$$

$$= 18879.55 \text{ rad/sec}$$

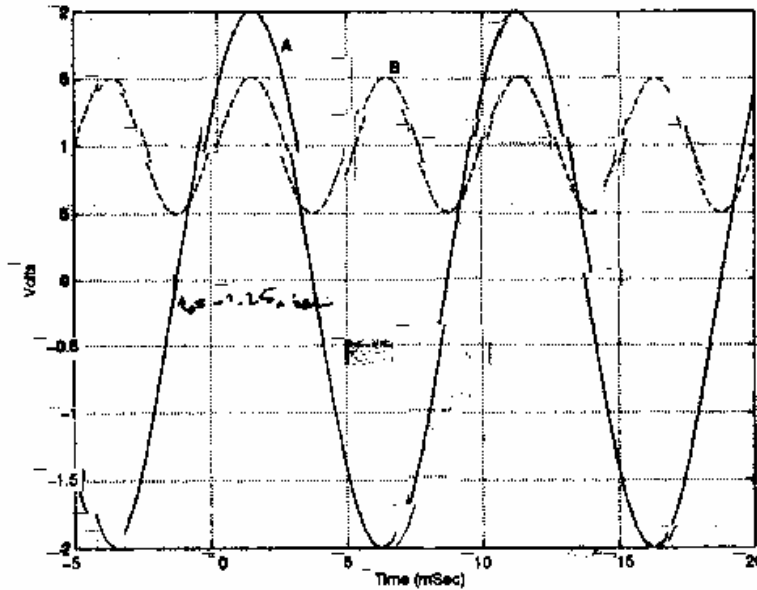
for part a) $V_{rms} = A/\sqrt{2} = 2/1.41 = 1.41\text{volts}$

5) Instrumentation (20 points)



- a) List two ways to obtain the frequency of the signal using the oscilloscope (4 points)
1. Use the "Time" Button, then press "freq" 2(pt)
 2. Use the display and find the period T , then $f = \frac{1}{T}$
- b) When the function generator is connected to the scope you should notice a discrepancy between the reading on the display panel of the function generator, and the signal displayed on the scope. What discrepancy do you see and which device is correct? (2 points) Why? (6 points)
- The discrepancy is that the scope shows a signal twice that of the f.g. display. The scope is correct. This discrepancy occurs because the f.g. has 50 ohms internal and EXPECTS a 50 ohm load. The result would be a voltage divider of $\frac{1}{2}$. Therefore the f.g. puts out 2.
- c) Explain as simply as possible how to set up the function generator and scope to display the signal shown. (Use of Autoscale is NOT allowed). Give specific values. (8 points)
1. Press triangle wave button
 2. Set offset to 100mV
 3. Set V_{pp} to 200mV
 4. Set frequency to 6.6 KHz
 5. Set scope to 100mV/div
 6. Set scope to 50ns/div

3. Sine Waves (20 points)



a) (6 points) Consider plot A in the above figure and give the following values:

(Do not forget the units):

Frequency = 100 Hz

Amplitude = 2V

RMS value = 1.414V

Peak-to-peak voltage = 4V

Phase shift = $\pi/4$

Offset Voltage = 0

$$T = 10 \text{ mSec} \rightarrow F = 100 \text{ Hz}$$

$$V_{\text{RMS}} = \frac{\text{Amplitude}}{\sqrt{2}}$$

$$\phi = -\omega t_0 = -2\pi \times 100 \text{ mSec} \times (-1.25 \text{ mSec}) = \frac{\pi}{4} \text{ rad}$$

b) (4 points) Write down the mathematical expression for A as $V_A(t) = V_{\text{off}} + V \sin(\omega t + \phi)$

$$V_A(t) = 2V \sin(2\pi \times 100 t + \frac{\pi}{4})$$

c) (6 points) Now Consider plot B in the above figure and give the following values:

(Do not forget the units)

Frequency = 200 Hz

Amplitude = 0.5V

RMS value = 0.353V

Peak-to-peak voltage = 1V

Phase shift = 0

Offset Voltage = 1V

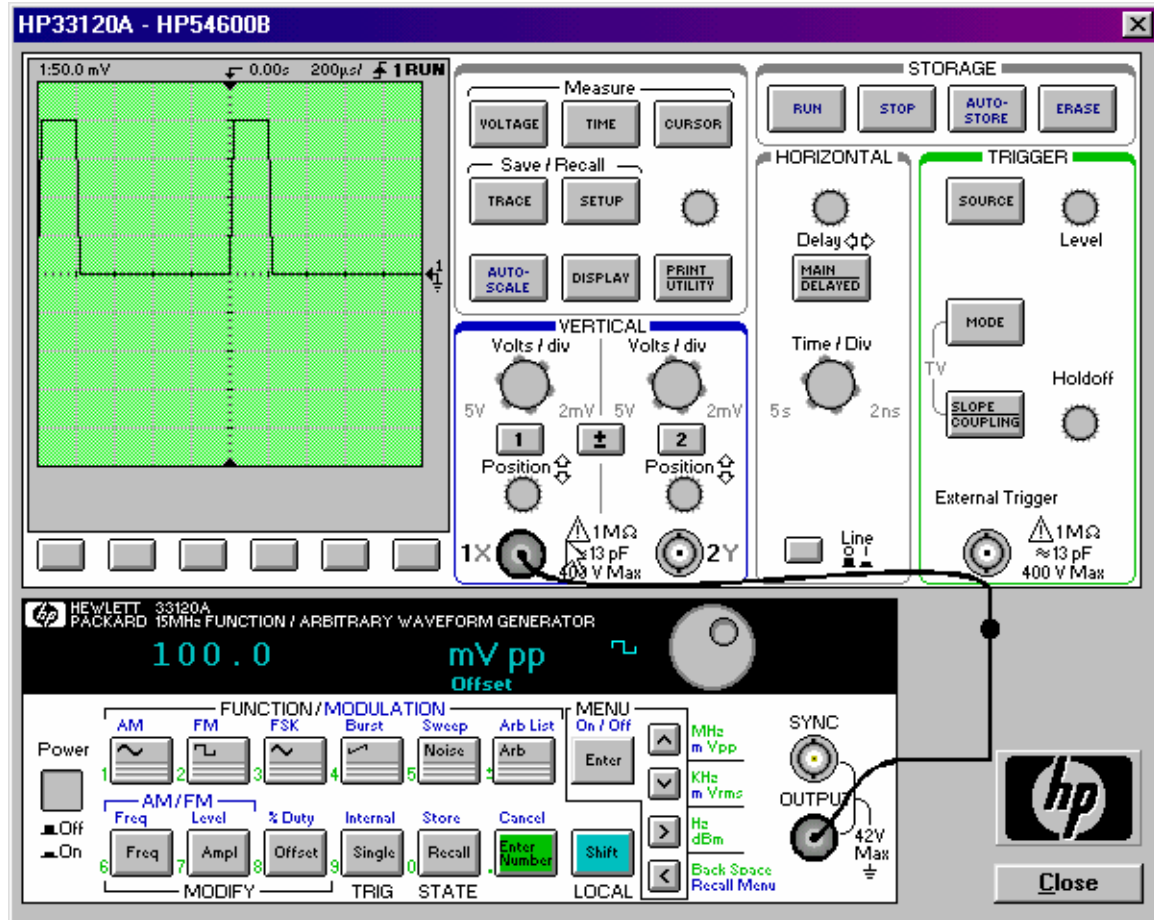
d) (4 points) Write down the mathematical expression for B as $V_B(t) = V_{\text{off}} + V \sin(\omega t + \phi)$

$$V_B(t) = 1V + 0.5V \sin(2\pi \times 200 t)$$

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5. Studio Hardware (15 Points)

Shown below is an image of the oscilloscope and the function generator we use in the studio.



- Circle the buttons we push to turn each of these devices on.
- When the function generator and 'scope are set up in this manner, you should notice a discrepancy between the reading on the display panel of the function generator and the signal displayed on the 'scope. What discrepancy do you see and which device is correct? Why?
- Explain, as simply as possible, how to set up the function generator and 'scope to display the signal shown.

6. Miscellaneous Info (15 Points for three correct answers)

For each problem, circle all correct answers.

a. Which of the following frequencies is in the audio range of frequencies?

100Hz 1kHz 10kHz 100kHz 1MHz

b. Which of the following is found in your parts kit?

Screwdriver Protoboard Solder Relay 555 Timer Chip

100k Resistor Doorbell Wire Stripper Microphone 10k Potentiometer

c. What kind of connectors are generally found on the cables we use in the studio?

Banana Mini-grabber RCA BNC D
Alligator DIN F

d. What is the approximate mass of the cantilever beam used in Experiments 2 and 3?

e. What are the names of your instructor and teaching assistants? Those of you who have seen more than two TAs need only write down two TA names.

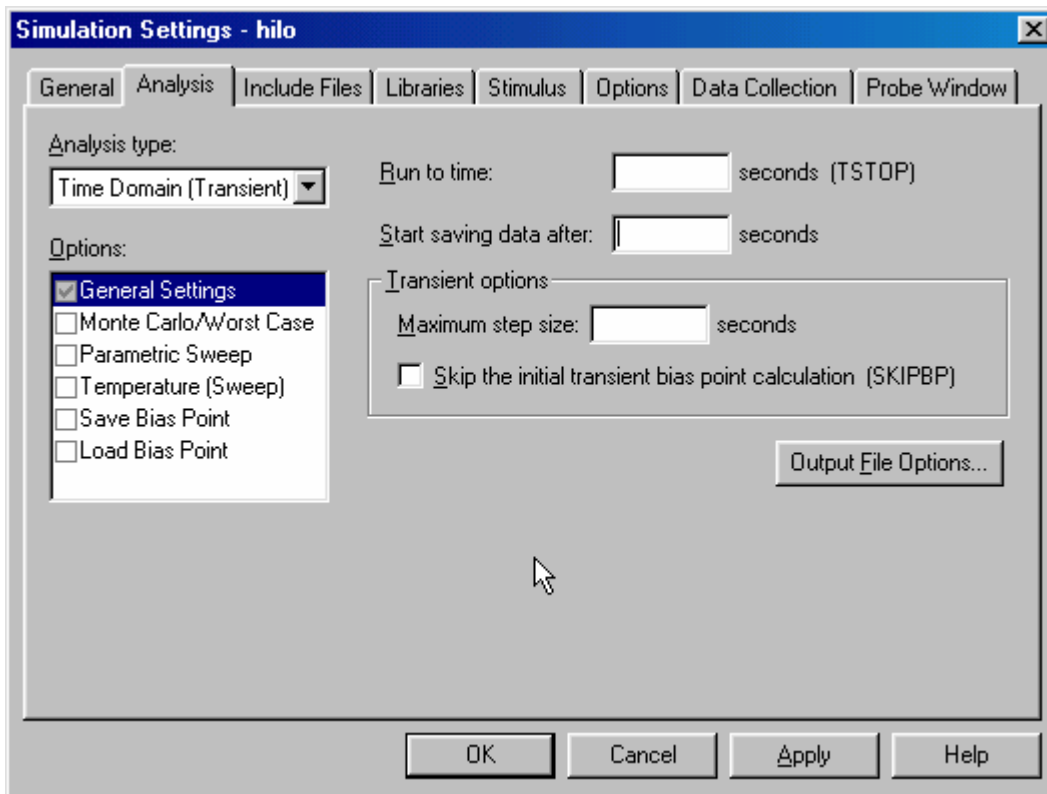
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4. Mathematical Representations and PSpice (15 Points)

a. Write the mathematical expression for the voltage at point A for the lower frequency plot. That is, write it in the form $V_A = V_o \sin(\omega t)$.

Extra Credit (3pts) – The voltage will actually have a phase, so it should be written in the form $V_A = V_o \sin(\omega t + \phi_o)$. Determine the phase.

b. Shown below is the window we use for setting up the PSpice simulation. Put the appropriate numbers in the appropriate boxes to obtain a plot like the top one on the previous page.



*Fall 2000 solution
(not available)*