

Physics 623 — Remote Lab Directions

First, you'll need to set up with Wise VPN and Microsoft Remote Desktop so you can access the lab computers. The directions for doing this were given in the Lab section of "Physics 623 remote lecture and lab directions" that was sent out on March 19th. Please let me know if you are having any difficulties getting this working.

Note that if you are working on a lab computer and someone else connects to it, you will be immediately bumped off, and they have no way of knowing this happened. They'll see the desktop exactly as you left it. You can reconnect and bump them off; this obviously requires some coordination.

Fortunately, this shouldn't be too difficult. Every set of regular lab partners can keep using the computer they usually had, *except* Brent and Reid will need to use 81 and Tyler will need to use 89. If everyone will stick to this, there will be no overlap or need for coordination except with your lab partner. The computers are available 24/7.

Lab partners can work individually if they wish; it is only necessary to coordinate access times. However, it should be quite possible to work together. We have two schemes.

The one that seems better was suggested by Preston. It allows both partners to access the lab computer together and both can control it. Here are the directions he provided:

Each Lab Partner:

Download the latest version of TeamViewer for your operating system here:

<https://www.teamviewer.com/en-us/download/>

If you are on a Mac, and you don't have the MacOS 10.13 or newer, try an older version here:

<https://www.teamviewer.com/en-us/download/previous-versions/>

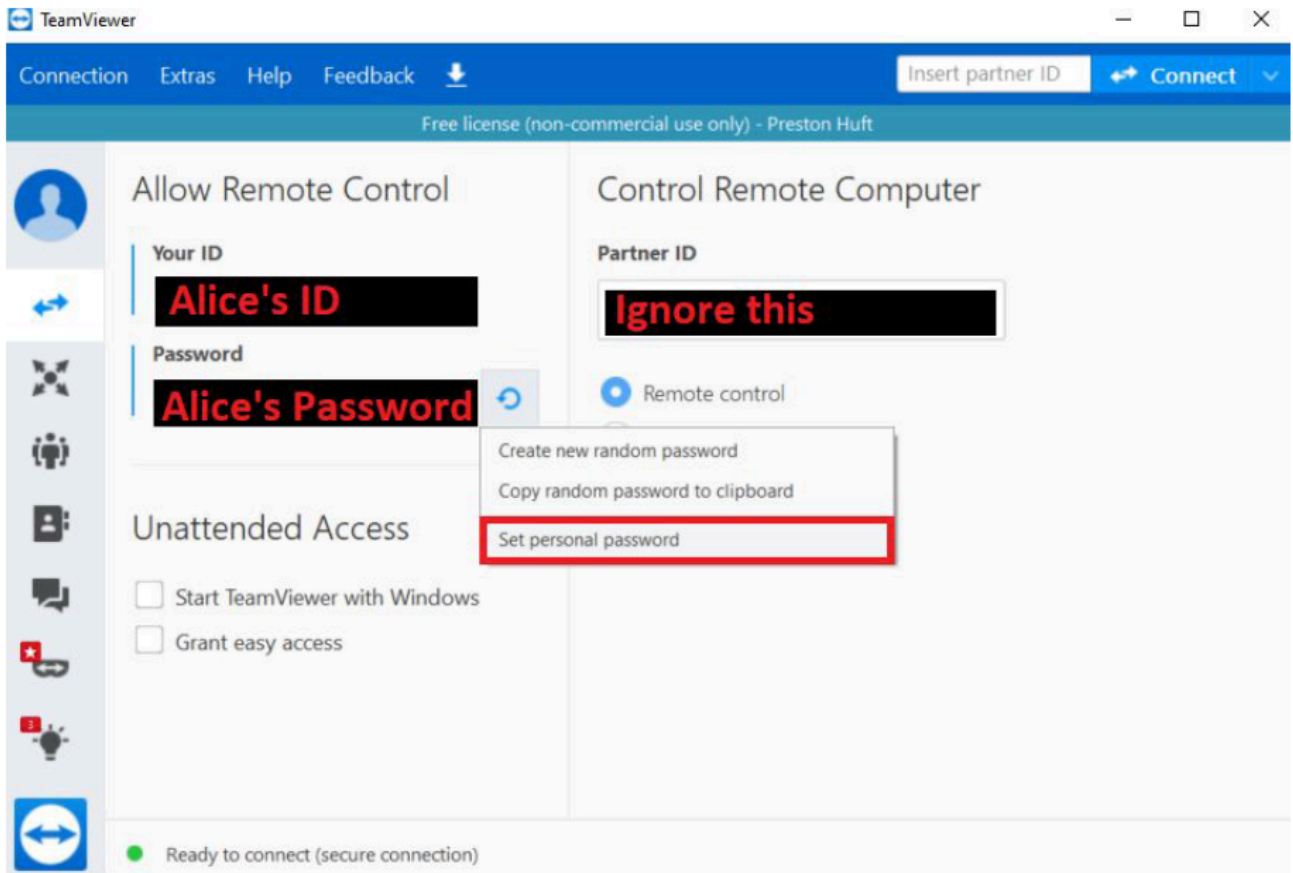
Download the installer, run it, and click through the prompts.

NOTE : if both partners do not have the same version (i.e. one person's installation is newer, like version 15 versus version 13), the user with the newer version **MUST** be Bob (because outgoing connections only work from new versions to older versions.) Only the lab partner who will remote into the lab computer ("Alice"):

Open TeamViewer on your machine. Communicate "Your ID" and "Password" (these are listed under "Allow Remote Control") to Bob in whatever way you feel is secure enough (phone call, text, etc)

Set static password (optional): Mouse over the Password field and click the little curly arrow that appears. Click "Set personal password", to give your computer a static password for Bob. You could choose not to do this, but then you might have to send Bob a new random password every

time you screen share with TeamViewer. I just find it easier to have a static password set.



If you chose to set a password in the step above, in the dialog that opens, just fill out either the section “ Personal password ” or “ Random password ”, and then click OK. Then communicate your password to Bob. The other lab partner (“Bob”):

Open TeamViewer, and type Alice’s ID into the “Partner ID” field. Make sure “Remote Control” is selected”, then click “Connect”. Enter Alice’s password when prompted. A new window should open and now you should have access to Alice’s machine, and both of you can control it.

Alice (or Bob on Alice’s machine):

On Alice’s machine, now connect to your lab computer with Microsoft Remote Desktop per Dan’s instructions. This can be done before or after Bob connects to Alice’s machine with TeamViewer.

(contact Preston Huft with questions . . .)

If this doesn’t work for you, or seems too complicated, another scheme is for both partners to log into the BB Collaborate Ultra session in Ph623 Canvas with the name

lab_nn, where nn is your computer number. These are listed below the session we use for lectures. Both of you will have full moderator access. One person can then connect to the lab computer and share their screen. The other person can only watch (and take screens shots), so you should trade off often. The second person just needs to connect to the lab computer and share their screen instead, so it only takes a few seconds to switch. The first person will get bumped off, and the second will pick up the screen right where they left it. *Note that it is never necessary to “log off” from the lab computer. When you’re done, just close the window in MRD.*

How to record and turn in a remote lab:

Labs should be done and turned in as Word (or one of the open source equivalents) documents. To turn them in, just email the file to me. They are due Wednesday of the following week (a week after the prelab was due). For including material from the lab computers, it is generally simplest to get things set up to look the way you want on the lab computer, then take a screen shot and paste that into your word document. Multisim will save all kinds of data files however, and if you want to transfer those to your own computer, MRD can be set up to do this. Directions are here:

<https://www.nextofwindows.com/how-to-access-local-drive-files-from-remote-desktop-session> (windows) or here: <https://apple.stackexchange.com/questions/7949/how-can-i-copy-files-from-my-mac-to-pc-via-microsoft-remote-desktop/140506#140506> (mac os).

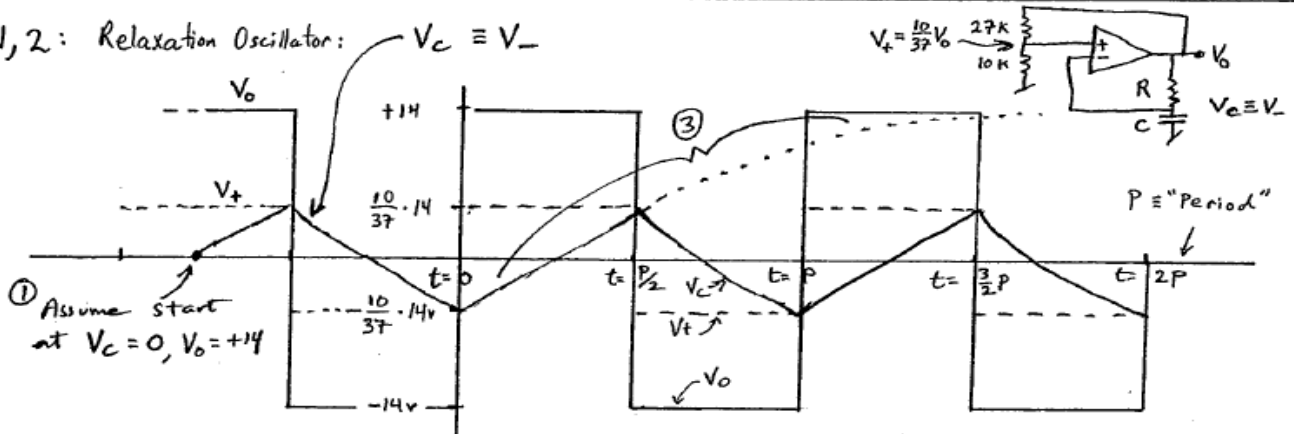
The Word file is just like your lab notebook, and needs to follow the same directions regarding organization (be sure to put in headings explaining what you are doing in that section), labeling everything, starting with a schematic for your circuit, being self-contained, and comparing results with expected values. (Uncertainties on numerical results are a little tough – Multisim calculates everything in double precision, and although it has ways to randomize resistor values and such, we aren’t going to do that. But do comment on the agreement you get or don’t get.)

Here are some example notebook entries with hints on getting nice output from Multisim:

Calculate expected period of relaxation oscillator:

[If you've done something in prelab, you can just paste it in:]

1, 2: Relaxation Oscillator: $V_c \equiv V_-$



① Assume start at $V_c = 0, V_o = +14$

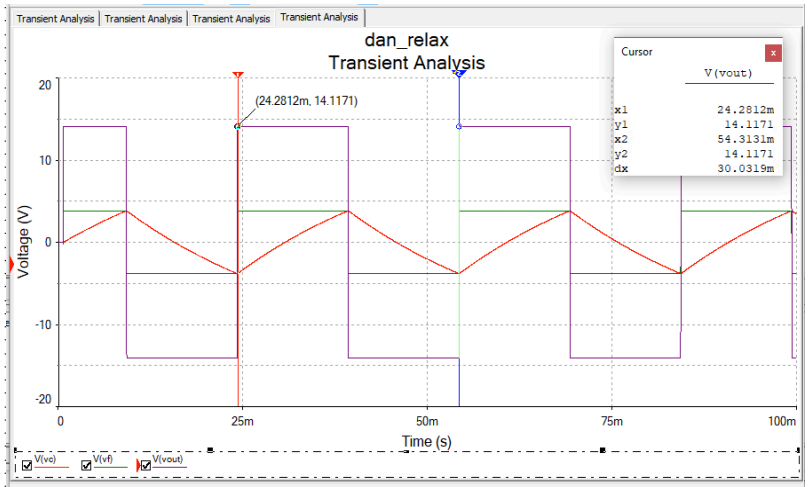
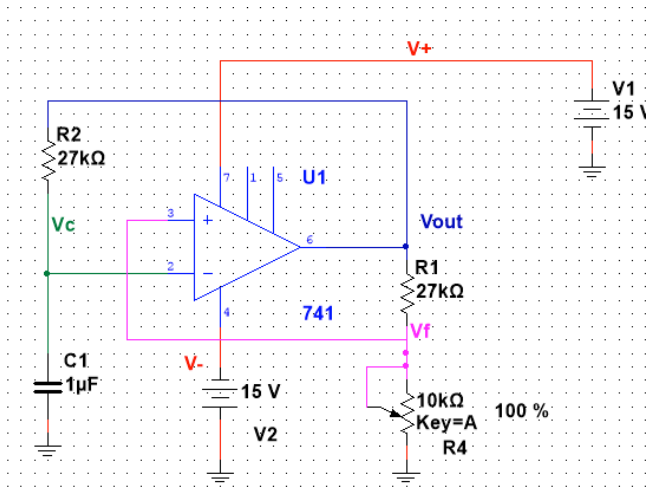
② Call this time $t=0$

③ The equation for this curve is: $V_c(t) = 14\left(1 + \frac{10}{37}\right)\left(1 - e^{-t/RC}\right) - 14 \cdot \frac{10}{37}$
 (since $V_c(0) \neq 0$)

④ It will follow this curve up until $t = P/2$, and then the output will switch, since V_c crosses V_+ at that time. To find $P/2$ in terms of RC , we can substitute into eq. 3:

$$V_c\left(t = \frac{P}{2}\right) = \frac{10}{37} \cdot 14 = 14\left(1 + \frac{10}{37}\right)\left(1 - e^{-P/2RC}\right) - 14 \cdot \frac{10}{37} \Rightarrow -\frac{P}{2RC} = \ln \frac{27}{47}, \text{ or } \frac{P}{2} = 0.55 RC$$

Circuit and measurement of period:



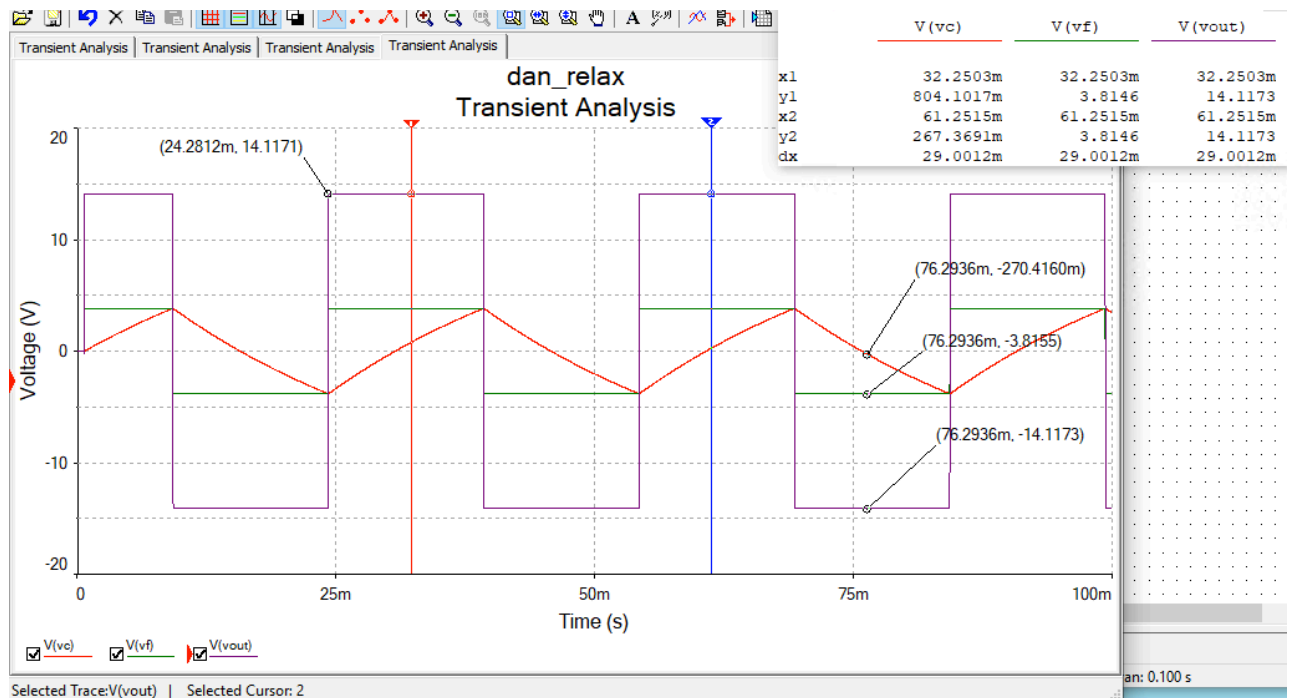
The period can be read off the cursor spacing: 30.03 ms. This can be compared with our calculated value above: $2 \cdot 0.554 RC = 29.93$ ms. So very close!

Multisim has a very nice help system that you can access with the function key f1. Check out the contents and index tabs. I haven't found any other way to access this help system. The "help" menu and the "?" tool tab take you to useful documents (most of which are on the course website), but not to this very well-organized and detailed system.

You should read the "[-Simulation lab hints-MultiSim.pdf](#)" document from the course webpage. The later parts are more specific to the upcoming simulation lab, but the first half gives a useful overview.

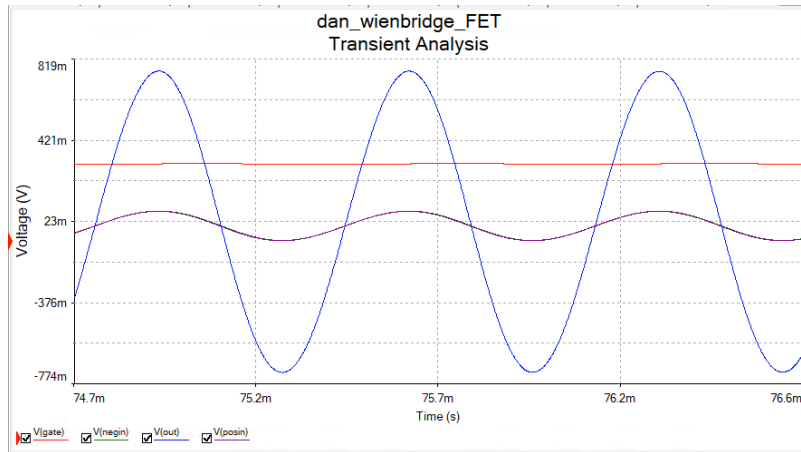
Simulation: To calculate outputs vs time, use "simulate→analyses→transient analysis..." to bring up transient analysis setup window. This gives you a plot of selected net signals vs time. Trial and error works, but you can save yourself some time by figuring out what reasonable start and stop times are. A maximum time step that gives you 10,000 steps across this time interval is pretty safe. You'll want to push "simulate" to exit this window. This saves and runs the simulator. ("save" won't do anything except save the entries you've put in).

The Grapher output plots can be formatted very flexibly, and it's worthwhile spending a little time to figure out how to get the way you want them.

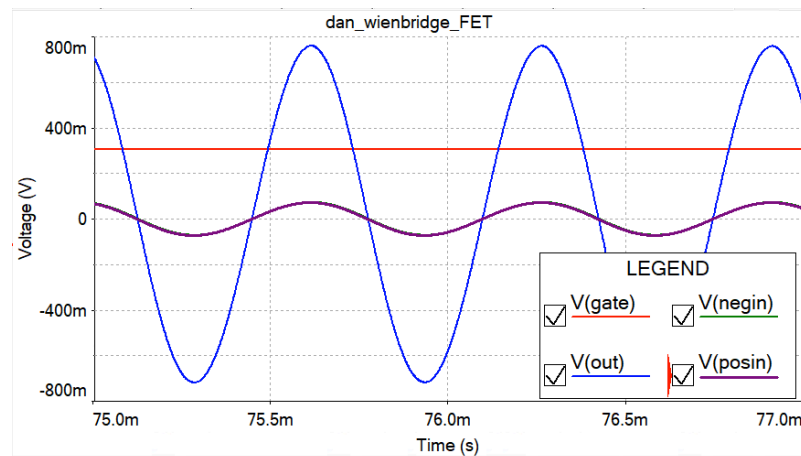


The cursors can be used to read out both X and Y positions, automatically find maxima and minima, and can be used to label points on the traces as shown above. The chart shown is giving the x coordinate of each cursor and all the y values at each, plus the x spacing. But it can be configured to show many other things (or fewer). Note the names

on the legend are the names you gave to the nets, so they should be self-explanatory if you chose good names when you laid out the schematic!



The initial plot defaults to show all the data, and usually picks reasonable axis limits. But when you expand part of it as shown at the left (often a good idea to show what you want), it will take the box limits literally, which will often end up with a grid that's hard to use.



The graph below shows that you can set the axis limits to even values and control the number of grid lines, which makes the graph a lot easier to interpret. Just double-click on an axis to bring up the "properties" GUI, already open to the right tab. You'll need to set the other axis separately.

I've also increased the font sizes to make them readable when you reduce the size of the graph. Default ones are pretty small.