Lab 9 Grading Standard:

1) *In grading, do not explicitly assign points to the various sections. Rather, take points off for incorrect, incomplete or missing items.*
2) *When you take point off, be sure to write a short comment as to why the points were lost.*
3) *Example: (-1) What is the measured value of the component?*
   (-3) What is the mathematical formula that you are plotting on top of your data?

General Notes:

- The axis of all plots must be labeled. This should include the quantity, the units and numerical values.
- The boxed questions should be answered in the lab book.
- Procedures must have a circuit diagram.
- Measured values of components used should be recorded in the lab book.
- Relevant formulas should be included in the lab book.
- Formulas for computed quantities in tables should be near the table in the book.

Failure to measure a component value when possible (max -1 per occurrence)
Missing units on components, plot axes, tables … (-1 per occurrence).
Missing plot (-4 per occurrence).
Missing axes labels on plots (-1 per label).
Missing column labels on tables (-1 per label).
Missing formula for computed quantity in table (-1 per table)--can be in column title
Missing important formulas (-2 per occurrence)
No fit to linear curves (-2 per occurrence).
No fit values with units (-2 per occurrence).
No comparison of fit values with expectations when possible (-2 per occurrence).
Missing theoretical calculations, including formulas (-3 per occurrence).
Failure to answer questions (-2 per question, maximum of -10)

Pre-lab Signature: 10

Purpose/Introduction 5

There should be a two to five line description of what they are going to do in this lab. This is all or nothing for five points.

Voltage Follower:

Procedure: 5

There should be a several line procedure that shows the circuit, indicates where they are going to measure voltages, what the measured values of the components are.

Slew rate measurement: 15

Measurements of the slew rate for the 741. They should have both the rising and falling slopes and should compare to the ``expected value''. They should then compute the maximum rate (f) for 5V, 1V and 0.1V. There should be a comment on what they observe at these rates and at a higher frequency.

Repeat the same measurements for the 411 op-amp.

Open loop gain of the 741: 20

There should be a brief explanation of what the measurement will be. The data should then consist of the input and output voltages, the frequency and the phase difference. There should be data up to 3 MHz and it should start by 100 Hz. They may need to change the input voltage at high frequency. There are lots of relevant formulas here.

The measurement should then be repeated for the 411 opamp.

Plots: Bode Plot of Gain, Phase plot and Bode Plot of the open-loop gain. There
There should also be discussion of the math involved.

Input and Output Impedance: 10

This should contain a brief description of what they will measure including circuits. The data should consist of two (I,V) points that can be used to compute R_in and R_out.

The Inverting Amplifier: 20

Using the 741 op-amp, they need to describe how to build a times 10 and times 100 amplifier. They should choose reasonable components and record the measured values. For both the times 10 and times 100, there should be a Bode plot. The optimal presentation is all three gains on the same lot showing that the open-loop gain is limiting the gain in both cases.

Plot and data for the DC gain of the times 10 amplifiers. Need a plot.

They need to compute the gain-bandwidth product for both amplifiers.

Questions	10
Conclusion/Summary	5