Three circuits including a voltage divider, an RC circuit, and an op-amp voltage amplifier were analyzed in this lab. For the voltage divider network, the analysis of its Thevenin equivalent circuit showed that when the load resistor was much larger than the Thevenin equivalent resistor, the voltage drop across the Thevenin resistor was much smaller than the voltage drop across the load, thus Vout (voltage drop across the load) was almost equal to the Thevenin equivalent voltage. The simulation results for the voltage divider network confirmed the findings from the circuit analysis. In addition, a parametric sweep of the load resistor value showed that for the load resistor values much smaller than the Thevenin equivalent resistor, the voltage drop across the load was very small and approached zero for the load resistor values close to zero Ohm.

In the second experiment, the effect of the time constant on the response of an RC circuit was analyzed. As observed in the simulated graphs, when the time constant was large compared to the half-period of the input voltage, the capacitor did not have enough time to fully charge or fully discharge. Thus, the voltage across the capacitor only changed by a small value. Consequently, the voltage across the resistor deviated from the input signal by a small value. When the time constant was small compared to the half-period of the input voltage, the capacitor quickly fully charged and quickly fully discharged, which resulted in the voltage across the load quickly decaying to zero from its maximum value.

In the third experiment, the voltage amplifier application of operational amplifiers was investigated. Negative feedback was established using a resistor feeding a portion of the output signal to the inverting input terminal of the op-amp. Since the input signal was fed into the op-amp through the inverting terminal, the output was expected to have a pi phase shift with respect to the input signal. The results of the simulations confirmed that expectation as the output voltage was the inverted and amplified version of the input signal. The amplitude of the node voltage at the inverting terminal was very small, close to zero volts compared to the 5V amplitude of the input signal. The output current of the op-amp was a sinusoidal signal proportional to the output voltage and in-phase with the output voltage.