ELECTRONICS

LAB 2: RC CIRCUITS

1) Construct an RC circuit using a 4 μF capacitor and a resistor of several hundred ohms and drive the circuit with a square wave. While watching the output voltage, adjust the drive frequency so that the capacitor fully charges and discharges in each cycle. Measure the time constant by determining the time for the output to drop to 37%. How does it agree with the theoretical value? Measure the time to rise from 0% to 63%. How does this compare with the time to fall to 37%? Try varying the frequency of the square wave (factor of 2 or 5).

2) Construct a low pass filter and make measurements of V_{in} and V_{out} as the input frequency* is changed. Make a graph of about 10 readings of V_{out} / V_{in} vs f. Take readings over a wide range of frequency values. (Taking equal steps won't give good results. Try doubling or tripling the frequency every time; these are logarithmic steps.) Develop the theory and compare the results to your data.

3) Also construct a high-pass filter and construct a similar graph of V_{out}/V_{in} vs f. (Do this on log-log paper and find the intercept and slope of the line and interpret them). How does the theoretical expression compare to your data?

Optional) Construct a phase shifter from resistors and capacitors that will shift the phase by 60° (V_{out} lags V_{in} by 60°). (Be careful to use the sine wave generator as the input voltage; what happens if the square wave generator is used?)

*Do not trust the setting on the frequency generator to give you accurate values of the input frequency. Check it with your oscilloscope.

*Capacitors can store a dangerous amount of charge. Be sure to discharge your capacitor before you place your fingers into the circuit.