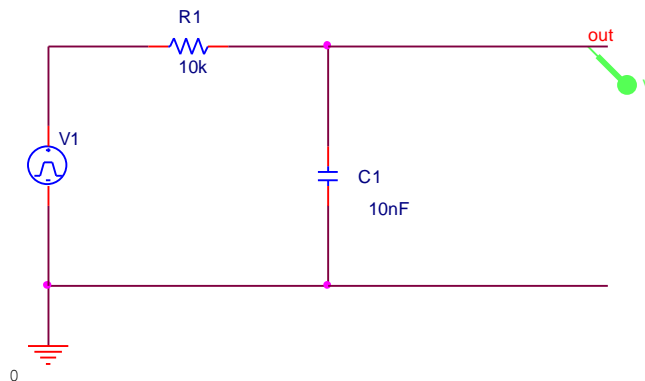


In this laboratory, you will determine the Transient Step Response and Sinusoidal Steady State (AC) Response of two simple circuits. You will estimate these circuits' behavior, simulate them with PSPICE and verify your results in the laboratory.

Turn in your results as printed lab report. Please use a word processor to type up the report – the only hand drawn sections should be the sketches, which can be scanned or taped in.

The first circuit is a single pole (first order) low-pass filter:

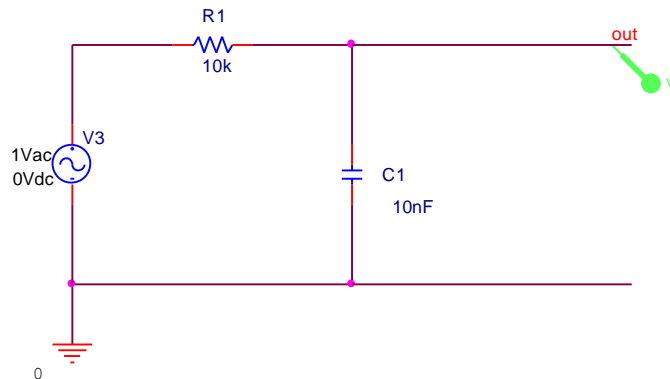


1.A Estimate (without using PSPICE or experiment) what this circuit will output if driven with a 1KHz symmetric square wave oscillating between + 1V and – 1V. Draw a sketch of the output for two cycles after some time has passed. Do the same for a 10KHz square wave drive.

1.B Enter this schematic into PSPICE and run it for enough cycles to reach periodic behavior. Plot the output for the last two cycles both for a 1KHz and a 10KHz and see if it agrees or disagrees with your sketch. Don't change your sketch.

1.C Build this circuit in lab, drive it with a signal generator, and see what the output is on the oscilloscope for both 1KHz and 10KHz drive. Capture and include this output from the oscilloscope in your lab report. Indicate any agreement or disagreement with the sketch or simulation. You may want to include the driving square wave for reference. Recall that the signal generator has an output impedance of 50 Ohms (e.g. a 50 ohm resistor in series with an ideal voltage source). Because $50 \ll 10K$, this should not have a significant effect on your circuit.

Next try the same circuit with a 1 Volt amplitude sine-wave drive:



2.A Estimate (without using PSPICE or experiment) what this circuit will output if driven with a 1KHz sine wave oscillating to peaks of ± 1 V around 0V. Draw a sketch of the output for two cycles after some time has passed. Do the same for a 10KHz sine wave drive.

2.B Sketch a Bode plot of the response of this circuit, both in decibels of amplitude and angle of phase, for a frequency range of sinusoidal inputs.

2.C Enter this schematic into PSPICE and run it for enough cycles to reach periodic behavior. Plot the output for the last two cycles both for a 1KHz and a 10KHz sine wave of 1 Volt amplitude and see if it agrees or disagrees with your sketch. Don't change your sketch.

2.D Do a Frequency Sweep analysis of this circuit in PSPICE and plot the result to see if it agrees or disagrees with your sketch. Don't change your sketch.

2.E Build this circuit in lab, drive it with a signal generator, and see what the output is on the oscilloscope for both 1KHz and 10KHz drive. Capture and include this output from the oscilloscope in your lab report. Indicate any agreements or disagreements with the sketch or simulation. You may want to include the driving sine wave for reference.

2.F Set the signal generator to sweep and synchronize the oscilloscope to the frequency output of the signal generator by connecting the second channel of the scope to the rear connector of the signal generator that outputs a voltage proportionate to frequency. Capture the result and see if it compares roughly with your sketch and PSPICE simulation. Include the captured picture in your lab report.

3.A – 3.C

Do the same work as in 1.A through 1.C, but for a high-pass circuit formed by reversing the placement of R and C in the circuit.

4.A – 4.F

Do the same work as in 2.A – 2.F, but for a high-pass circuit formed by reversing the placement of R and C in the circuit (same circuit as 3.A – 3.C)