

Idaho State University College of Technology
Robotics and Communication Systems Engineering Technology

Lab Experiment 2
TIME CONSTANT AND TRANSIENT RESPONSE

OBJECTIVE: After completion of this lab, the student should be able to compute and graph the instantaneous voltage and current waveforms in a series resistive capacitive circuit with a sine wave or square wave input voltage. The student should also be able to construct the circuit, measure, and draw the instantaneous voltage waveforms. In addition the student should be able to evaluate and explain any discrepancy between, the computed and measured value of instantaneous voltages. The student will use standard laboratory generator, oscilloscope and apply the knowledge of output and input characteristics of the test equipment.

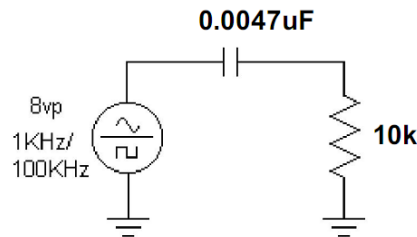
REFERENCE

1. Theory notes
2. FIRST YEAR TEXTBOOKS

EQUIPMENT AND MATERIALS

1. Oscilloscope as assigned
2. Sine-square Audio Generator
3. Diode as assigned by your instructor.
4. 10K Resistor
5. 0.0047uf Capacitor

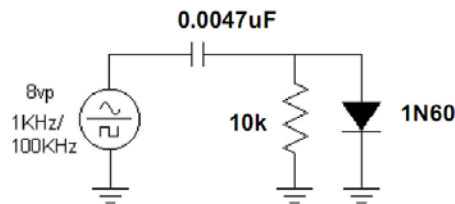
SPECIFIC OBJECTIVES: Given the following circuit:



1. Calculate and show how many cycles it will take before the signal stabilizes to what you will see on the scope. Calculate and draw the voltage waveforms across the generator, resistor and capacitor for two different square wave frequencies (1KHz and 100KHz). Generator output should be 0 to 8 volts.
2. Measure and draw the voltage waveforms across the generator, resistor and capacitor for the frequencies used in specific objective number 1. (Use the Sine-Square Audio Generator, NOT the sweep generator) Draw the waveforms observed on your scope exactly as you see it to show what you observed. Label in your drawing frequency and amplitude.
3. Compare, analyze, and explain the computed voltage waveforms and the measured voltage waveforms in specific objective 1 and 2.
4. Document in your own words what a differentiating circuit is. Pick a frequency between 40KHz and 70KHz for a square wave on your generator and show in your lab book how to design a differentiation circuit. Use a 0.0047uF capacitor. Draw the predicted output waveform. Build the circuit and measure the output. Be able to explain **any** discrepancies between your predicted and measured waveform. **Verify your working circuit with your instructor.**

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5. Document in your own words what an integrator circuit is. Pick a frequency between 10KHz and 30KHz for a square wave on your generator and show in your lab book how to design a integrating circuit. Build the circuit and measure the output.
6. Compute and draw the voltage waveform across the generator, capacitor, and resistor with a diode connected in parallel at two different square wave frequencies (1KHz and 100KHz). The generator output should be 0 to 8V. Show your predicted waveforms for both frequencies.



7. Measure and draw the voltage waveforms across the generator, capacitor and resistor for the frequencies used in specific objective number 6. (Use the Sine-Square Audio Generator, **NOT** the sweep generator) Draw the waveforms observed on your scope **exactly** as you see it. Label amplitudes and frequencies on your drawing.
8. Compare, analyze and explain the computed voltage waveforms in specific objective 6 and 7. **See your instructor for verification**
9. Using the same circuit for specific objectives 6 and 7, compute and draw the voltage waveforms across the generator, capacitor, and resistor with a diode connected in parallel at two different **sine** wave frequencies (1KHz and 100KHz). Show your predicted output waveforms.
10. Measure and draw the voltage waveforms across the generator, capacitor, and resistor for the frequencies used in specific objective number 9. (Use the Sine-Square Audio Generator, NOT the sweep generator) Draw the waveforms observed on your scope exactly as you see it. Label frequencies and amplitudes.
11. Compare, analyze and explain the computed voltage waveforms and the measured voltage waveforms in specific objective 9 and 10. **See your instructor for verification.**

In your conclusion, make sure you briefly explain what you have learned about the diode you used in this experiment and how it affected your circuit.