OBJECTIVES

Objective of this experiment is to become familiar with the some of the common applications of diodes with capacitors. We will compare the theoretical results with the practical ones. We will also see the input output relationship in a DC diode circuit.

PRELAB

1. The analysis of the following circuits is required to be done before the lab. You will not be allowed to enter the lab session if you do not bring your prelab with you.

2. Diode states in DC circuits
   Plot $V_{OUT}$ vs. $V_{IN}$ for the circuit in figure 1. Assume that the diodes show zero resistance in ON state, and have a turn-on voltage of 0.7 Volts.

3. Half-Wave Rectifier
   Half-wave rectifiers are found in many applications such as AC/DC conversion (power supplies) and AM demodulation (radios).

   (a) Consider the circuit shown in figure 2. Let $V_{IN} = 10V_{pp}$ sine wave at 1kHz with no DC component. Sketch $V_{OUT}$ vs. time and $V_{IN}$ vs. time on the same axis. Indicate any relevant voltage values.

   (b) Repeat (a) with $V_{IN} = 0.8V_{pp}$

   (c) Repeat (a) for circuit in figure 3.
4. Level Shifter (DC Restorer)
   (a) Consider the circuit shown in figure 4. Let $V_{IN} = 10V_{pp}$ square wave at 1kHz with no DC component. Sketch $V_{OUT}$ vs. time and $V_{IN}$ vs. time on the same axis. Indicate any relevant voltage values.
   (b) Repeat (a) with $V_{IN} = 0.8V_{pp}$
   (c) Repeat (a) for circuit in figure 5.

5. Voltage Tripler
   Using certain combinations of previous circuits we can build ourselves a "voltage tripler". As its name implies it is going to multiply the input AC voltage by 3 and show it at the output as a DC voltage.

   Consider the circuit shown in figure 6. Let $V_{IN}$ be a square wave at $2kHz$ alternating between -5V and 5V. Plot the waveforms observed at $V_1$, $V_2$, $V_3$, $V_4$ and $V_{OUT}$.
**EXPERIMENT**

1. Build the circuit in figure 1. From your prelab, determine reasonable peak-to-peak amplitude for $V_{IN}$. Set the waveform to triangle and frequency to 1kHz. Using X/Y mode of the oscilloscope plot $V_{OUT}$ vs. $V_{IN}$.

2. Build the circuit shown in figure 2.
   a) Set $V_{IN} = 10V_{pp}$ sine wave at 1kHz with no DC component. Plot $V_{OUT}$ vs. time and $V_{IN}$ vs. time on the same axis on the provided sheet.
   b) Repeat (a) with $V_{IN} = 0.8V_{pp}$
   c) Repeat (a) for circuit in figure 3. Find the amplitude of the ripple.
   d) **Comment** on the observed results and computed results.

3. Build the circuit shown in figure 4.
   a) Set $V_{IN} = 10V_{pp}$ square wave at 1kHz with no DC component. Plot $V_{OUT}$ vs. time and $V_{IN}$ vs. time on the same axis on the provided sheet.
   b) Repeat (a) with $V_{IN} = 0.8V_{pp}$
   c) Repeat (a) for circuit in figure 5.
   d) **Comment** on the observed results and computed results.

4. Build the circuit shown in figure 6. Set $V_{IN}$ to a square wave at 2kHz alternating between -5V and 5V. Sketch $V_1$, $V_2$, $V_3$, $V_4$ and $V_{OUT}$. Measure the ripple. **Comment** on the observed and computed results.

**REPORT**

Please follow the instructions given in the experiment section and work out a report of your own. Each person should submit a separate report. Remember to fully label the plots: plot title, axis labels and axis units. Note that the report deadlines are as follows:

- Monday group: First Monday after the lab
- Wednesday group: First Wednesday after the lab