ECEN204 **Lab 3**

Diode Applications: Report

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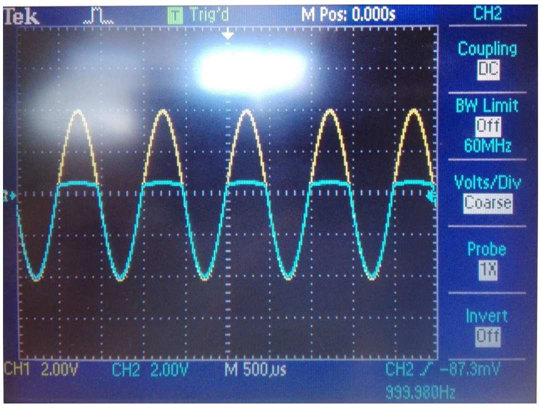
Level 1:

Part A1: Diode clipper

1. Sketch your resultant of Part A1 (a and b) and explain this result.



The above is a clipping circuit, using a diode and current limiting resistor. V_{in} is an AC source and V_{out} is taken across the diode.
In positive cycle of the AC source the diode is in forward bias, and thus has a constant voltage drop of ~0.7v. This is seen as the positive peaks are clipped at ~0.7V.
On the negative cycles, the diode (in reverse bias) is essentially a short, and thus has the voltage drop = V_{in}, seen as unaltered troughs.

2. Sketch your resultant waveform of Part A1 (c and d) and explain this result.

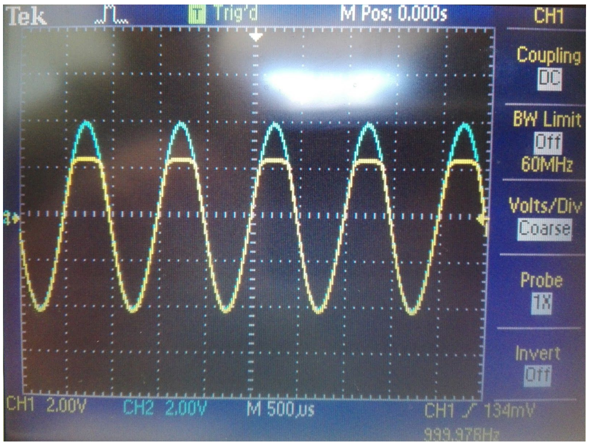


Figure 1: FWD Bias + Source

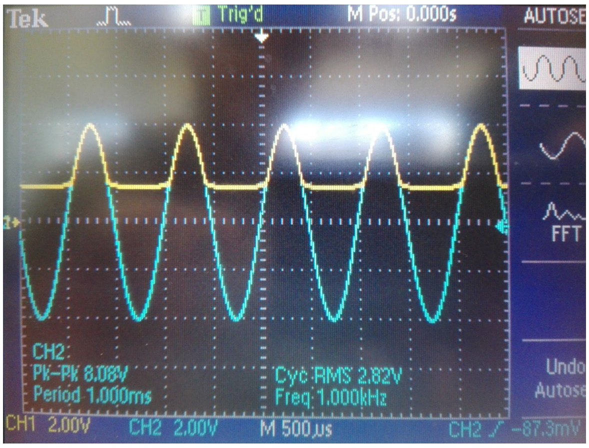
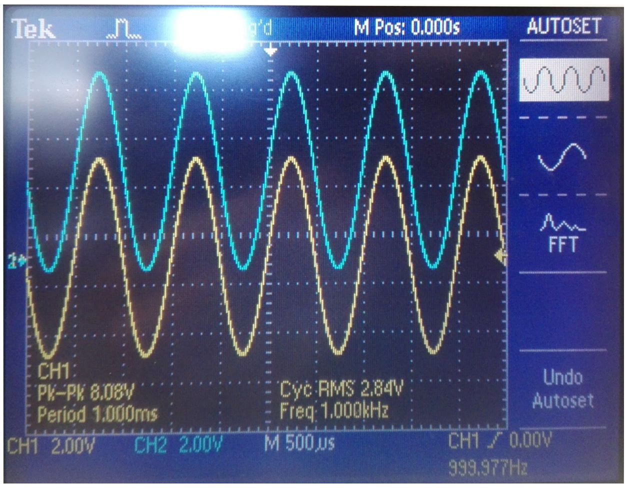


Figure 1: FWD Bias + Source

The figures above are the same as a standard clipping above, but the added voltage source in series with the diode added to constant voltage of the diode in forward bias, seen in both f1 and f2 as the plateau is shifted up by Vz + Vs.
note: fig2 is the reverse to f1 so diode clips the negative cycles.

Part A2: Diode clamp

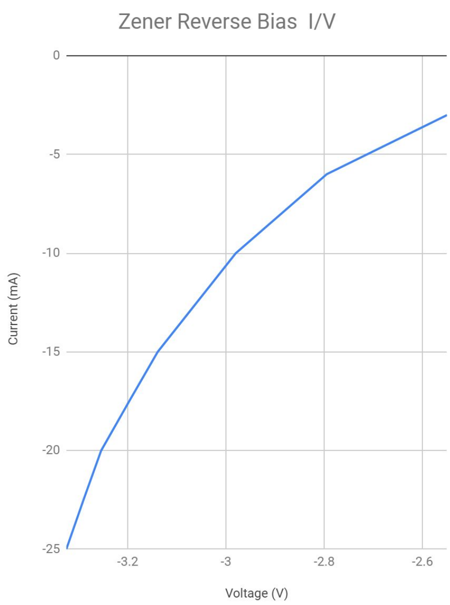
3. Sketch your resultant waveform of Part A2 (b) and explain this result.



The added capacitor will initially charge to $V_c = V_{in}$ but due to the diode being an effective open in the negative cycle (reverse bias) the capacitor does not discharge and holds V_c this is effectively an added DC source and thus offsets the signal by $+V_c$. Seen here by the shifted (up) sine wave.

Part B2: Zener diodes

4. Show your plot of I_Z vs V_Z as obtained in Part B1 (b and c).



5. Show your calculation of the stability ratio as obtained in Part B2 (b and c) and compare to the value expected from the diode model.

At measured voltages {+12, +14}, V_z = {3.226, 3.295}
$\Delta OP / \Delta IP = 0.069 / 2 = 0.0345$ or **3.45%**
expected: 3.33%

Solving simultaneous at 2 points:
$V_{Z0} = 2.97V$

R_z = 14.2R

Level 3:
Additional question

6. Design a voltage reference of 3.6 V capable of driving a load of 200 Ω. This reference voltage must be produced from a voltage supply that can vary between 4.5 and 5.5 V. Also calculate the power rating that would be needed for the Zener diode.

Hint: Use a 3.6 V Zener diode and then calculate the series resistor needed for the circuit below.