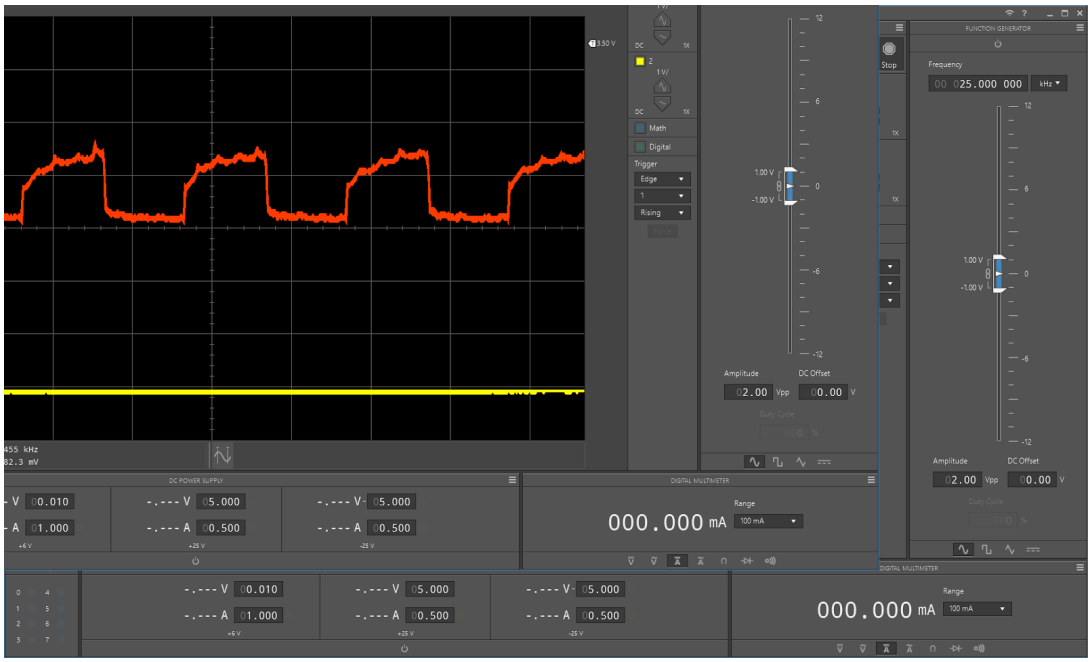
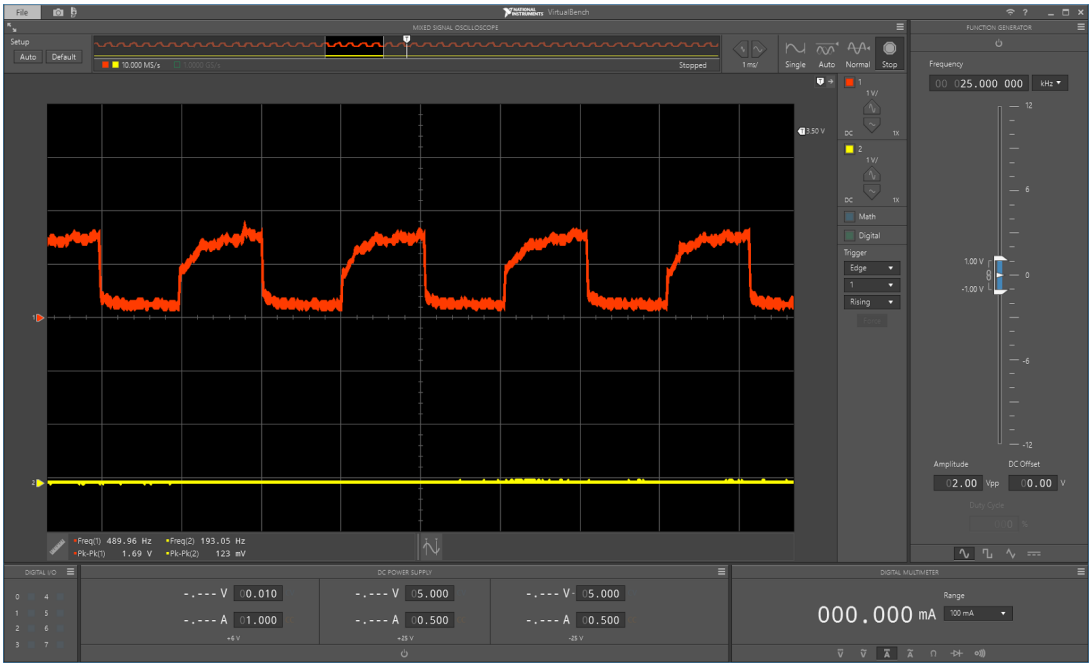
Question 1:

(With diode, image below)



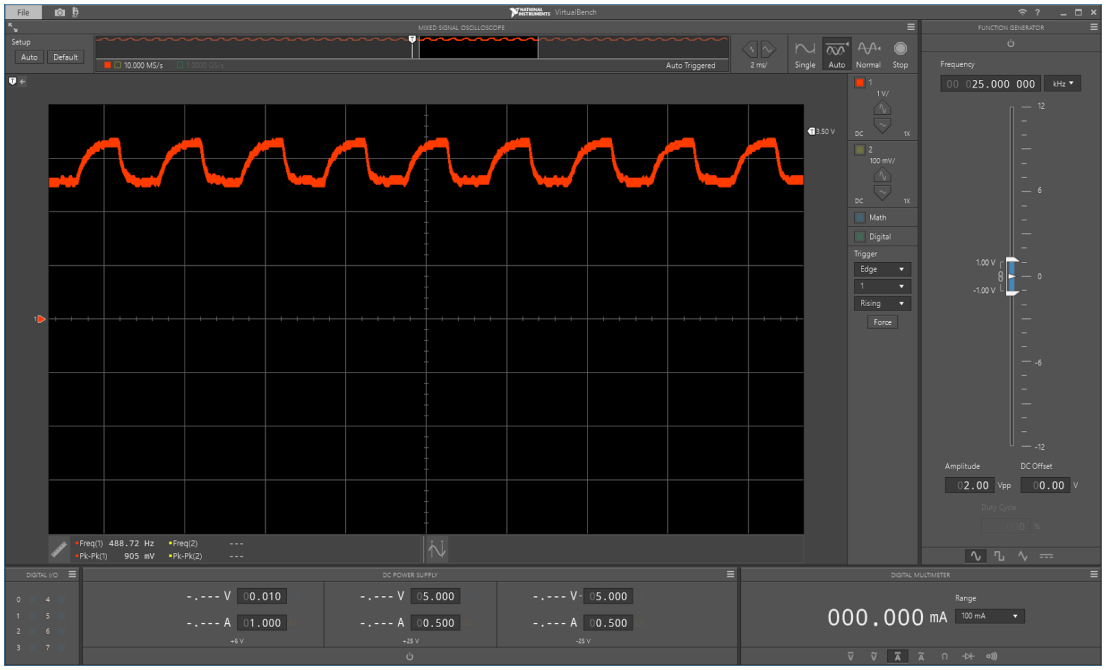
(Without diode, image below)



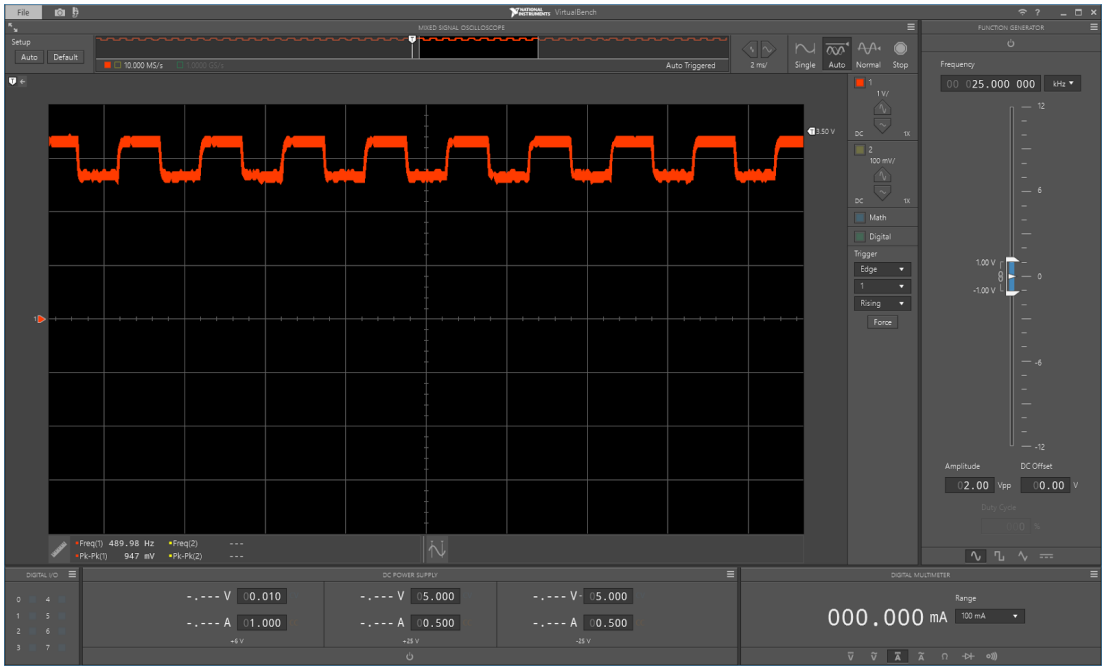
1. We observed that with the diode it has less noise than without it.

Question 2:

(With capacitor, image below)

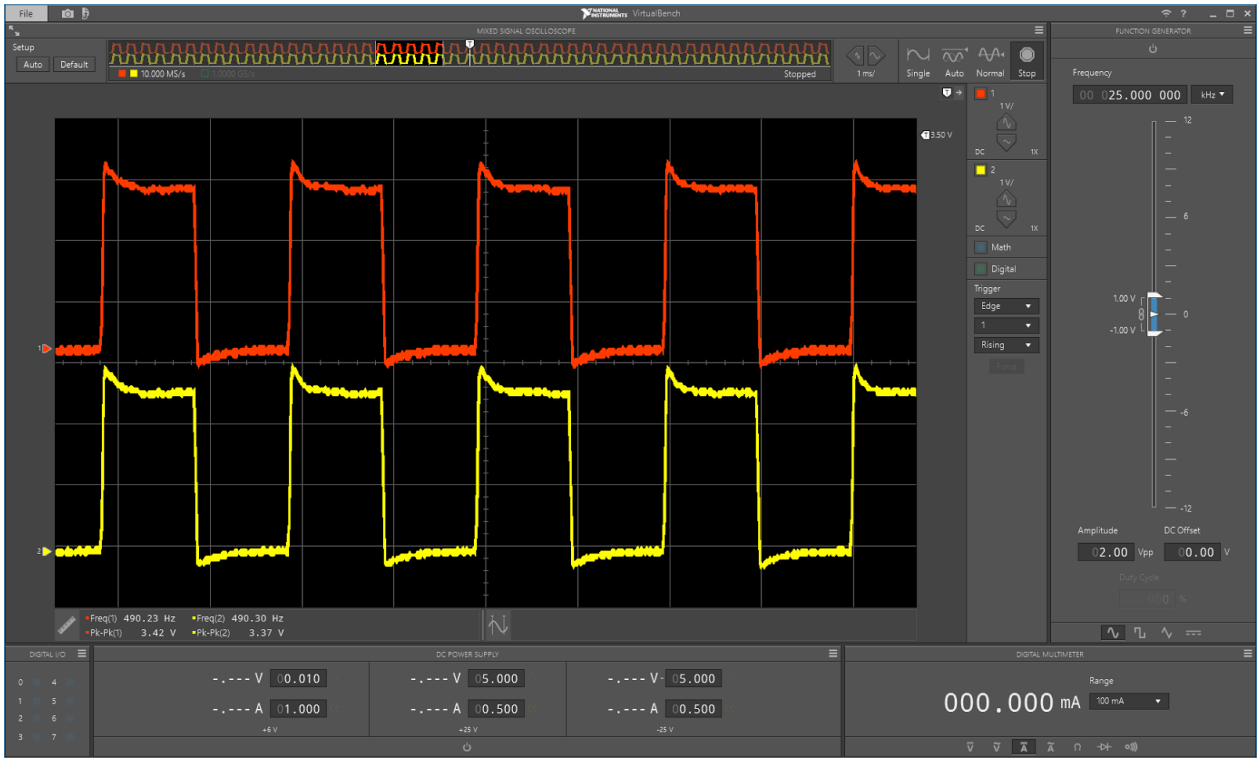


(Without capacitor, image below)



2.Minimum voltage without capacitor is 2.6 volts.
Minimum voltage with capacitor is about 2.8 volts

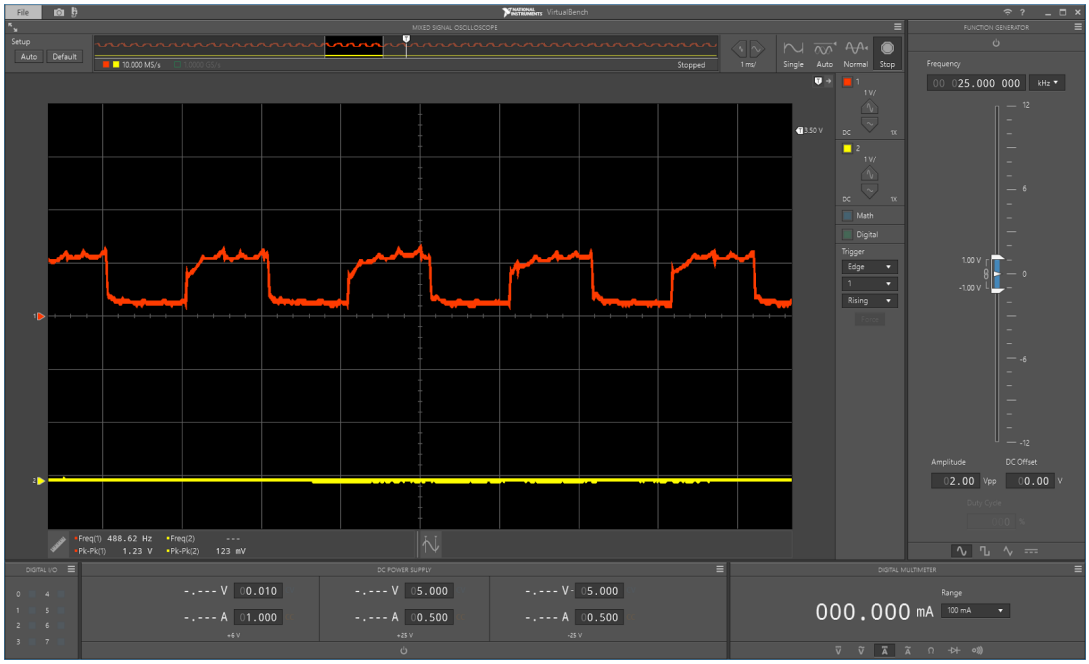
Question 3:



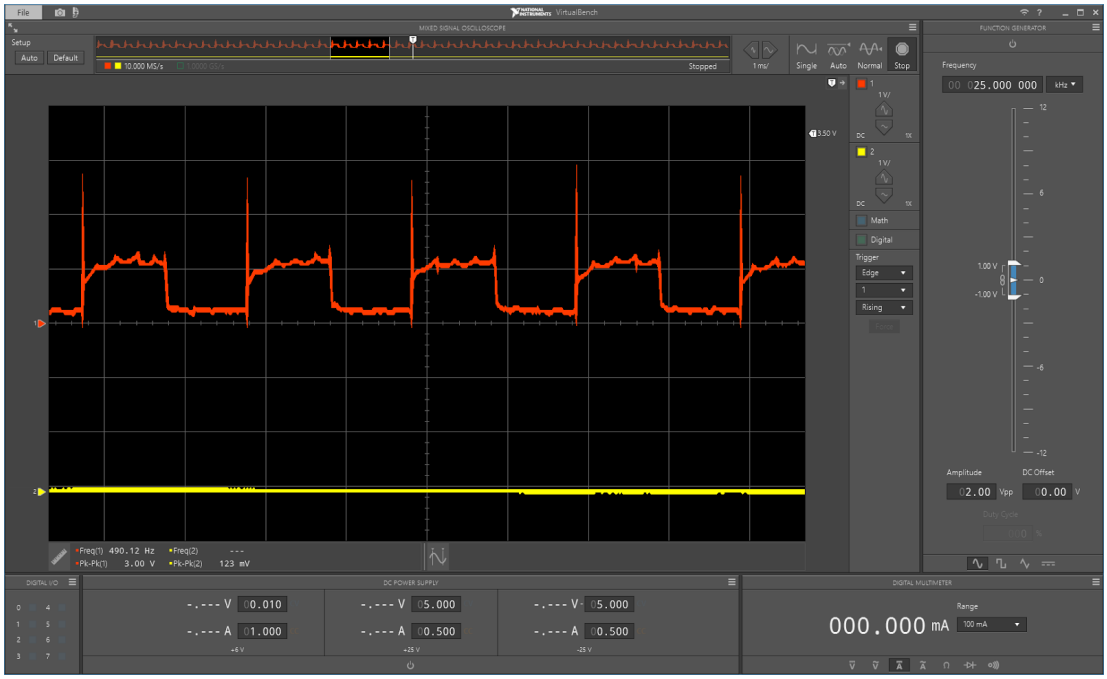
3.The red wave is with the filter and the yellow wave is without the filter.
From what we can find, our conclusion is that the effect the filter has on the PWM input to the controller is that the filtered circuit can block high frequency signals. The rc circuit can block high frequency signals therefore the red wave looks smoother than the yellow wave.

Question 4:

(with filter, image below)



(without filter, image below)



4. The motor when it is not running, acts like an inductor and as current tries to flow through it, it generates a current which has an opposite current that is running towards it. This causes the spike that can be seen in picture two. With the filter, the current flowing into the inductor is more smooth and would not create the spike.