

EE 311: Electrical Machines and Power Electronics Laboratory

LAB REPORT - 4

EXPERIMENT 4 : Design of Buck converter for the given specifications

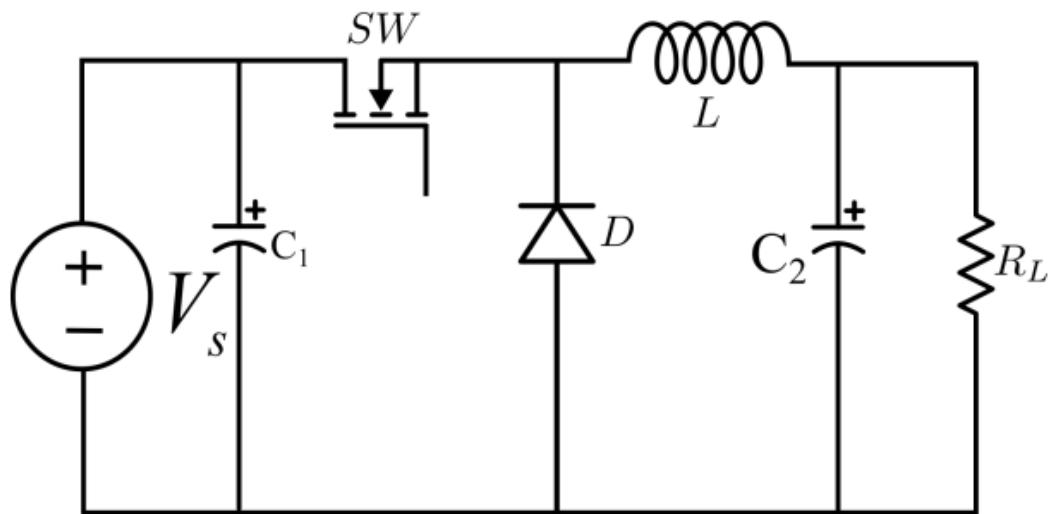
Aim - The buck converter is used to step down the input dc voltage to the desired output voltage. The duty cycle of the switch (MOSFET) can be varied to change the output voltage. To smoothen the output voltage and current the LC filter is used.

$$V_o = d \cdot V_{in}$$

$$L = \frac{V_{in} - V_o}{f_s \cdot \Delta i}$$

$$C = \frac{\Delta i}{8f_s \cdot \Delta v}$$

Circuit Diagram / Experimental Setup :

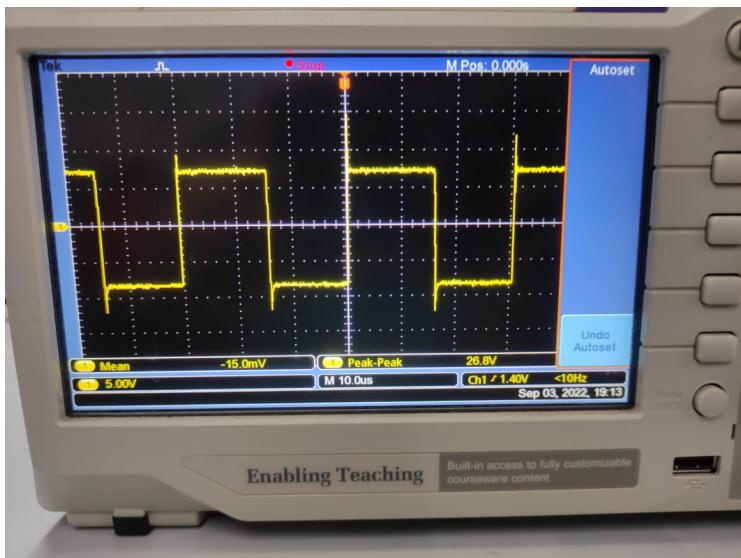


Procedure / Steps:

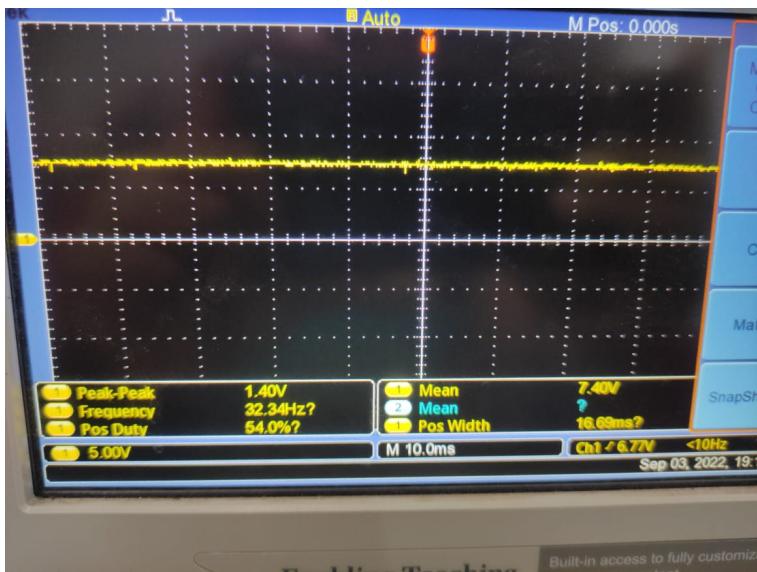
1. Connect the components according to the circuit diagram.
2. Apply the gate pulses using the TL494 PWM generator designed earlier.
3. Vary the duty cycle and observe the variations in the output voltage.
4. Obtain the plots for the inductor voltage and the diode voltage.
5. Turn on the power supply, only after the gate terminal of MOSFET is connected to the driver.

Data recorded & measured:

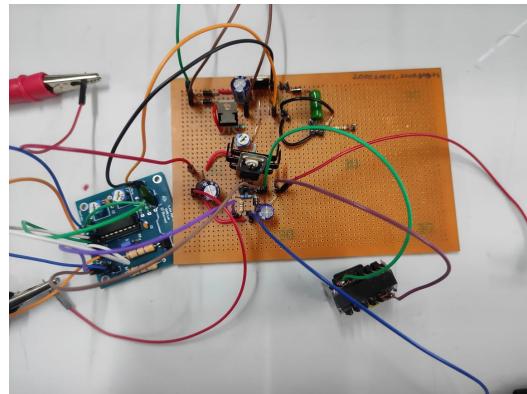
1. Inductor voltage for the buck converter:



2. Output voltage with duty cycle = 0.5 & frequency set to 30 KHz:



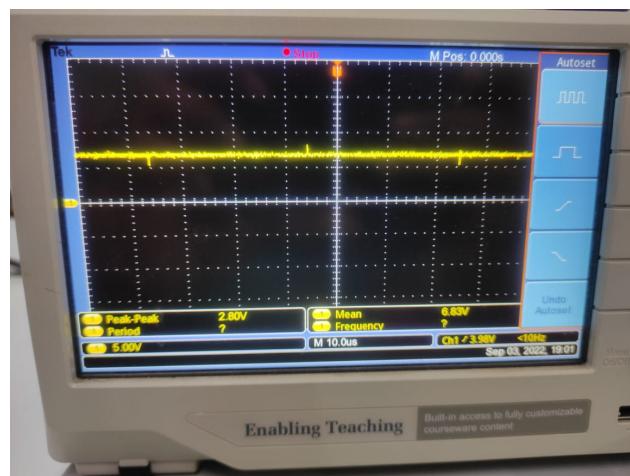
Soldered Board Snapshot:



ANALYSIS:

We first observed the output voltage after setting the input voltage to 15 V and the duty cycle to 0.5 and the switching frequency for the gate pulses from the TL494 chip to be 30 KHz, and we then measured the output voltage, and we got 7.40 V as the output voltage.

Then we added a resistive load, where we observed the ripple increase in the output voltage, and the output voltage decreased from 7.4 to 6.8 V after loading.



ADDITIONAL RESULTS:

Our final goal is to give gate signals to the mosfet in a buck or boost voltage converter, so we use this **TL494 PWM** chip to provide the appropriate gate pulses, and the buck converter gives out the output voltage as per the set duty cycle.

The waveforms of the buck converter will look like:

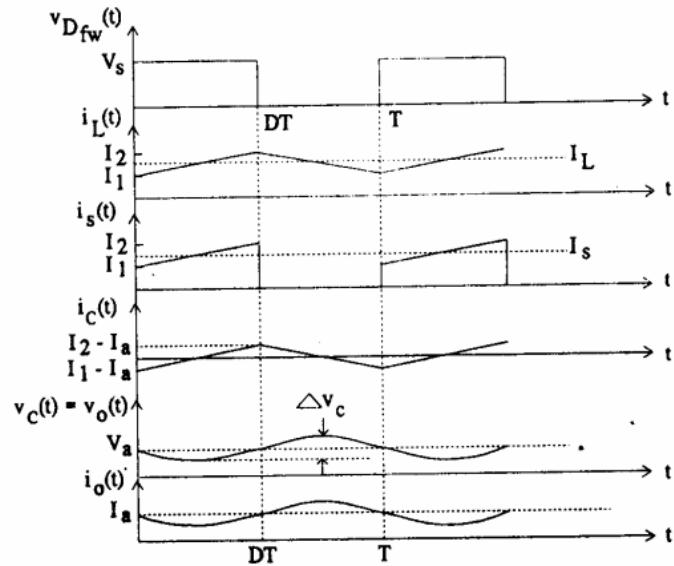


Fig. 3-6, Buck converter switching waveforms

INPUT DC-DC converters : [Source](#)