ECE 320 - Homework #6

H-Bridge, DC to DC Converters, Fourier Transforms. Due Wednesday, February 22nd

Please email to jacob.glower@ndsu.edu or submit as a hard copy or submit on BlackBoard

Pick an NPN and PNP transistor (preferably one you have in your kit)

	3904 NPN	6144 NPN	3906 PNP	TIP117 PNP
hfe (beta)	100	200	100	1,000
Vce(sat)	0.2V	0.2V	0.2V	0.9V
Vbe(on)	0.7V	0.7V	0.7V	1.4V

H-Bridges:

The following circuit is 1/2 of an H-bridge. (the mirror image (minus the 2.5V supply) is repeated to the right for a full H-bridge). Also note: the 50 Ohm & 2.5V source is the Thevenin equivalent of two 100 Ohm resistors (shown to the right). The circuit to the right is easier to build and is equivalent to the part shown in purple.

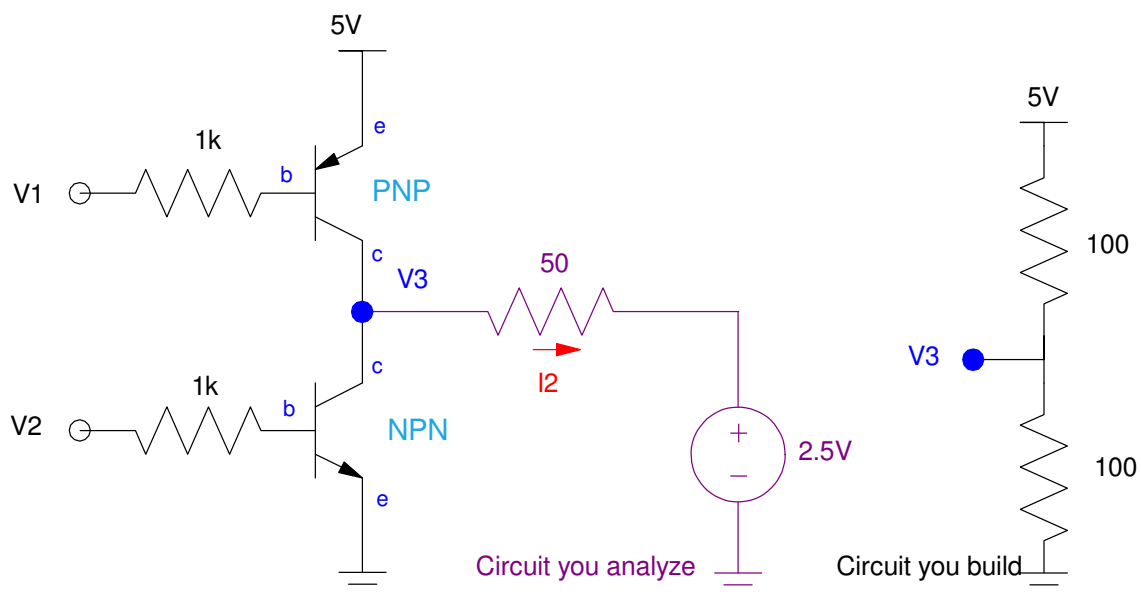1) Determine the voltages and currents for the following 1/2 H-bridge for

- V1 = 0V, V2 = 0V
- V1 = 5V, V2 = 5V
- V1 = 5V, V2 = 0V

Assume 3904/3906 transistors

- | Vbe | = 0.7V
- current gain = 100
- $V_{ce(sat)}$ = 0.2V

2) Check your results (votlages and currents) in CircuitLab

3) Lab: Build this circuit and measure the voltages and currents. (note: it's OK to compute the currents from the measured votlages).

DC to DC Converters

4) Determine the voltages (both DC and AC) for V1 and V2.

5) Simulate the circuit in CircuitLab and determine V2 (DC and AC)

6) Change the duty cycle and C so that
   - The DC voltage at V2 = 5.00V
   - The ripple at V2 is 1Vpp

7) Check your results for problem #6 in CircuitLab
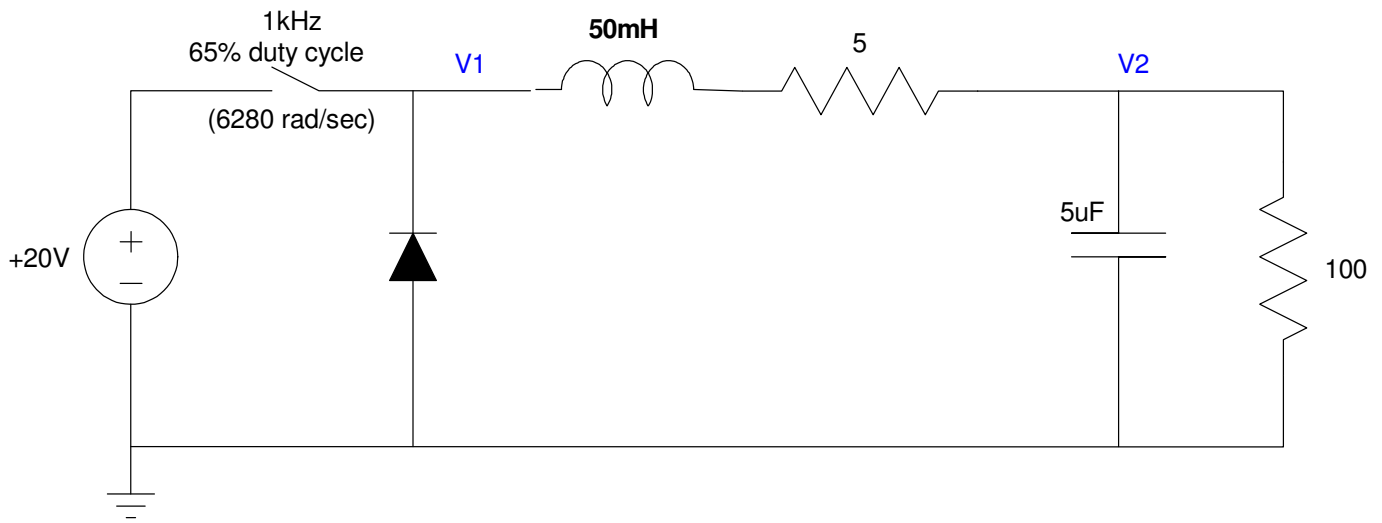
DC to DC Converter (problems 4 - 7)

Fourier Transforms

8) Going back to problem #4, determine the Fourier Transform for V1 out to the 3rd harmonic (3kHz)

9) Using the Fourier Transform approximation for V1, determine V2 out to the 3rd harmonic (3kHz)