ECE 320 - Homework #7

DC to AC, SCR, Boolean Logic. Due Monday, February 27th

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

DC to AC

1) Let C1 = 100uF, L1 = 50mH

- Va = 0V / 5V square wave, 60Hz, 0 degree time delay
- Vb = 0V / 5V square wave, 60Hz, 180 degree time delay
- C1 = 10uF

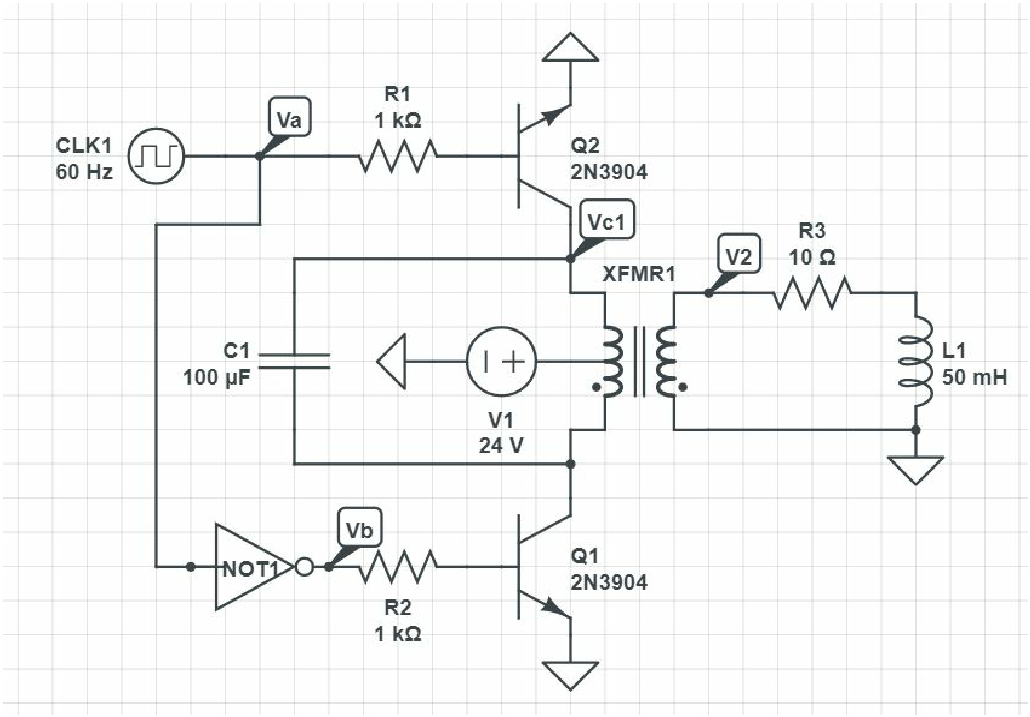
Determine using CircuitLab the voltage V2 (i.e. the votlage across a DC motor, modeled as a 10 Ohm & 100mH load)

2) Adjust C1 so that V2 looks closer to a sine wave

3) With the adjusted C1, determine the frequency content of V2 out to 300Hz

- From, CircuitLab, run a time-domain simulation
- Download the voltage at V2 to a CVS file (Export Plot CVS)
- Copy the data in to Matlab and determine the Fourier transform of V2 out to the 5th harmonic (300Hz)

What percentage of the energy is in the 1st harmonic (60Hz)?



DC to AC Converter (problem 1 & 2)

SCR

4) Assume a firing angle of 50 degrees. Determine the voltage at V1 and V2 (both DC and AC).

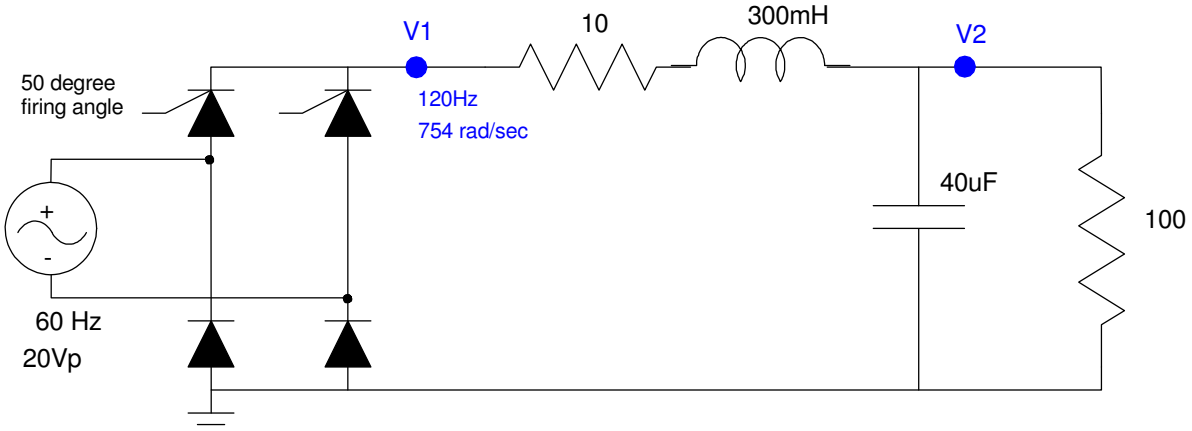
- Assume V1 has two terms: a DC term and an AC (120Hz) term
- The DC term matches the actual DC voltage at V1
- The AC term matches the peak-to-peak voltage at V1.

5) Repeat problem #4 using Fourier transforms (more accurate analysis of V1 and V2)

- Find the DC and 1st-harmonic (60Hz) terms for V1 using Fourier transforms
- Determine V2 based upon these two terms

6) Change this circuit so that

- The voltge at V2 is 9.00V (DC)
- With a ripple of 1.00Vpp



SCR: Problem 4 - 6

Boolean Logic:

7) Design a circuit to implement Y using NAND gates

8) Design a circuit to implement Y using NOR gates

Y(A,B,C,D)

AB \ CD	00	01	11	10
00	1	0	0	x
01	1	0	x	1
11	1	x	1	0
10	0	1	x	0