ECE 320 - Quiz 6: Name _____

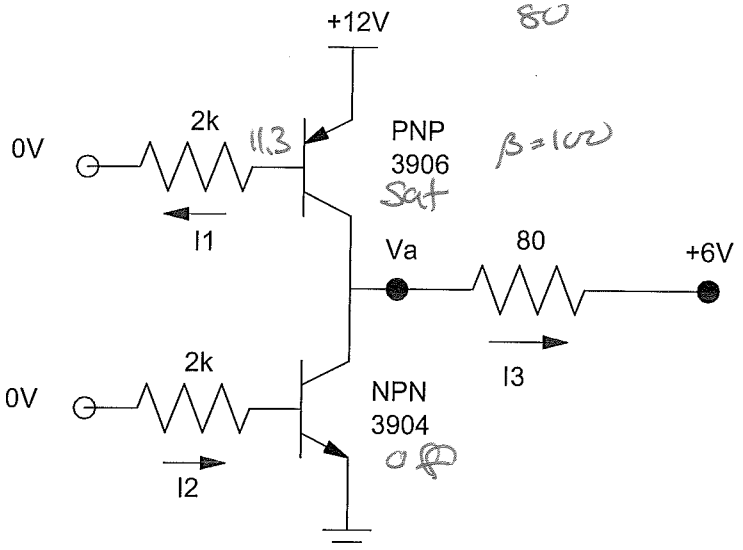
H-Bridge, SCR Rectifiers. October 8th, 2015

For the following half-H-bridge, determine the voltages and currents. Assume each transistor has a current gain ~~200~~. 100

I1	I2	I3	Va
5.65mA	0	72.5mA	11.8V

11.3V / 2k

11.8−6 / 80



check: $\beta I_b > I_c$

$100 \cdot 5.65mA > 72.5mA$

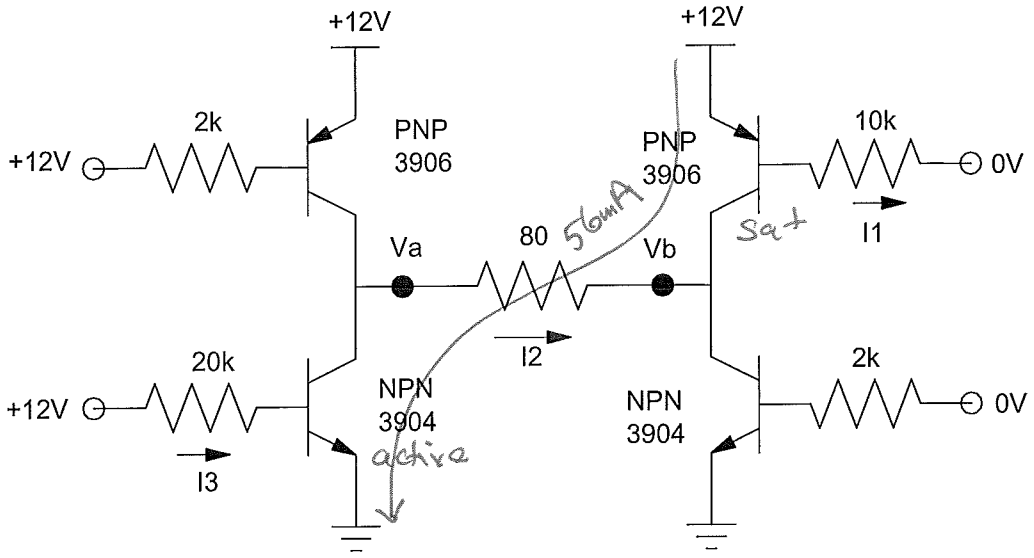
$565mA > 72.5mA$

yes, the PNP is saturated

2) Assume each transistor has a current gain of 100. Determine the voltages and currents.

I1	I2	Va	Vb
1.13mA	-56.5mA	7.28V	11.8V
2	3	3	2

11.8V - (56mA)8Ω



$I_3 = \frac{12 - .7}{20k} = 565\mu A$

$I_1 = \frac{11.3 - 0}{10k} = 1.13mA$

$\beta I_3 = 56.5mA$

$\beta I_1 = 113mA$

$\frac{12}{80} = 150mA$

$I_2 = \min(56mA, 113mA, 150mA)$

$= 56mA$

3) Assume the output of a DC to AC converter is

$$V_{out} = 7\sin(100t) + 1.5\sin(200t) + 0.7\sin(300t)$$

with a load of 1 Ohm. What is the energy in the 1st harmonic (100 rad/sec), the total energy, and the percentage of the energy in the 1st harmonic?

Energy in the 100 rad/sec term	Total Energy	Efficiency: E(100) / E(total)
24.5W	25.87W	94.7%

$P_{100} = \frac{1}{2}\frac{V_p^2}{R} = 24.5W$

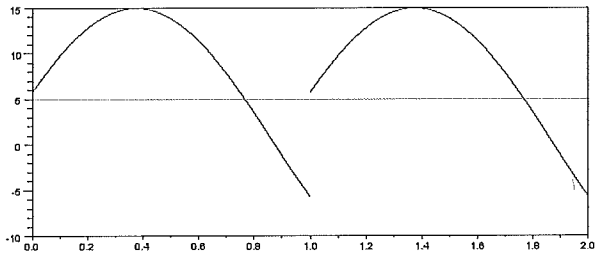
$P_{200} = \frac{1}{2}\frac{V_p^2}{R} = 1.125W$

$P_{300} = \frac{1}{2}\frac{V_p^2}{R} = .245W$

$P_{total} = 25.87W$

4a) Assume a SCR with four diodes with the output of the full-wave rectifier being:

$$V_a = 15\sin(t+\phi) \qquad 0 < t < \pi$$



Determine the firing angle, ϕ, so that the DC level is 5.00V

$$\frac{1}{\pi}\int_0^{\pi} 15\sin(t+\phi)dt = 5$$

Firing Angle = 58.43°

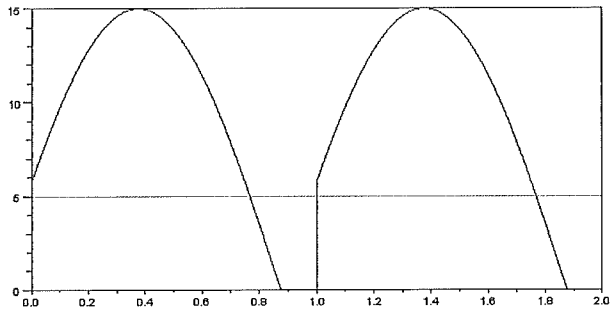
$$-\cos(t+\phi)\Big|_0^{\pi} = \frac{5\pi}{15}$$

$$2\cos(\phi) = \frac{3\pi}{15}$$

$$\phi = 58.43°$$

4b) Assume a SCR with five diodes, with the output of the full-wave rectifier being

$$V_a = \begin{cases} 15\sin(t) & t > \phi \\ 0 & t < \phi \end{cases}$$



Find the firing angle, ϕ, so that the DC level is 5.00V

$$\frac{1}{\pi}\int_{\phi}^{\pi} 15\sin(t)dt = 5$$

Firing Angle = 87.29°

$$-\cos(t)\Big|_{\phi}^{\pi} = \frac{5\pi}{15}$$

$$1 + \cos\phi = \frac{5\pi}{15}$$

$$\phi = 87.29°$$

5) Assume a SCR with a firing angle of 45 degrees so that voltage at Va is

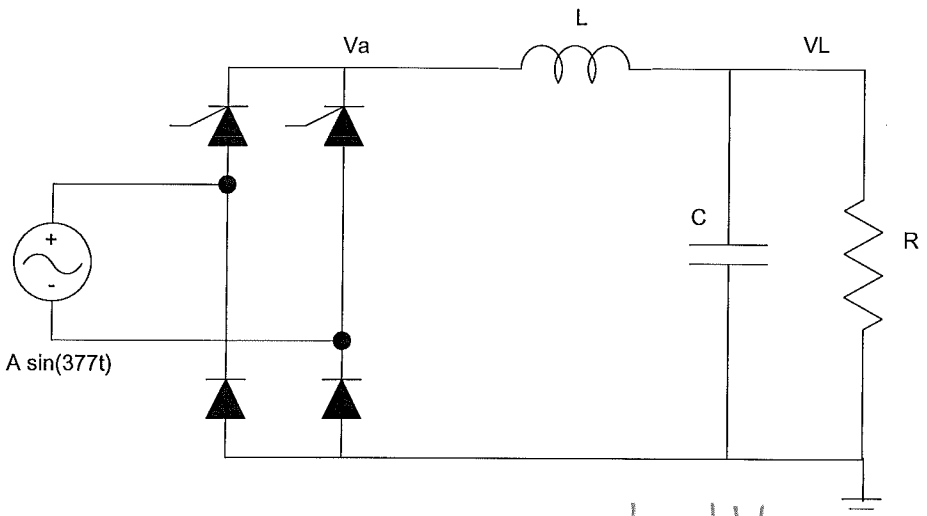
DC Term: 8.81V

AC: 20.74Vpp @ 120 Hz

Find R, L , C so that the load has

- A current to the load (R) is 100mA and
- The ripple across the resistor is 100mVpp

R	L	C
88.1Ω	24.23H 1H	0 364.8μF



$C=0$

$\left(\frac{R}{R+j\omega L}\right) 20.74_{pp} = 0.1_{pp}$

$\omega L = 18.27k\Omega$

$L = 2423H$

$L=1H$

$\frac{1}{\omega^2 C} = \frac{.1}{20.74}$

$LC = 364.8 \cdot 10^{-6}$

$C = 364.8\mu F$

Colbert Trivia! What was the slogan for Steven Colbert's presidential campaign in 2012?

- a) Making a better tomorrow tomorrow.
- b) Corporations are people, people are people, cats are people.
- c) We're making cheese great
- d) Vote early, vote often, vote Colbert
- e) Colbert Nation Unite!