ECE 320 - Quiz #6 - Name _____

DC to AC Converters, SCR's, Operational Amplfiers. October 11, 2018

1) The output for a DC to AC converter with a period of 2π is

$$x(t) = \begin{cases} 10V & -0.5 < t < 0.5 \\ 0V & otherwise \end{cases}$$
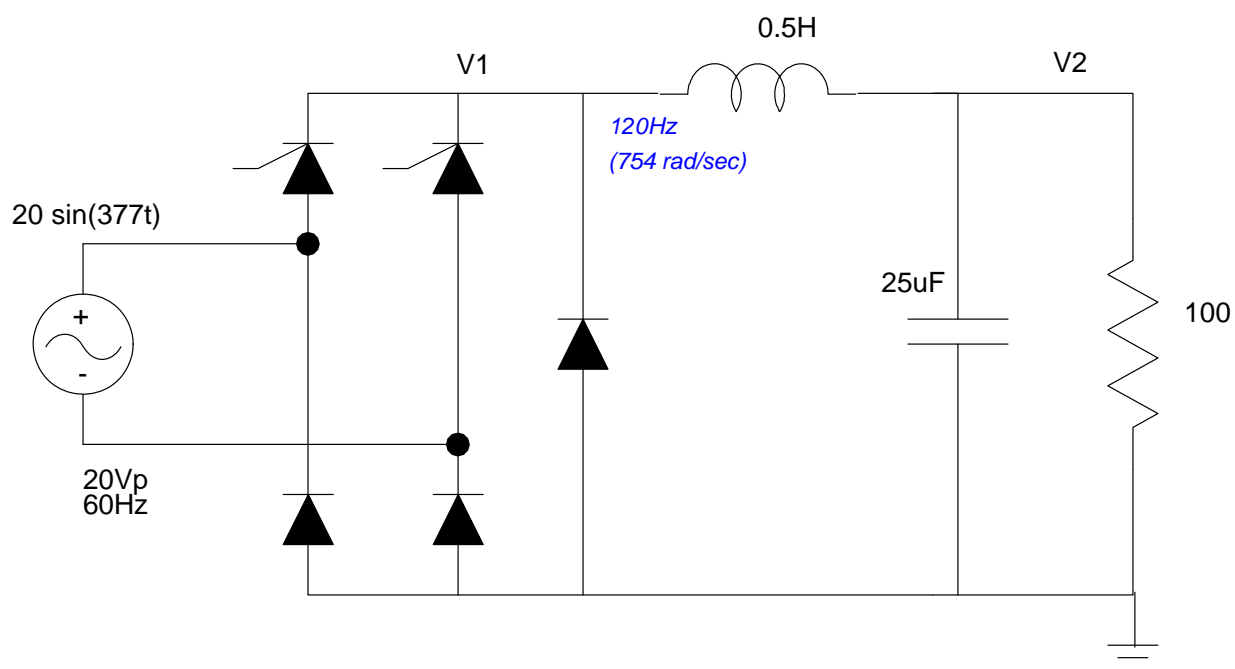
Determine

- The energy in the signal (assuming it goes across a 1 Ohm resistor)
- The 1st harmonic (sine term will be zero: it's an even function), and
- The energy in the 1st harmonic (assuming it goes across a 1 Ohm resistor)

Total Energy in the signal (Watts)	1st Harmonic (cosine term) (Volts)	Energy in the 1st harmonic (Watts)
$\frac{1}{2\pi}\int_{-\pi}^{\pi} x^2(t) \cdot dt$	$a_1 = \frac{1}{\pi}\int_{-\pi}^{\pi} x(t) \cdot \cos(t) \cdot dt$	$\frac{1}{2\pi}\int_{-\pi}^{\pi} (a_1\cos(t))^2 dt$

2) An AC to DC converter uses semiconductor relays (SCR) with a firing angle of 37 degrees. Determine the voltages at V1 and V2. Note that

- $V_1(DC) = \left(\frac{V_p}{\pi}\right)(1 - \cos\theta)$ $\qquad\qquad$ θ = firing angle
- frequency at V1 = 120Hz (754 rad/sec)

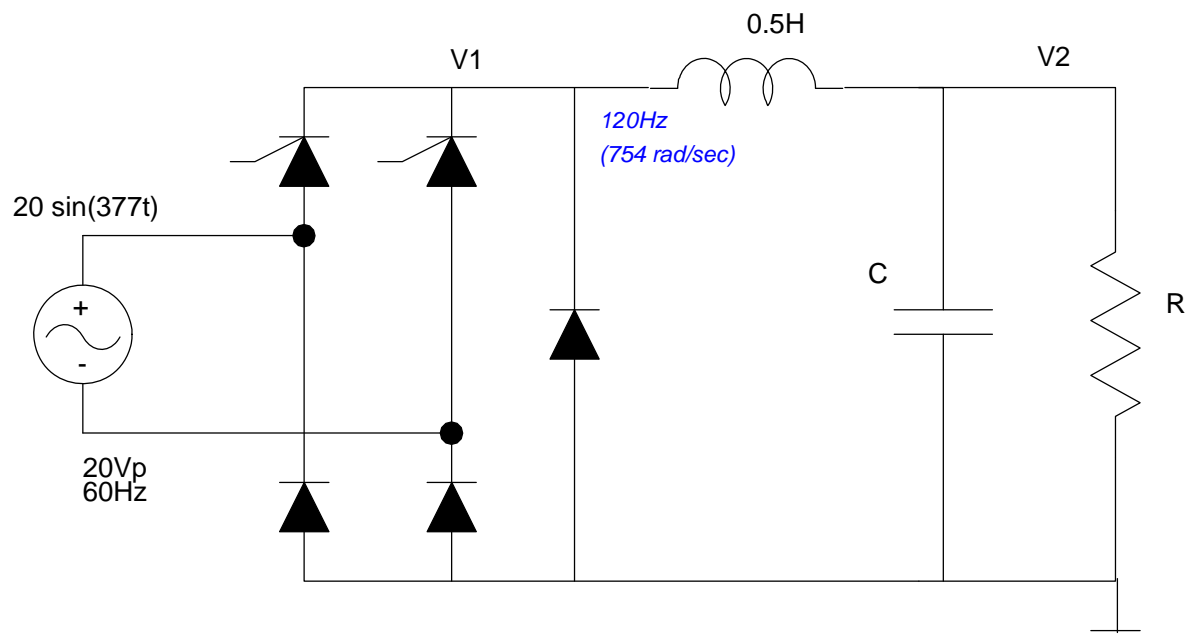| V1		V2	
DC: V1	AC: V1pp	DC: V2	AC: V2pp

3) Determine the firing angle, C, and R so that the following AC to DC converter has
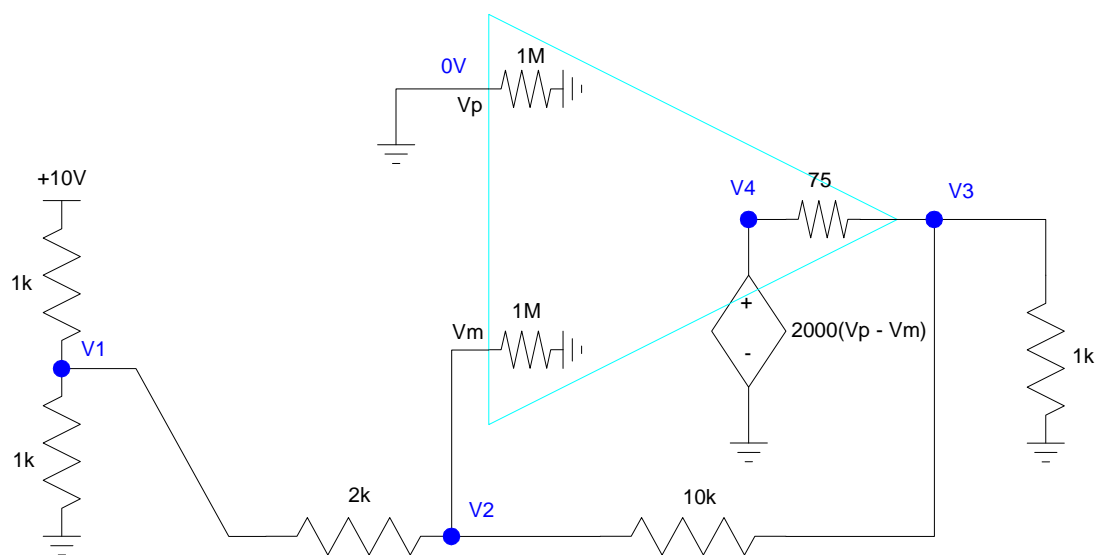- 5.00V at V2
- 75mA current draw, and
- 1Vpp ripple at V2

Note that

- $V_1(DC) = \left(\frac{V_p}{\pi}\right)(1 - \cos \theta)$ θ = firing angle
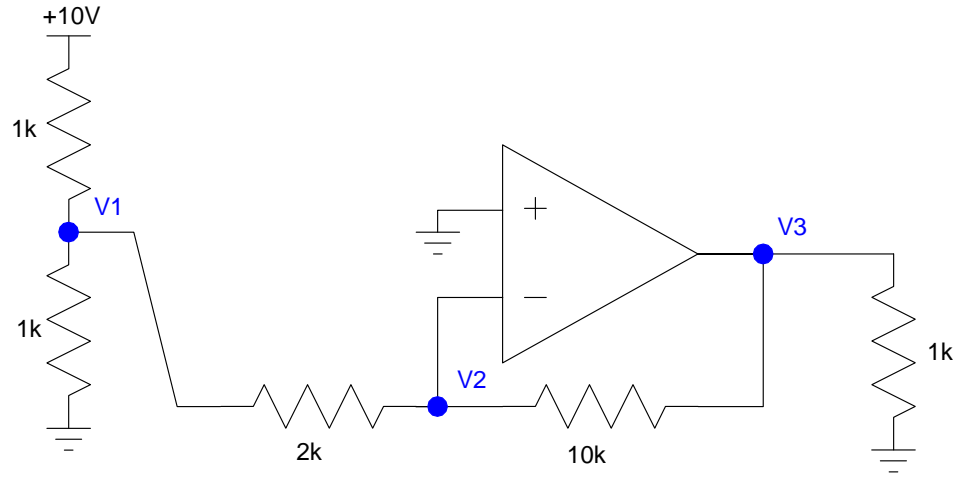- frequency at V1 = 120Hz (754 rad/sec)

Firing Angle	C	R

4) Write the voltage node equations for the following op-amp circuit (non-ideal op-amp)

5) Write the voltage node equations for the following op-amp circuit (assume and ideal op-amp)

Bonus! Name one person who is running this fall for the U.S. House of Representatives from you district