## ECE 320 - Homework #7

Comparitors and Schmitt Triggers, DC to AC, SCR. Due Monday, October 14th

## **Comparitors and Schmitt Triggers**

Assume a thermistor with a temperature - resistance relationship of

$$R = 1000 \cdot \exp\left(\frac{3905}{T} - \frac{3905}{298}\right) \,\Omega$$

1) Design a circuit which outputs

- 5V when the temperature is less than 0C
- 0V when the temperature is more than 0C

Assume the load is 20mA or less (i.e. a LM833 op-amp can drive it directly)

2) Design a circuit which outputs

- 5V when the temperature is less than 0C
- 0V when the temperature is more than 5C
- No change for 0C < T < 5C

Assume the load is 20mA or less (i.e. a LM833 op-amp can drive it directly)

3) Design a circuit which

- Turns on a motor when the temperature is less than 0C
- Turns off a motor when the temperature is more than 5C
- No change for 0C < T < 5C

Assume the motor draws 200mA at 10V.

(hint: use problem #6 along with a transistor switch)

4) Simulate your design for problem #3

5) (Lab): Build your circuit in lab and verify it works

- Check the temperature (i.e. resistance or voltage) where the motor turns on
- Check the temperature (i.e. resistance or voltage) where the motor turns off
- Check that the transistor is saturated when on

## DC to AC

6) Determine the efficiency of the following DC to AC converter (i.e. how much of the energy is in the 1st harmonic?). (15% high, 35% off, 15% low, 35% off, repeat)



7) If you change the off times (when the signal is 0V), you can improve the efficiency. What is the maximum efficiency you can get with this type of DC to AC converter?

## SCR

8) Assume a firing angle of 27 degrees. Determine the voltage at V1 and V2 (both DC and AC).



- 9) Change this circuit so that
  - The voltge at V2 is 10.0V (DC)
  - With a ripple of 0.5Vpp