# ECE 320 - Homework #5

555 Timers, Transistors used as a Switch, Schmitt Triggers. Due Monday, February 14th

Assume a 3904 transistor (NPN) and 3906 (PNP) (\$0.04 each)

$$\beta = 100$$
 min ( $|V_{ce}|$ ) = 0.2V max ( $I_c$ ) = 200mA

Assume a thermistor with

$$R = 1000 \, \exp\left(\frac{3905}{T + 273} - \frac{3905}{298}\right) \, \Omega$$

#### 555 Timers

- 1) Determine the on and off times for the voltage at V2 for following 555-timer circuit
- 2) Simulate this circuit in CircuitLab and verify the on and off times

### **Transistor Switch**

- 3) Determine the voltages {Vb, Vc} and currents {Ib, Ic} when
  - V2 = 0V
  - V2 = 5V
- 4) Verify your calculations using CircuitLab



## Comparitor

Add an electronic switch to turn the speaker on and off

- 5) Design a comparitor (shown in blue don't add the red resistors (they are for a Schmitt trigger) ) to
  - Turn on the speaker (V3 = 5V) when T > 40C, and
  - Turn off the speaker (V3 = 0V) when T < 40C
- 6) Simulate the comparitor in CircuitLab to verify the on / off temperature (or resitance or voltage)
  - use a voltage source (V4) to simulate the voltage at the voltage divider)

7) Build this circuit and verify it's on and off temperature (or voltage or ressistance. Replace R with a potentiometer for test purposes)

## Schmitt Trigger

Add an electronic switch to turn the speaker on and off

- 8) Design a Schmitt Trigger (modify section in blue) to
  - Turn on the speaker (V3 = 5V) when T > 45C, and
  - Turn off the speaker (V3 = 0V) when T < 40C
- 9) Simulate the comaritor in CircuitLab to verify the on / off temperature (or ressitance or voltage)
  - use a voltage source (V4) to simulate the voltage at the voltage divider)

10) Build this circuit and verify it's on and off temperature (or voltage or ressistance. Replace R with a potentiometer for test purposes)

