

This assignment should be completed by Wednesday, February 6<sup>th</sup>. **Note: there is nothing to hand in for this assignment.** In this homework assignment, you will explore:

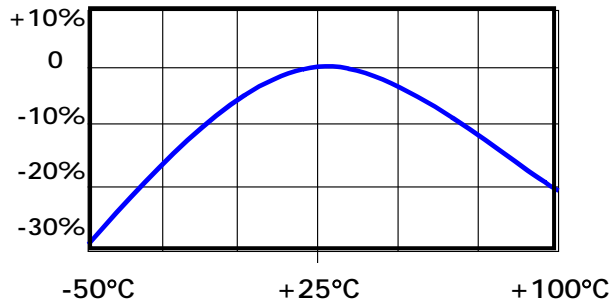
- External memory interfacing, EPROMs and SRAMs
- Logic families and programmable logic

The majority of the assigned reading will be available on the course web site in PDF format.

**NOTE: You should always try to use the data sheet provided by the manufacturer of the exact part that you are using in your circuits, since there can be differences between manufacturers of similar chips—even standard chips, such as the 74LSxx TTL logic family members.**

1. Review the final project assignment, available from the course web site.
2. Read pages 1–18 of Philips application note AN457 "80C51 External Memory Interfacing". While you're reading it, keep in mind that the processor on the board that you will build will be running at 11.0592MHz, a significantly lower speed than 33MHz. Take time to understand the timing diagrams and what each of the minimum and maximum timing specifications really means. Take a few minutes and review the timing diagrams in the C501 or 80C51 product specification. Remember that during a read cycle, the peripheral chip (EPROM or SRAM) is driving the data bus, while during a write cycle, the processor is driving the data bus.
3. Obtain and read the following EPROM-related documents:
  - Data sheet for the EPROM you have in your parts kit. Your EPROM may be one of several types, including the AMD Am27C256 (32Kx8) or Fairchild FM27C256 EPROM.
  - Technical note "Programming AMD's CMOS EPROMs"Determine how you would hook up the EPROM to the 80C51. Get a basic understanding for how EPROMs work, and how you would program and erase an EPROM. Think about how would you design a circuit to program an EPROM. The AMD documents are also available at the AMD web site: <http://www.amd.com/> (see EPROMs under the Flash Memory/Technical Resources/Technical Documentation link).
4. Obtain and skim a data sheet for the SRAM on the course web site. Your SRAM may be one of several types, including the Cypress CY62256 (32Kx8), Hitachi 62256, Samsung K6T0808C1D, Winbond W24257 SRAM, or **TI BQ4011 NV-SRAM**. Determine how you would hook it up to the 80C51. Compare the SRAM and EPROM pinouts. Note that the package used in this class is the 28-pin DIP.
5. Understand how each of the following LS TTL chips works. The data sheets are available on the course web site, but you may also want to store them on a USB drive key, floppy disk or on your PC.
  - 74LS00, 74LS02, 74LS04, 74LS08, 74LS74, 74LS138, 74LS156, 74LS244, 74LS245, 74LS373, 74LS374The On Semiconductor LS TTL General Data document includes interesting technical information.
6. How is 'noise margin' associated with the following logic gate specifications:  $V_{OH}$ ,  $V_{OL}$ ,  $V_{IH}$ ,  $V_{IL}$ ?
7. Does a TTL totem pole output sink or source current?
8. When a logic high is applied to a TTL gate input, is the input sinking or sourcing current?
9. When a logic low is applied to a TTL gate input, is the input sinking or sourcing current?
10. What is 'fanout' and how does that relate to  $V_{OH}$  and  $V_{OL}$ ?
11. Read about the Atmel ATF16V8C SPLD (programmable logic). Read about WinCUPL. Documents and links are available on the course web site.
12. Is a decoupling capacitor required when using an EPROM?
13. What is the difference between an OTP EPROM and a UV EPROM?

14. Do more standard values exist for resistors or for capacitors? How might this impact your use of these components in designs?
15. Why should components be derated when used in circuits? Suppose you have a capacitor that has a working voltage of +10V. What maximum operating voltage should be applied to this capacitor for extended periods of time?
16. Suppose you have an RC circuit consisting of a 5% 100K $\Omega$  resistor and a 10% 5 $\mu$ F capacitor. What is the maximum and minimum time constant of this circuit at 25°C?
17. How does the temperature characteristic or profile of a resistor or capacitor affect its operation? Take a look at the temperature characteristic for an electrolytic capacitor (shown below) and determine how the component's value changes when operating at 100°C.



18. How do the characteristics of an X7R capacitor compare with a Z5U capacitor?
19. **[Optional]** Review a logic book or visit a web site such as one of the following and explore logic families. While you're at the chosen web site, explore a little and try to understand some of the differences between the different logic families (e.g. LS, S, ALS, FAST, HCT, etc.). Note the differences in supply voltages, and input and output voltages of some of the different devices. Using the information from the data sheets or from a text book, compare the fanout, propagation delays, signal transition times, and power consumption of at least three of the families. Think about the advantages and disadvantages of using each of the particular families you examined.
  - Texas Instruments: <http://focus.ti.com/general/docs/scproducts.jsp>
  - Texas Instruments: <http://focus.ti.com/lit/ml/sdyu001z/sdyu001z.pdf>
  - ON Semiconductor: <http://www.onsemi.com/PowerSolutions/> (formerly Motorola logic)
  - Toshiba: <http://www.toshiba.com/taec/> (see Products > Logic ICs)
  - Philips: <http://www.philipslogic.com/products/>
  - Fairchild: <http://www.fairchildsemi.com/>

For a list of logic manufacturers, see: [http://www.interfacebus.com/Standard\\_Logic.html](http://www.interfacebus.com/Standard_Logic.html)