ECE-218 EMBEDDED MICROCONTROLLER PROJECTS:
PROJECT 1: TEMPERATURE MONITORING AND DISPLAY

This is an individual project. You will be expected to complete the project on your own. You may ask questions of other students or the instructor when you get stuck, but copying anything is not helpful for your learning and is not allowed.

PROJECT OBJECTIVE

The goal of this project is to develop an embedded microcontroller system with the Microchip Microstick II board to monitor temperature in the room. You will use an analog temperature sensor, the ADC on the PIC24, and an LCD display. Some specifications follow:

- The temperature should be displayed in Fahrenheit and be precise to 1 degree.
- The LCD display should display the units (°F) as well as the value.
- The temperature should be accurate to within 1 degree Fahrenheit when compared to a reference thermometer.

PROJECT DOCUMENTATION

You will document your project in a video demonstration, and a project report. Both will be uploaded to Nexus.

DEMONSTRATION

For this project the demonstration to illustrate the functionality of the system is quite simple. Your video should have the following three parts:

1. A segment that shows you and your system, explaining the project goals, the results that you obtained, and how well the results meet the project goals.
2. A segment that zooms in on the system, and shows the sensor, the LED display, and another temperature reference to verify the values are correct.
3. A segment where you change the temperature and show that both LED display and temperature reference respond.

REPORT

The project report is where you document the details of how you solved the problem. The report will have the following components:

- **Title page** – should include a project title, author (that's you), course number and title, and date.
- **Objective** – The purpose of this section is to detail the goals of the design. In addition to the goals given in the assignment, elaborate on any requirements that got clarified during the project implementation, or that you added as a specification.

- **Design Overview** – The purpose of this section is to orient the reader to your system and design approach. Describe the main components and how they address the goals. This section should include a simplified block diagram of the hardware, showing all major components, but without wiring details, and a brief description of the software behavior in the form of a flow diagram or pseudocode. You will describe both hardware and software in other sections in more detail, so this section is meant to give the reader an overview.
- **Hardware** – The purpose of this section is to describe, in detail, the hardware in the embedded system. Introduce this section with some text that introduces the schematic. Describe the hardware in a logical way. One possible organization is to first describe input components and signals and then output components and signals. The hardware schematic of your system should be complete and of sufficient detail that it could be used to duplicate your circuit. For example, include all port labels for any signals connected to the microcontroller and values or labels for all components. It should not be hand drawn. It is acceptable to use schematics provided in class or in the exercises as a starting point. Discuss the important characteristics of the hardware. For example, in this project the voltage range of the analog signal that represents the temperature, and the relationship between the temperature and the voltage are important.
- **Software** – The purpose of this section is to outline and then explain the software in the system. The software should also be described in a logical way. One possible organization is an overview of all code segments, followed by more detailed descriptions of each segment. Include the relevant code with your descriptions. You will be including all of the source code in the Appendix.
- **Results** – The purpose of this section is to objectively describe the behavior of the system when operating. An image of the completed system should be included. You should include other figures and data as appropriate. Be sure to compare the behavior of the system with the original specifications. Give the testing conditions for the results, and be as quantitative as possible. For example, don't say "the temperature was a little off", but instead provide data that illustrates the expected and observed temperature displayed for the full testing range. Compute the percentage error when appropriate.
- **Conclusion and Discussion** – The purpose of this section is to provide the reader with a holistic discussion of the project design process and results. Summarize the overall results and how they compare to the project goals. If there were problems encountered in the design and implementation, discuss these. If there are improvements that you would have made if time permitted, describe these. The reader should learn about any difficulties to watch out for, and any useful strategies if they were to repeat this design.
- **Appendix** – Here is where you will provide resources that would be needed by anyone building a duplicate of your prototype. Include any information about the hardware that is not included in the Hardware section, as well as the source code for the project. You do not have to include .h files.