Possible Structure for Course in Embedded Systems/Microcontrollers, making use of PIC 18 Series Microcontrollers and the C Programming Language

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This lecture plan gives suggestions for building a course or module based on the book *Designing Embedded Systems with PIC Microcontrollers* by Tim Wilmshurst. It can be adapted in many different ways. The pace of delivery will depend on the aptitude of the group, and their initial level of achievement. It is assumed that the class are beginners in C programming, but have some knowledge of Assembler and PIC microcontroller architecture. Different levels of background knowledge can however be accommodated by adjustment of the content and pace.

Notes:

1. This lecture series can follow directly from the *Introductory Course in Embedded Systems/Microcontrollers*, and preferably some or all of the *Intermediate Course in Embedded Systems/Microcontrollers*, or equivalents.
2. The course relies heavily on programming and simulation using the MPLAB IDE, and the Microchip C18 compiler. A hardware system is useful, but not essential. The book uses the Derbot AGV - the example programs can be studied whether or not this hardware is available. It is essential to have MPLAB and the Microchip C compiler. Students can copy the student version of this direct from the book CD, or download from the Microchip web site.

Lecture	Topic	Book Pages	Program examples/ exercises	Book Pages
1	**An Introduction to C**. History, introductory features – functions, data types, keywords. Compiling the C Program and the MPLAB C18 Compiler. Overview of MPLAB C18 libraries.	Ch 14. pp 386-396, 403-406	C18 Tutorial.	396-401
2-3	**Writing Simple Embedded Programs.** Declaring variables, arithmetic operations. Setting and branching on bit values. (Review port structure if necessary). The **do-while**, **goto**, **if**, and **if-else** branch structures. MPLAB C18 library delay functions. Using the **break** and **for** keywords.	Ch 14. pp 401-403 Ch 15. pp 409-413	Program Example 14.2 (Fibonacci), simulating the program. Program Example 15.1 Program Example 15.2	401-402. 410-411 416
4	**Overview of the PIC 18FXX2 Microcontroller**. Block Diagram and Status Register. Data Memory and Special Function Registers, Access RAM. Program Memory and its memory map. The Configuration Registers. The Stacks and their use.	Ch 12. pp 335-353	-	-
5	**Using Peripherals.** 18FXX2 Timer and PWM overview. Simple use of Timer and PWM.	Ch 13. pp 371-378 Ch 15. pp 415-422	Program Example 15.3	417-420
6	**Acquiring and Using Data with C.** 18FXX2 ADC overview. The Light Seek Program Structure. Use of the ADC. Further Use of **if...else**.	Ch 13. p 380. Ch 16, pp 423-431	Program Example 16.1	424-427
7	**Pointers, Arrays and Strings**. Intro to Pointers & Arrays. Using	Ch 16. pp 431-437	Program Example 16.2	433-434

	Pointers with Arrays. Strings. Evaluating the **while** condition.			
8	**Data Formatting, and using the I^2C Peripheral.** Review of I^2C communication. Configuring and applying the synchronous serial port using library functions. Use of ++ and - - operators. Using library functions for data formatting	Ch 16. pp 437-443	Program Example 16.3	437-439
9-10	**Assembler Inserts & Interrupts.** Implementing Assembler inserts. Overview of 18 Series instruction set and interrupt structure – sources, enabling and prioritisation. Controlling memory allocation – use of Pragmas. C implementation of Interrupt Service Routine. Locating and Identifying the ISR. Setting the configuration words.	Ch 12. pp 340-345, 353-358 Ch 17. pp 444-453	Program Example 17.1 Program Example 17.3	446 449-450
11	**The Wider C Environment.** Storage Classes – Scope, Duration, Linkage. Working with the 18 Series memory. Structures, Unions and Bit-Fields. Processor Specific Header Files. SFR Definitions.	Ch 17. pp 453-462	Program Examples 17.4-17.6	461-463
12	**Expansion time**			