



OVERVIEW: Hands-On Training on Embedded Systems

Software Concepts:

Module 1: Embedded C Programming

Introduction to C - Features of C language, Data types, Operators. **Decision Making and Looping** - Decision Structure, Looping Structure, Break and Continue statement. **Functions** - What are Functions?, Steps Involved In Processing A Function, Recursion Functions. Types of functions, Functions Returning Pointers. **Arrays, Structures and Unions** - Definition of Arrays, Comparison between arrays and pointers, Single Dimension Array, Two Dimensional Arrays, Structures & Unions, Memory layout, Bit fields in structure, passing structures in a function. **Pointers** - Declaration of pointers, Rules valid for pointers, Pointer usage, Pointers addressing, referencing and dereferencing, Passing pointers to a function, Strings with Pointers. **Strings** - Accessing individual characters, Printing strings with printf, Printing strings with puts, Inputting strings with scanf, Inputting strings with gets, String Library. **File management** – Opening a file, Naming a file, Writing data to a file, Reading data from a file. **Preprocessor**

Module 2: PIC18F Microcontrollers

Introduction to microcontrollers and embedded systems, Brief on PIC series of microcontroller architecture, pin description, Memory organization, Special Function Registers (SFRs), Demonstration of hands-on practice on a development board and software tool MPLAB IDE.

Peripherals Include

Input/output ports - Configuration of ports, **Interrupts** – Interfacing with Push buttons, **Timers** – Using timers for various applications, **UART** – Serial interface to the desktop PC, **Analog to digital converters** – Interfacing with temperature sensors, etc, **Keyboard** - Getting input data into the microcontroller, **7-segment display** - Display of output, **16x2 LCD display** – Display of output, **PWM** – Dimming of led, **RTC** – Real Time Clock, **I2C** – Read and Write to EEPROM.

Module3: RTOS

Introduction to Operating Systems, OS Concepts (Scheduling, Semaphores, Mutexes) , Linux Programming (Process, Signals, Threads, Semaphores etc), RTOS (FreeRTOS), Demonstration of hands-on practice on PIC development board using a software tool MPLAB IDE.

Applications of Free-RTOS on PIC18F Microcontroller

Task Creation – Creating a task to turn on the LED, **Task Delay** – Task Delay to implement Running LED's and 7 segment display, **Interrupts** – To Toggle an LED using switch, **Semaphores** – Synchronization of a task using keypad, **Queues** – Sending Messages to the LCD, **Co-routines** – Turning on an LED using Co-routines.

Hard-Ware Concepts

Module4: Basics Of Electronics

- ✓ To get familiar with commonly used active and passive electronic components
- ✓ To learn the basic building blocks commonly used in making projects
- ✓ To learn software simulation tools used for circuit design and analysis
- ✓ To learn soldering and the use of test equipment in fault finding

Familiarization with electronic components

Resistors – functions, characteristics and types ,**Capacitors** -- functions, characteristics and types ,**Inductors** and transformers, **Relays, switches, cables and connectors, Diodes**, zener diodes and **LEDs**, **Transistors** as switching devices, **Operational amplifiers, 555 timers, Basic logic gates** and **combinational circuits**

Circuit simulation and analysis using QUCS Simulator

- a) **DC analysis** (steady state) of simple circuits, and verifying basic laws of electrical circuits
- b) **Transient behavior** of circuits containing energy storing elements like inductors and capacitors
- c) **Simulation** of diode and transistor characteristics
- d) Design and simulation of half wave, full wave and bridge rectifiers with filters
- e) Opamp's operation as inverting, non-inverting amplifier
- f) Opamp's application -- differential amplifier, summing amplifier, comparator, integrator, differentiator, square wave generator

Module5: Printed Circuit Board design (Ki-CAD)

Introduction

Introduction to different types of PCBs

Schematic creation

Understanding schematics and symbols, Searching components footprints and symbols, choosing the right components, Schematic drawing, Editing symbol libraries, Running ERC

Board creation

Manual routing, Component-placing, Practice via manual routing on PCB, Design verification, Designing of single-sided PCB, Using of packaged libraries, Auto routing, Editing and creation of components

Report generation

Net list, Bills of Material (BOM), Gerber file creation, Drill legend generation

Module6: Project

Construct a useful using both software and hardware concepts

Note:

1. Course fee is Rs 24,700+ 10.3% service tax = Rs 27,244 (including registration, training and reference CD).
2. Timings for week days are 10:30 AM to 5:30 PM.
3. Timings for weekend classes are: Saturday 1.30 PM - 5:30 PM; Sunday 10 PM - 5 PM
4. Students will receive certificates from EFY on successful completion of the course.
5. A CD, which contains the course content, reference manual, library of programs, Software will be provided at the end of the course.