

Embedded Sys Course Content:35-40hours

Course Outline

C Programming

PCI drivers

Fundamentals of C

- Datatypes and Constants
- Simple & Formatted I/O
- Memory Usage
- Operators & Expressions
- Flow Control
- Loops

Functions

- Role of Functions
- Pass by value / reference
- Returning values from Functions
- Recursive Functions
- Call Back Functions
- Implications on Stack
- Library Vs User defined function
- Passing variable number of arguments

Arrays

- Defining, initializing and using arrays
- Multi Dimensional Arrays
- Arrays of Characters and Strings
- Arrays and Pointers
- Passing arrays to functions
- String handling with and without library functions

Storage Classes

- Scope and Life
- Automatic, Static, External, Register
- Memory(CPU / RAM)

Structures & Unions

- What structures are for
- Declaration, initialization
- Accessing like objects
- Nested Structures
- Array of Structures
- Passing structures through functions
- Allocation of memory and holes
- Structure Comparison
- Structure bit operation
- Typedef for portability
- Unions
- Overlapping members

Enumerated data types

- Enum, Indexing, enum Vs #define

Bit Operations

- AND (&), OR (|), XOR (^)
- Compliment (~)
- Left-Shift (<<), Right Shift (>>)
- Masking, Setting, Clearing and Testing of Bit / Bits

Pointers

- The purpose of pointers
- Defining pointers
- The & and * operators
- Pointer Assignment
- Pointer Arithmetic
- Multiple indirections
- Advanced pointer types
- Generic and Null Pointer
- Function Pointers
- Pointers to Arrays and Strings
- Array of Pointers
- Pointers to Structure and Union
- Pointers to Dynamic memory

- Far, Near and Huge Pointers
- Pointer Type Casting

Dynamic Memory Allocation

- Malloc(), Calloc(), Realloc(), Free()
- Farmalloc(), Farcalloc()

File Handling Concepts

- Concept of a FILE data type
- Inode, FILE structure
- File pointer
- Character handling routines
- Formatted Data Routines
- Raw data Routines
- Random Access to FILE

Command line Arguments

- Argc, argv
- Variable Inputs to the main

Compiler in Practical

- Preprocessor Directives
- Compiler, Assembler, Linker
- Conditional Compilation
- Multiple File Compilation
- Code Optimization techniques
- Volatile, #pragma

Data Structures

- Linear & non-linear
- Homogeneous & non-homogeneous
- Static & Dynamic
- Single, Double & Circular Linked Lists
- Stacks & Queues
- Binary Trees

Sorting and Searching Techniques

- Insertion, Selection, Bubble, Merge, Quick, Heap

Concepts and Real-time Exposure

- Development Tools and Environment
- Make Utility
- MISRA Coding Standards
- Object / Executable File Format
- Debugger

Linux Internals

Introduction

- Kernel Architecture
- Application
- Shell and Services
- System Calls
- Error Handling

Library

- Linker and Loader
- Static Dynamic Library

Process Management

- Process Control Block
- Process Creation and Exit
- Process Scheduling Policies
- Process Limits
- Process Priorities
- Foreground & Background Processes
- Race Condition
- Synchronization
- Copy-on-write
- Process time values
- Daemon Process

Interrupts

- Process Interrupt
- Raise of Signal
- Catching signal
- Signal action

File Management

- Files and File Attributes
- File Descriptor
- File I/O
- Duplicating File & File Descriptor
- File Control operations
- File types
- Protection
- Inode

Inter Process Communication & Synchronization

- Pipe
- Fifo
- Message Queue
- Shared Memory
- Client – Server properties
- Semaphore

Threads

- Creation
- Termination
- Synchronization
- Attributes

Memory Management

- Paging
- Reentrancy
- Segmentation
- Virtual Memory
- Memory Protection
- Memory Sharing

Shell Script

- Types of Shell
- Shell Variables
- Control Statements
- Looping
- Command Line Arguments

Networking and TCP/IP Applications

- Network Structure

- Classifications and Topologies
- Switching and Routing
- Gateway, repeater, Hub, Bridge
- OSI & TCP/IP Protocol Layers
- Physical & Logical Addresses
- ARP & RARP
- internet Protocol
- Routing Protocol and IP Datagrams
- Error and Control Messages (ICMP) UDP
- Transfer Control Protocol
- TCP Networking Applications
- (FTP, TFTP, TELNET, DNS, DHCP, SMTP, POP3, IMAP, SNMP)

Socket Programming

- Overview
- Concurrent Processing
- Programming Interface
- Socket Interface
- Client / Server Design
- Concurrent Connection-Oriented Servers
- Socket Calls for TCP and UDP
- Single Process
- Concurrent Servers
- Remote Procedure Call
- Implementation of TFTP / SMTP

Microcontroller Inter 8051

Introduction

- Microprocessor vs Microcontroller
- CISC vs RISC

Overview of Architecture of 8051

- Processor Core and Functional Block Diagram
- Description of memory organization
- Overview of ALL SFR's and their basic functionality

Low-level Programming Concepts

- Addressing Modes
- Instruction Set and Assembly Language (ALP)
- Developing, Building and Debugging ALP's

Middle Level Programming Concepts

- Cross Compiler
- Embedded C Implementation, prog. * Debugging
- Differences from ASNSI-C
- Memory Models
- Library reference
- Use of #pragma directive
- Functions, Parameter passing and return types

On-Chip Peripherals

- Ports: Input/output
- Timers & Counters
- Interrupts, UART

External Interfaces

- LEDS
- Switches (Momentary type, Toggle type)

Device Drivers

- Kernel Compilation
- Kernel Module Programming
- Writing Device Drivers
- Character Drivers
- Block Drivers
- Network Drivers
- Mutex, Semaphore and Spinlock in Kernel level
- USB

Protocols

- I2C (EEPROM), SPI (EEPROM)